

SILESIA UNIVERSITY
OF TECHNOLOGY

SCIENTIFIC PAPERS

POLITECHNIKA ŚLĄSKA

ZESZYTY NAUKOWE

ORGANIZATION
AND MANAGEMENT
Scientific paper no. 166

**ORGANIZACJA
I ZARZĄDZANIE**
Zeszyt Naukowy nr 166

Edited by
Radosław WOLNIAK

Pod redakcją
Radosława WOLNIAKA

GLIWICE 2022

Kolegium redakcyjne

REDAKTOR NACZELNY – Dr hab. inż. Barbara KULESZ, prof. PŚ
REDAKTOR DZIAŁU – Prof. dr hab. inż. Radosław WOLNIAK

**Wydano za zgodą
Rektora Politechniki Śląskiej**

**ISSN 1641-3466
ISSN 2720-751X**

© Copyright by
Wydawnictwo Politechniki Śląskiej
Gliwice 2022

**WYDAWNICTWO POLITECHNIKI ŚLĄSKIEJ
ul. Akademicka 5, 44-100 Gliwice
tel. (32) 237-13-81, faks (32) 237-15-02
www.wydawnictwopolitechniki.pl**

**Sprzedaż i Marketing
tel. (32) 237-18-48
wydawnictwo_mark@polsl.pl**

CONTENTS

Foreword	7
1. Akerke AKBERDIYEVA, Romana ANTCZAK-JARZĄBSKA – Trust as an element of social capital and factor of economic growth	9
2. Anna ALBRYCHIEWICZ-SŁOCIŃSKA – Motivational aspects of remote working – a generation z perspective	19
3. Gerda BAK, Regina REICHER – Challenges of the SMEs in the 21st century	31
4. Robert BALCERZYK, Karolina GABOREK – Talent management in sport	49
5. Piotr BANASZYK – Reconstruction and comparison of the approaches of international supply chains and global value chains	63
6. Katarzyna BROŹEK – The impact of human capital on the effectiveness of enterprises in the V4	83
7. Paweł CHLIPAŁA, Agnieszka ŻBIKOWSKA – Data completion and verification in social research projects based on the third methodological path	101
8. Monika CHŁAD – Analysis of a company's activity in terms of distribution costs ...	129
9. Iwona CZERSKA – Activity of selected healthcare entities in the Lower Silesia region through their social media activities in the context of image shaping	139
10. Iwona CZERSKA – Development directions of the gaming industry as opportunities for people with disabilities	157
11. Karolina CZERWIŃSKA, Andrzej PACANA, Michalene Eva GREBSKI – Analysis of the fourth industrial revolution in the context of innovation and the idea of technology development	167
12. Irena DUDZIK-LEWICKA – Talent management in Polish companies in the light of empirical studies	181
13. Marcin FLIEGER – Dynamics of network relations: how organizations exploit inter-organizational networks to gain set	195
14. Anna GEMBALSKA-KWIECIEŃ, Elżbieta MILEWSKA – Impact of the Covid-19 pandemic on management. remote work – new challenges for employees and companies	213
15. Magdalena GĘBCZYŃSKA – Employee job satisfaction in Industry 4.0 era: insights from the Polish SMEs	225
16. Bolesław GORANCZEWSKI, Grzegorz KĄDZIELAWSKI – ISO 50001 energy management system effectiveness indicators in a chemical sector enterprise	245
17. Magdalena GOSTKOWSKA-DRZEWICKA, Ewa MAJEROWSKA – Capital structure formation in stock exchange listed companies of the Visegrad Group: a dynamic approach	255
18. Marlena GRABOWSKA, Iwona OTOLA – Building value in high-growth enterprises in an uncertain environment	275

19. Jadwiga GRABOWSKA – Dual studies as a response for the needs of the contemporary market	289
20. Marlena GRZELCZAK, Michał SOLIWODA – Do non-cash payments affect economic growth? Empirical evidence from EU countries	301
21. Marcin HABERLA – The demand for competence and qualification of medical personnel in the light of the results of empirical studies	319
22. Martin HOLUBČÍK, Gabriel KOMAN, Milan KUBINA – UAV technology to support management decision-making in the industry	333
23. Marta JUCHNOWICZ, Hanna KINOWSKA – Factors affecting occupational well-being of public administration employees in Poland	351
24. Angelika KANTOR, Jakub KUBICZEK – Increasing effectiveness of management in foodservice sector through dynamic delivery pricing model	363
25. Elżbieta KARASŃ, Katarzyna ŁUKANISZYN-DOMASZEWSKA – Craft development in learning organization (LO): economic approach	377
26. Mariusz KMIECIK – Automation of warehouse resource planning process by using a cloud demand forecasting tool	391
27. Julia KORALUN-BEREŹNICKA – Patterns in corporate trade credit management: insights into the Polish trade sector	411
28. Tatiana KRAWCZYŃSKA-ZAUCHA – Mapping leadership styles in the worldview space	435
29. Michał KRÓL, Marcin ZAWICKI – Changes in remote education introduced by Polish universities of economics as a result of the Covid-19 pandemic	449
30. Anna KWIOTKOWSKA – The relationship between entrepreneurial orientation and organizational resilience in the digital context	473
31. Wojciech LEWICKI – Assessing the effectiveness of the implications of selected social policy instruments in the management of the electromobility development process in Poland	489
32. Lidia LUTY, Monika ZIOŁO – Differentiation of climate and energy policy in the countries of the European Union	505
33. Aneta MICHALAK, Michał ZOCHOREK – Review of motivation theory and the methods for its implementation in mining industry.....	519
34. Aneta MICHALAK, Michał ZOCHOREK – Salary motivators from the perspective of underground mine workers employed in blue-collar and managerial positions in a selected mining enterprise	533
35. Elena MIESZAJKINA, Paula BOCHEN – Assessment of digital competences of Lublin Province residents in relational terms	545
36. Elena MIESZAJKINA, Agata MYŚLIWIECKA – Digital activity of Polish small enterprises	565
37. Jurgita PAUŽUOLIENĖ, Ligita ŠIMANSKIENĖ, Aušra PACEVIČIŪTĖ – Responsible consumption in Europe: causes and habits	581
38. Andrzej PAWLUCZUK – The color shades of leaders in the countries of economic transformation: the case of Poland	593

39. Elżbieta PAWŁOWSKA, Marta PENKALA – Innovations in the area of health in selected countries of the European Union on the example of Poland and Germany ...	605
40. Luiza PIERSIALA – Emergency management in communication incidents	623
41. Joanna PIOCH, Joanna SOSZYŃSKA-BUDNY – Analysis and evaluation of the performance of micro and small enterprises in selected countries of Central and Eastern Europe from 2017 to 2020	645
42. Irena PYKA, Jan PYKA – Policy of green financing of companies	659
43. Agnieszka SAMSEL – Generation Zalpha facing emotional investments	671
44. Małgorzata SCHULZ – Teleworkers and their identification with the company	683
45. Bartosz SEILER, Hanna BORTNOWSKA – CSR in the mission statements of Polish chemical companies (research report)	699
46. Olayinka Abideen SHODIYA, Tijani Abideen ADEKUNLE – Reliability of research instruments in management sciences research: an explanatory perspective	711
47. Ewa STAWIARSKA – Management system for innovations created in the open model (with managerial tools)	731
48. Dagmara SURPEL – Outsourcing of logistic services in Polish e-commerce stores ...	769
49. Radosław SZULC, Katarzyna MUSIELAK – Product photography in product attractiveness perception and e-commerce customer purchase decisions	783
50. Igor SZYMAŃSKI, Julianna STASICKA, Honorata STADNIK – Presumed consent in organ donation – limitations of consent model regarding transplantology in Poland	797
51. Daniel TOKARSKI – Risk analysis of construction a logistic centre in economic and environmental aspects	813
52. Medine Gül ÜNLÜ, Vildanur DİNÇ, Katarzyna MIDOR, Grażyna PŁAZA – Plastic waste management in the smart cities: Poland and Turkey as a case study	829
53. Tomasz WĘGRZYN, Bożena SZCZUCKA-LASOTA, Krzysztof LUKASZKOWICZ, Adam DÖRING – TIG welding of 1.4462 duplex steel in antenna and car structures	851
54. Radosław WOLNIAK – Individual innovations	861
55. Radosław WOLNIAK – Traits of highly innovative people	877
56. Aneta ZAREMBA, Małgorzata BLASZKE – Selected sources of property information fundamental to property investment	893
57. Monika ZIOŁO; Lidia LUTY – Disproportions in the level of innovation in European Union countries	903

FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Contemporary management. Presented papers contain result of researches conducted by authors from Poland, USA, Lithuania and Turkey. The number consists of 57 papers.

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: social capital, human resource management, small and medium enterprises management, human management, innovations in management, production management, network management, Industry 4.0, energy management, capital management, environmental management, finances, technology management, leadership, entrepreneurship, digital management, responsible consumption, health sector management, Corporate Social responsibility, logistics, e-commerce and risk management.

Radosław Wolniak

TRUST AS AN ELEMENT OF SOCIAL CAPITAL AND FACTOR OF ECONOMIC GROWTH

Akerke AKBERDIYEVA^{1*}, Romana ANTCZAK-JARZĄBSKA²

¹ Central Asian University Almaty; WSB University in Gdańsk, Faculty of Computer Science and New Technologies; aakberdiyeva@cau.kz, ORCID: 0000-0001-7520-2828

² WSB University in Gdańsk, Faculty of Computer Science and New Technologies; rantczak@wsb.gda.pl, ORCID: 0000-0002-6853-2041

* Correspondence author

Purpose: Organizations nowadays are increasingly using a nondisclosure agreement to protect against the dissemination of certain information by employees. However, such methods have not always been successful, especially since a pandemic. Therefore, the aim of the article is to present the main trust factors. Identification of trust-building factors in the organization in order to increase efficiency and reduce indirect costs, as well as conduct theoretical analysis on this topic.

Design/methodology/approach: The synthesis method and the analytical and comparative concept of building staff motivation were used. The theoretical analysis in the text is based on research that can be found in Polish, English and Russian literature.

Findings: The article shows that by engaging the right disciplines it become possible to achieve absolute trust, which in turn serves as the key to effective work.

Research limitations/implications: Building an atmosphere of trust begins with ways of learning, sharing information and knowledge while meeting the needs of the trusted person. Therefore, in future research on trust in the area of management, it is necessary to take into account the point of view of the related disciplines mentioned in the article.

Social implications: A conscious desire to build organizational trust leads to an increase in work efficiency and a decrease in corrupt practices. Ultimately, this will lead to increased meaning of trust in business.

Originality/value: A model of trust levels and their impact on work performance has been developed. The article can be used by the management as a guide to creating employee motivation systems.

Keywords: employee career development, trust in an organization, factors of trust, cooperation.

1. Introduction - the phenomenon of trust and its social functions

Intellectual and social aspects are important in communication between stakeholders in the context of economic globalization, both in terms of quantitative and qualitative indicators. Currently, the elements of soft management have a significant impact on the productive potential of the organization, whether it be traditional or virtual organizational culture. According to sociologists and psychologists, formative integration consists of various links and elements of the human factor, such as culture, worldview or habits (Green, 2000; Vopel, 1999). The main direction of the "global economy" is the principles of functioning of the organization in the field of economics on an international scale, including trends in the development and regulation of processes occurring in the market. Among the 114 existing definitions of globalization, 25 explanation emphasize the importance of integration and intensification (Al-Rodhan, 2006). Currently, the definition of integration in a broad sense refers to the process of combining several separate objects into one whole, while intensification means the expansion and development of production, which uses the most effective methods (Oxford Dictionaries, 2006, p. 4). The implementation of both definitions relies on the correct design and management of the way of communication that creates a certain level of trust. Therefore, it can be stated that trust is one of the concepts relating to the conditions of the functioning of a market economy and can be treated as a factor of economic development.

Contemporary Management Science considers trust as a key factor of social capital that permeates human life, both individual and social (Shaw, 1997). According to authors in the field of management and sociology, distrust of the organization leads to constant optimization of current operational processes (Laloux, 2014).

If one considers the government as a large organization, distrust between government and citizens could lead to the creation of artificial systems, for instance the purpose of cheating in the calculation of taxes, obtaining certain social security or financial fraud, as well as the loss of educated people in a broad sense. Regarding commercial organizations, the consequences of mutual distrust can lead in employee rotation, financial losses when providing valuable information to third parties, low productivity and lack of motivation of employees. This kind of clutter requires additional control, time and financial resources. Trust between an employee and employers consists in building a system of relations through the use of soft elements of management that influence the organizational culture (Sztompka, 2007).

The concept of culture has different definitions depending on the direction of the scientific discipline. To form an atmosphere of trust in organizational culture, definitions from the fields of philosophy, sociology and psychology are more suitable.

From a sociological point of view, the universal cultural elements defined by Smelser N. are based on understanding the interlocutor and his interrelationships, creating values and acting in accordance with the relevant principles of culture (1998). In turn, philosophy connects culture with the upbringing and education of a person, interpreting it as a means by which it is possible to achieving an appropriate humanistic ideal of a universal human personality. (Sztompka, 2007). At that time, the discipline of psychology argues that trust is a factor in mental health and the basis for building personal relationships, makes the group cohesive, makes cooperation more interesting and productive (Vopel, 1999). Taking into account the above definitions, it is possible to identify the basic elements that create trust, which include mutual understanding, the creation of common values and principles, as well as the humanity that arise through upbringing and education. The level of trust in the organization depends on the evolutionary development of these elements.

2. Features and factors of trust in the organization

Authors of various scientific disciplines provide different definitions of the concept of trust. In management science, Shaw R. refers to the definition that trust is comfort, which measured by the ability of another person (Covey, 2020). This definition is also confirmed by Sztompka P., who interprets trust as a mechanism for transforming a set of individual subjective opinions into one objective idea (2007). Management science emphasizes the importance of trust in the economy, which acts as a risk reduction factor and simultaneously as an increase in the efficiency of the enterprise.

Nowadays, there are several methods for calculating the optimal degree of trust, measured over time and financial resources. Considering that trust largely determines the final cost and effectiveness of organizational activities, it is essential to properly estimate its level in order to be able to manage it during the change process.

Giddens A. connects the concept of trust with time and space, defining it as a compensatory mechanism in the process of interaction. According to the author, there is trust in abstract systems and individualized personal relationships (2015). In this case, the trust can act as an intermediary, namely anonymously, when there are no relations between objects, for instance, between depositor and banker, citizen and government, buyer and producer of goods. In the second case, trust has a pronounced focus, in which the parties know each other personally, an example is the relationship between the employee and the employer. The chain of links of this reasoning indicates that the circle of trust includes not only interpersonal relations, but also political and economic relations that extend to institutions and organizations. Here one can refer to Giddens' concept, which states that trust in abstract systems has an important role in a society consisting of personified relationships of individuals (2015).

In J. Coleman's theory of exchange, trust has both rational and irrational characteristics (1994). Endress M., on the other hand, divided groups into reflexive and hidden (2013). In both cases, the first definition refers to the assessment of risk, namely, deliberate actions that involve the reasonable waiver of the control and verification functions of one person in order to maximize the benefit for another person.

The phenomenon of trust has a general concept, consisting of common goals, regardless of the various definitions of scientific disciplines. Based on the presented interpretations of trust, they can therefore be classified as shown in Figure 1.

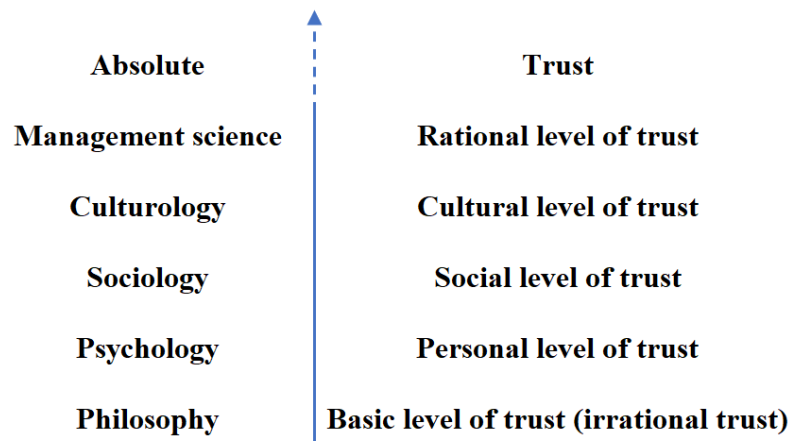


Figure 1. Phenomena of trust by scientific discipline.

Source: Own elaboration.

Basic level of trust (irrational trust). Basic trust is one of the initial levels and is a certain system of knowledge about the environment. Covey S. compares trust with individual inner confidence (2020). The basic level includes unconscious ideas about the natural sciences and knowledge of religion, which is the result of the direct action of individuals (Shirazi, TSzy, Konfutsiy, Khayyam, 2017).

Personal level of trust. Personal or personified trust emerges in the process of waiting for social action, depending on the role of the individual. This level is closely connected with the psychological aspect, namely the formation and change of behavior, character, worldview of a person, which are based on consciousness, subconscious and unconscious personality (Freyd, 2015).

Social level of trust. The social level includes public or vertical trust defined by Sztompka P. According to his interpretation, such trust arises at different levels of the hierarchy, where one of the partners acts as an empowerment (2007).

Rational level of trust. The rational level is an activity based on financial gain. In such a relationship, one of the parties transfers transactions to the other party for the purpose of obtaining benefits, where the end result is measured in monetary terms. In this regard, an important critical aspect is the amount of the possible benefit (Coleman, 1994).

Cultural level of trust. In this context, trust is based on ethical values, which include the principles of religion, education, and moral consensus. At the level of cultural trust, mutual understanding occurs in the form of verbal communication (White, 2005).

The authors of the theory and practice of management science believe that the lack of moral qualities neutralizes the value of a professional function, which consists in special knowledge and skills. The mechanism of interaction and connection of these features and functions constitutes the sphere of information and communication (Seiwert, 1989). According to many authors, the criterion and methods for assessing the level of trust were developed on the basis of the presented phenomenon of trust. This means that the creation of absolute trust is impossible without taking into account the concepts of each phenomenon, since they are closely related both in content and in time.

The methodology for determining the level of trust in an organization developed by R.B. Shaw is perceived according to the criteria of efficiency, decency and concern for employees. The author applied a practical method implemented with the assistance of quantitative questionnaires reflecting the trust of employees in the organization (1997). The goal of an investigation was to determine the relative value of the researching criteria for creating a balanced complex, taking into account their proportional relationship. Research by Covey S. on identifying the level of trust was accomplished in public and individual relations in the United States, in which indicators of individual attitudes, namely dishonesty towards oneself, ranged from 52 to 75%.

According to the author, trust at the individual level is the main factor on which the social, institutional and organizational spheres of trust depend.

Table 1.
Identification of the level of trust

Country and year of the research	Trust Scope	Percentage
USA (2005)	Media	22%
	Political parties	8%
	Government	27%
	Corporations	12%
UK (2011)	Personal trust among US residents	33%
	Personal trust among the people of Latin America	23%
	Personal trust among the people of Africa	18%
	Scandinavians (Denmark, Sweden, Norway)	68%
	Dutch	60%

Source: Own elaboration based on the literature by Covey S. (2012).

Sztompka considers that communication and information exchange between people allows building democracy in an organization where trust is the foundation. Considering Sztompka's term, one can assume that the indicator of the existing democracy is a significator of the level of trust. The 2007 Democracy Index shows that Scandinavian countries have a high level of democracy, namely Denmark -9.22, Sweden -9.03 and Norway 9.87 on a scale of 1 to 10, which confirms the results of Covey's research presented in Table 1. The conclusion of comparing

Sztompka's theory with Covey's research can be interpreted using Maslow's pyramid, that is, the more a person possess comfort and freedom, the more chances he has to achieve an absolute level of trust. This assumption was explained on the basis of Maslow's pyramid.

Table 2.

Factors of Maslow's pyramid of needs

Hierarchy of Needs	Features
Physiological needs	Satisfying the needs of homeostatic functions
Security and Safety Needs	The need for order, law and stability in the power structure of society
Emotional need	Emotional needs involve the exchange of positive feelings, which creates partnership in society, and its absence can lead to disorientation.
Esteem Needs	Satisfaction of the need for self-esteem evokes pride in self-confidence, dignity, ability and adequacy, as well as an understanding of one's own usefulness to others.
Cognitive needs	Ability to obtain and access information, acquire and share knowledge
Aesthetic needs	Satisfaction of volitional and cognitive needs to achieve harmony
Self-Actualization Needs	The tendency to self-realization in accordance with one's own potential.

Source: Own elaboration based on the literature A. Maslow, 2014.

Based on the author's point of view, the next one cannot be achieved without satisfying the previous need. However, it is worth noting that the satisfaction of all the above needs depends on the subject and on the various items that have been explained in the phenomenon of trust. This means that the creation of an atmosphere of trust depends not only on the employee and the employer, but also on the institution, as well as on the structure and policies of the authorities.

3. The principles of building trust in the organization

Trust is the basis for creating personal and business relationships that visually form a two-sided vector line, where on the one hand there is a confidant, and on the other - a partner. The vector variables within the article are the employer and employees, including subordinates.

The identification of principles for building an atmosphere of trust is concluded by considering the factors of each member of the organization. Referring to Maslow's pyramid presented above, the following participants can be conditionally distinguished:

1. Employees - individual factors.
2. Employer - internal factors.
3. Government - external factors.

The individual factors of employees can be determined based on the spiral model of Covey S., influencing the building of an atmosphere of trust in the organization (2006). According to the author, the possession of the necessary skills, namely knowledge, ability and desire to learn, allows to create a flexible structure in the organization, in which mutual trust is created.

According to Covey, the main employee factors that can determine the presence and relative level of trust in the organization are:

1. proactive skills,
2. the ability to perform work in accordance with the purpose, mission and vision of the organization (in the long-term goals),
3. the ability to prioritize,
4. resource management skills,
5. the presence of an empathic understanding of the surrounding situation,
6. the ability to work and create synergies,
7. continuous improvement (balanced self-renewal of intellectual, socio-emotional and spiritual factors).

The presented factors are closely related to the culture of behavior and lifestyle, which refer to the level of personal and cultural trust. If one considers that the employee is responsible for all or part of the seven factors, then there is a willingness to trust the organization.

The process of trust management between the employee and the employer is reflected in behavior and actions in the following aspects:

- informational - designate access to information regardless of the position and value of documents,
- decision making - ensuring that personnel make decisions and take responsibility,
- make plans - participation, regardless of the structural and organizational unit, budgeting, organizational and production plan, including strategic,
- management model - providing choice for the performance of responsibilities and lack of control over the process of performing work.

The establishment of trust and mistrust are the result of the influence of individual, internal and external factors. Factors of internal trust are largely determined by objective conditions, such as:

- strategic views of the leader or founder of the organization (mission, vision and purpose),
- organization management model (organizational culture and ethics, structure, methods of motivation as well as processes and systems),
- management methods of individual managers,
- perception and reaction of subordinates to the above methods (tools) and management.

External factors can be attributed to the overall political and economic structure of the government, including unemployment, inflation, and welfare, which directly affect people.

Returning to Maslow's pyramid, the presence of satisfaction of the need for security allows to develop on an emotional and intellectual level, which has an impact on work performance.

Thus, it is possible to illustrate the model of the influence trust level on the efficiency of work, presented in Figure 2.

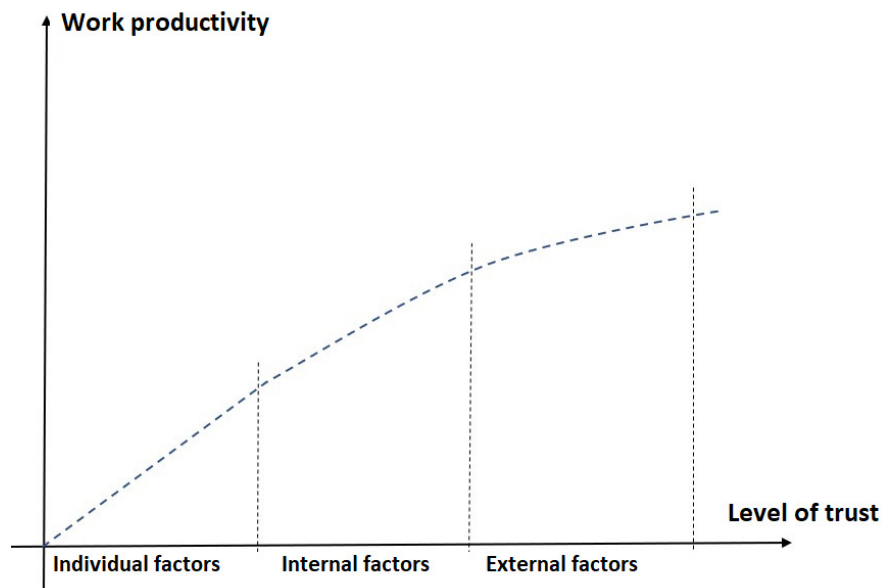


Figure 2. Model of the impact of the level of trust on work performance.

Source: Own elaboration.

Referring to the phenomenon of trust from a scientific point of view, it can be argued that the more factors are present in this phenomenon, the faster an atmosphere of trust can be created in an organization. It should be noted that the formation of an atmosphere of trust in the organization depends on the balanced development of individual, internal and external factors. This means that possessing a separate factor will not be as effective without an internal factor, since all factors are interdependent. These factors are closely related to each other, which in the process of work serves as a means of support.

4. Employee motivation through the trust

The significance of motivation in contemporary management is important, since the success of an organization directly depends on the self-fulfillment of each employee. Organizations use different types of motivational management models based on American and Japanese value systems such as individualism, rationalism, and collectivism.

It is assumed that an organization with an atmosphere of mutual trust has a combined model of motivation, namely rationalism and collectivism (Semler, 2007). This kind of combined model of motivation engenders to the possibility of self-fulfillment and career growth of an individual employee, regardless of professional experience and position. In addition, this model of motivation is the interaction between the employer and the employee.

The essence of motivation is to create a comprehensive organization with a synergistic effect without a hierarchical structure. This means that the effective use of each employee is aimed at the sustainable development of employees and the organization.

In such an organization, lower-level employees perform or participate in the same key tasks of the organization on an equal basis with managers. As that time managers perform routine tasks, namely self-organization of negotiations, scanning and copying of documents, which are performed by secretaries in hierarchically structured organizations. Today, one of these organizations is the “Semko Company”. The founder of the company notes that a significant advantage of changing the management system is saving time, improving the skills of lower-level employees, which in turn creates a reserve of labor resources to eliminate staff turnover.

Demonstrating trust on the part of an employee has two functions, namely character and competence. Character implies traits at the cultural level of trust, that is, motives, intentions towards people. Competencies include skills as well as professional results and achievements.

According to Mority A., trust is based on experience, competence and reliability (1996). The concept of experience was interpreted as awareness and rational decision-making that does not have negative consequences for the environment. Reliability was attributed to stability and sustainability, while competence was explained as professionalism in terms of both specialist knowledge and communication skills.

5. Conclusions

According to the considered theoretical aspects, it can be seen that trust should be considered as a kind of cyclical process that develops evenly as the next cycle passes. The process of trust begins at a basic level, when a person trusts himself and the world, then the people around him, after all the trust transformer to a new, personal level. Thus, each subsequent cycle will accompany a person in the direction of intellectual and emotional development.

The importance of controlling the level of trust and identifying problems, as well as the possibility of professional optimization in the management of the organization, become key factors in the company's activities. Checking distrust takes time, and each element of control, in turn, demotivates the employee.

At present, trust is considered as an element of the economic concept that has real conditions in the functioning of the market and as a factor in economic development. From a managerial point of view, trust contributes to improving communication skills, investment attractiveness and increasing the working capital of enterprises, as well as reduces the costs associated with the need for control.

Therefore, researching the factors influencing trust and formation of an appropriate atmosphere is important for the development of the effectiveness of personnel and the organization's activities.

References

1. Al-Rodhan, N.R.F. (2006). *Definitions of Globalization: A Comprehensive Overview and a Proposed Definition*. Geneva. Available online https://www.academia.edu/2969717/Definitions_of_Globalization_A_Comprehensive_Overview_and_a_Proposed_Definition-The_International_Relations_and_Security_Network_ETH_Zurich_June_19_2006, 3.05.2019.
2. Coleman, J. (1994). *Foundations of Social Theory*. USA: Harvard University Press.
3. Covey, S. (2020). *The 7 Habits of Highly Effective People*. New York: Simon and Schuster.
4. Covey, S., Merrill, R. (2006). *The speed of trust*. New York: Simon and Schuster.
5. *Democracy Index 2017*. A report by The Economist Intelligence Unit. Available online <https://spcommreports.ohchr.org/TMResultsBase/DownloadFile?gId=34079>.
6. Endress, M., Pabst, A. (2013). Trust Sociological Considerations. *A journal for philosophy and the social sciences*.
7. Freid, Z. (2015). *Psychopatologia życia codziennego*. Kraków: vis-a-vis Etiuda.
8. Gara, G.L., La Porte, J.M. (2020). *Processes of building trust in organizations: internal communication, management, and recruiting*. Available online <https://doi.org/10.1080/23753234.2020.1824581>.
9. Giddens, A. (2015). *Konsekwencje nowoczesności*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
10. Green, R. (2000). *The 48 Laws of Power*. London: Profile Books Ltd.
11. Khayyam, O. (2017). *Vostochnaya mudrost*. Moskwa: AST.
12. Krot, K., Lewicka, D. (2012). The importance of trust in manager-employee relationships. *International Journal of Electronic Business Management, Vol. 10, No. 3*.
13. Laloux, F. (2014). *Reinventing Organizations*. Brussels: Nelson Parker.
14. Maslow, A. (2014). *Motywacja i osobowość*. Warszawa: PWN.
15. Mority, A. (1996). *Sony. Made in Japan*. Warszawa: WNT.
16. Ritzer, G. (2000). *The McDonaldization of Society*. California: Pine Forge Press.
17. Seiwert, L. (1989). *Managing Your Time*. New York: Kogan Page Ltd.
18. Semler, R. (2007). *Maverick*. New York: Warner Book.
19. Shaw, R.B. (1997). *Trust in the Balance*. New York: Wiley.
20. Shirazi, S., TSzy, L., Konfutsiy Khayyam, O. (2017). *Vostochnaya mudrost*. Moskwa: AST.
21. Smelser, N. (1998). *Sociologia*. Moskwa. Wydawnictwo: Fenix.
22. Sztompka, P. (2007). *Zaufanie fundament społeczeństwa*. Kraków: Znak.
23. Vopel, K.W. (1999). *Poradnik dla prowadzących grupy*. Kielce: Jedność.
24. White, L. (2005). *The Science of Culture*. New York: Percheron Press; Eliot Werner Publications.

MOTIVATIONAL ASPECTS OF REMOTE WORKING – A GENERATION Z PERSPECTIVE

Anna ALBRYCHIEWICZ-SŁOCIŃSKA

Częstochowa University of Technology; a.albrychiewicz-slocinska@pcz.pl, ORCID: 0000-0002-7245-4461

Purpose: This article aims to present the results of a survey on young people's views on remote working concerning selected aspects of motivation.

Design/methodology/approach: Many employees remember the Covid-19 pandemic period as a forced shift to remote work and a significant experience with all its advantages and disadvantages. After many months of operating in a new professional reality, employers and employees got used to working under new conditions. Still, more importantly, this period marked a new trend in the labour market by opening institutions to this way of working. This issue was addressed in a 2021/2022 student survey. Its main objective was to explore the relationship between young people's remote learning experiences and their preference for remote working. The data were analysed using the STATISTICA software, and the Kruskal-Wallis rank ANOVA, Mann-Whitney U and Pearson's chi-square tests were applied.

Findings: The results show that remote working is becoming increasingly important and that hybrid work is recommended, regardless of whether the demotivating aspects of remote working are known or perceived.

Practical implication: When analysing the percentage distribution of responses to individual questions, it can be seen that respondents' answers on the motivational or demotivational aspects of remote working were mainly in line with the literature. However, an in-depth analysis that considers the significance tests of the differences between the individual independent variables requires a more thorough look at the results obtained.

Originality/value: As Generation Z is entering the labour market it is important information for future employers, as it will be difficult to build a message for this generation that will encourage future employees to work stationary based on rational premises regarding the advantages and disadvantages of remote or hybrid work.

Keywords: Generation Z, remote work, motivation.

Category of the paper: Research paper.

1. Introduction

During the pandemic, most companies switched some employees to remote work, mainly without technical, organisational or social preparation. Before the lockdown, remote working was treated as a ‘premium benefit’, aimed at a specific group of professionals and managers, to be used occasionally or in exceptional circumstances. At the time, changing the mindset about remote working seemed impossible. Entrepreneurs themselves repeatedly pointed out the legislative, technical and organisational barriers to implementing this form of work. Spring 2020 led to a real revolution in this area; the need to stay home and isolate led to a massive and rapid technological change. From the first months of the pandemic, remote work became the norm wherever it could be implemented. Employers, protecting the physical health of their employees and fighting for the survival of their organisations, adopted this organisational solution without fully understanding the consequences for mental health and intellectual performance, exposing employees to overload and exhaustion, threatening their well-being, efficiency and productivity (Villa, 2021, p. 15). The advantages and disadvantages of remote working have already been widely analysed and highlighted in the literature. Still, such a massive application of this form of work has never happened before and has revealed the issue’s complexity. Remote working requires many problems to be solved, and many questions to be answered, both on the part of the organisation, the employees and the managers, as this group is mainly responsible for implementing and coordinating remote working solutions. An interesting thread in the debate on this issue is the motivational aspects of the employees. This issue was also addressed in a 2021/2022 student survey. Its main objective was to explore the relationship between young people’s remote learning experiences and their preference for remote working. On the other hand, this article aims to present their views in conjunction with an analysis of selected aspects of motivation.

2. Generation Z’s attitudes towards remote working

There is still a lively debate in the literature regarding the validity and appropriateness of grouping employees by age and the very definition of the term generation. Hence, different authors mention different classifications of generational segmentation concerning the question under analysis (Rodriguez et al., 2019; Bencsik et al., 2016; Bencsik, Machova, 2016; Goh, Lee, 2018; Kirchmayer, Fratricova, 2018; Dries et al., 2008, Lazanyi, Bilan, 2017; Bejtkovsky, 2016; Hejnova, 2015; Cichobłaziński, 2022). The most common division in the literature assumes that the youngest generation operating in the labour market is Generation Z, which includes people born after 1995. While researchers sometimes include those born in

1990, other approaches include only those born in 2000 and later. The generation preceding Z is referred to as Y. It is made up of people born between 1980 and 1994, generation X comprises people born between 1965 and 1979 and the Baby Boomers are the post-war generation born between 1946 and 1964. Despite the academic debate about the validity of these classifications, however, it is an objective fact that today's workplaces are characterised by people of different ages, with different perceptions of certain values and experiences of historical, economic, technological and social change.

By analysing reports and studies (Dolot, 2018; Duffy, 2018; Hijzen, Menyhert, 2016; Lazanyi, Bilan, 2017; Generation Y...; Lyons et al., 2017; O'Boyle et al., 2017; OECD, 2014; Robak, 2017; Singh, Dangmei, 2016; Tulgan, 2013; Zwart, Baker, 2018) on the organisational behaviour of younger workers - representatives of generations Y and Z – it is possible to draw some synthesis from the authors' findings. In doing so, it should be noted that there seem to be the fewest differences between the two generations mentioned. Generation Y is, in a sense, the link between the 'analogue' world as we know it before the 1900s and 2000s and the modern technology-based world of today. In the light of the publications cited, the two generations have in common a strong attachment, even dependence, on modern information technologies and their tools.

Literature studies on remote working indicate a wide range of terminology on the subject (Slazak, 2012, p. 220; Nilles, 2003, p. 21; Pyöriä, 2011). This leads to difficulties in comparing research findings. In the reality of Polish companies, the term 'remote work' was somewhat offensive. In Polish labour legislation, only telework was and still is used (Krzyżanowska, 2020) (at the end of 2022, there is still talk of a draft law regulating only remote work). However, it should be noted that under the current special law provisions, the employer has the right to delegate an employee to work remotely, but it is not a form of work available on request (Cichobłaziński, 2022).

Villa (2021, pp. 12-13) offers an exciting perspective on the topic analysed, focusing his reflections on the term 'smart working', using it to refer to work done away from the office. Smart working is the result of an agreement between employer and employee; it concerns the optimisation of workstations, the voluntary delegation of responsibility and authority, the renunciation of control and classical supervision during work, and the ability to self-motivate and self-organise work.

Comparing the situation of the collective experience of remote working during the pandemic to the concept of smart working, it should be noted that this situation, firstly, was not the result of a decision by employees. Still, a necessity linked to the regulation, according to which the employer directed the employee to perform tasks from home. Secondly, it highlighted all the disadvantages of remote working:

- the boundary between home life and work life became blurred,
- problems of exclusion or voluntarily placing oneself outside the professional community have emerged,

- problems of misaddressed productivity have increased,
- participation and involvement decreased with physical distance,
- there was a work overload, so-called digital piecework,
- additional reporting and control procedures were introduced to replace direct managerial oversight,
- excessive focus on technical and formal aspects of work, depriving it of meaning and context, etc.

However, this way of working and learning (which was almost inaccessible before the pandemic) has also offered some positive aspects, especially for young people:

- accelerated digital literacy,
- skills development and the opportunity to make extensive use of digital tools as a natural environment, which has given them an edge in their new work situation,
- convenience and freedom to perform tasks,
- savings in commuting time and costs associated with working away from home,
- inability to directly supervise the employee.

It seems interesting that after the lockdown, employers mainly stated that working this way brings more losses than benefits. Remote work or working in a so-called hybrid system became more popular, especially among Generation Z workers. As part of this model, some organisations give employees the freedom to choose where they work; others determine the proportion of home and office work, while others organise work by dividing teams (Tarnawska, 2020). However, employers state that remote work affects the impact of existing motivational systems, leads to the loss of social ties, the so-called ‘social glue’, and significantly weakens the impact of non-material incentives, and to some extent, the effect of material ones (Czarnecka, Słocińska, 2016).

3. Methodology

The research results presented in the study are part of a quantitative survey conducted among young people (Generation Z and Generation Y) in late 2021/early 2022. The study presents an excerpt from the findings on selected aspects of motivation in the context of remote working.

The study was conducted using quantitative research methods, employing a survey technique. The technique was chosen due to the possibility of direct contact with the respondent. The survey covered young people (representatives of generations Z and Y) studying at various faculties and from the Silesian Voivodeship. For this group of educated young people,

their professional skills make it possible to use forms of remote working or hybrid work in the future.

The research tool used was a standardised questionnaire consisting of closed statements. A Likert scale was used for responses (Babbie, 2004, p. 192). The research tool (questionnaire) is authoritative and was formulated by members of the research team - employees of the Department of Applied Sociology and Human Resource Management at the Faculty of Management of the Czestochowa University of Technology. The questionnaire was validated (Cronbach, 1995; Czakon, 2014) using Cronbach's Alpha index, which confirmed the internal consistency of the tool ($\alpha = 0.9338$).

The STATISTICA programme was used to process the results of the study. Non-parametric tests were used to assess the significance of differences in analysed variables: Mann-Whitney U test (UMW), Kruskal-Wallis ANOVA test (AKW), and the Chi-square test. The publication of A. Stanisiz (2006, pp. 369-391) was used to analyse the statistics obtained. Several statistical hypotheses were adopted to analyse the study results regarding the presence of significant differences in respondents' statements due to their characteristics. Only statistically significant relationships will be presented in the study.

4. Findings

A total of 226 students took part in the survey. According to the criteria indicated earlier for dividing by generation, the distribution of respondents in the study group is shown in Table 1.

Table 1.

Distribution of the study group according to Generation Z definition categories

	Born in 1990 and after %	Born in 1995 and after %	Born in 2000 and after %
Generation Z	89.82	83.19	29.20
Others	10.18	16.81	70.80
Total	100.00	100.00	100.00

Source: survey results.

Since the most common distinction made between generations in the literature shows 1995 or 1990 as the year in which Generation Z can be mentioned, it is assumed that Z is the dominant demographic group in the study group in the research results.

50.44% of the respondents were female and 48.23% male (3 persons - 1.33% did not indicate their gender). 86.72% of the respondents indicated they had experience with remote learning, while 12.83% had no experience (1 person did not comment). Concerning work experience, the majority of respondents - 86.28% confirmed having such experience, while 13.27% negated having such experience (1 person did not indicate anything). 48.67% of the respondents had the experience of working remotely, while 50.88% had no experience of

this type of work (1 person did not indicate anything). When asked which form of work they would prefer in the future, respondents most often chose a combined form of work - 50.00% - followed by on-site work 35.40%, and remote work was selected by only 12.39% of respondents (2.21% did not comment on this question). Concerning the issue analysed in the study, a group of indicators was selected that represent respondents' opinions on the motivational aspects of remote work:

- A. Not conducive to maintaining adequate work readiness.
- B. There are various 'distractions' (barking dog, children, train noise, etc.).
- C. Gives greater freedom/independence.
- D. Allows better concentration on work.
- E. Is mainly based on self-motivation.
- F. Makes it more difficult for employees to motivate each other.
- G. Negatively affects earnings.
- H. Makes it difficult to evaluate employees fairly.

The indicators presented were analysed in terms of the variation in respondents' statements in relation to independent variables such as:

- I. age;
- II. gender
- III. distance learning experience
- IV. work experience
- V. work experience in remote work; VI. with work experience in distance work;
- VI. preferred form of work in the future (stationary, hybrid, remote).

Respondents' answers were distributed as follows regarding indicators related to specific aspects of motivation (Table 2).

Table 2.

Percentage distributions of responses in relation to individual indicators

Indicators	Answers %						total
	1	2	3	4	5	N/A	
A	12.39	14.60	26.99	22.57	17.70	5.75	100
B	5.31	6.64	11.95	28.76	42.92	4.42	100
C	2.65	3.10	11.50	31.86	47.79	3.10	100
D	12.39	15.49	29.20	19.47	19.03	4.42	100
E	0.88	3.98	11.95	32.74	45.58	4.87	100
F	4.87	13.27	23.01	24.34	29.20	5.31	100
G	24.78	18.14	31.86	7.52	4.87	12.83	100
H	8.41	12.89	23.01	26.11	20.35	9.29	100

1-strongly disagree; 2-somewhat disagree; 3-neither agree nor disagree; 4-somewhat agree; 5-strongly agree.

Source: survey results.

Non-parametric tests were used to assess the significance of differences between the variables analysed. The distribution of results is presented in Table 3 - the table shows only statistically significant differences, which allows us to reject the null hypothesis H0 that there

are no differences due to the grouping variable, and to accept the alternative hypothesis H1 that there are such differences.

Table 3.

Statistical test results for independent variables and selected indicators

Indicators AKW/UMW test at the assumed significance level ($\alpha = 0.05$)	Independent variables					
	I	II UMW	III	IV UMW	V	VI AKW
A				p = 0.0466		p = 0.0001
B				p = 0.0319		p = 0.004
C						p = 0.0019
D						p = 0
E		p = 0.0212				
F					p = 0.0369	
G						p = 0.0033
H						

UMW - Mann-Whitney U test; AKW - Kruskal-Wallis ANOVA test.

Source : survey results.

When asked for their opinion on whether remote working prevents adequate work readiness, the majority of respondents (40.27%) confirm the existence of such a problem; it should be noted that 26.99% of respondents hold the opposite view. The answers to this question differ according to having professional experience and the preferred way of working in the future. Among those with no work experience, the proportion agreeing or disagreeing was evenly distributed, while the largest group, 36.67%, could not determine their opinion in this area. Concerning those with work experience, 43.08% of respondents agreed with the statement that remote working is not conducive to maintaining work readiness, with 27.18% disagreeing. Among those who preferred stationary work, the group in whose opinion remote working is not conducive to sustaining work readiness prevailed (57.50%). With regard to those who prefer remote or hybrid working in the future, no particular pattern was observed.

The vast majority of respondents (71.68%) confirmed that remote working is associated with various types of distractions. Here, respondents' answers were similarly differentiated by their work experience and preferred future working style. Those with work experience mostly (75.39%) agreed that it is more challenging to fight distractions when working remotely. Still, a similar pattern, although not as significant, was observed among those without work experience. As with the previous indicator, only the preference for doing stationary work in the future significantly conditioned the respondents' responses, confirming increased concentration difficulties in remote working situations.

Regarding the statement that remote working gives greater freedom and independence, 79.65% of respondents agree. For this indicator, statistically significant differences in responses were observed as to which type of work they prefer in the future. 85.71% of those who prefer remote working in the future, 87.61% of those who prefer hybrid working and 65% of those who prefer stationary working agree with the analysed statement.

Respondents were also asked whether they think remote working allows them to concentrate more on their work. 38.5% of respondents agreed with this statement, while 27.88% disagreed. These opinions depend on the type of work preferred in the future, i.e. those who prefer working in a stationary position mostly disagree with the statement analysed (50%). In contrast, those who prefer remote or hybrid work confirm that remote work favours concentration on work (46.43% and 49.56% respectively).

Another indicator is that remote working is mainly based on self-motivation. A whole 78.32% of respondents agree with this statement. Interestingly, this indicator depends on gender. Women are much more in agreement with the statement (84.21%) than men (71.56%).

Respondents were then asked whether remote working makes it difficult for employees to motivate each other. The majority, 53.54%, agreed with this statement. Responses were influenced by remote working experience. Those without such experience were much more likely to agree with the analysed statement (61.74%) than those with remote working experience (45.46%).

Another indicator referred to whether remote working negatively affects earnings. The majority of respondents (42.9%) disagreed with this statement. Their opinions were conditioned by their preferred form of work in the future. Those favouring the form of remote or hybrid work strongly disagree with this statement, while respondents preferring remote work are mostly indifferent.

The last indicator examined is related to the statement that remote working hinders the process of fairly evaluating employees. Most respondents agreed with this statement (46.46%); however, there was no difference in opinion according to any of the independent variables analysed.

5. Discussion

When analysing the percentage distribution of responses to individual questions, it can be seen that respondents' answers on the motivational or demotivational aspects of remote working were mainly in line with the literature. However, an in-depth analysis that considers the significance tests of the differences between the individual independent variables requires a more thorough look at the results obtained.

An in-depth analysis of the issues at stake should begin by noting that, contrary to the expectations of the researchers designing the survey, the remote learning experience had no impact on respondents' opinions on remote working. Nor did the experience impact their preferred form of work in the future. This leads to two speculations: the students surveyed had already done some work while studying remotely, which influenced their opinions to a greater extent, or the respondents separated the experience of learning remotely from working

remotely. However, both activities relied on similar technological solutions and could follow a similar format. Job preferences were much more influenced by having work experience (Chi-square NW $p = 0.01879$, $\alpha = 0.05$; Chi-square Pearson $p = 0.00281$, $\alpha = 0.05$) and having remote working experience (Chi-square NW $p = 0.00704$, $\alpha = 0.05$; Chi-square Pearson $p = 0.01079$, $\alpha = 0.05$). This is an important consideration as the preference for the future form of work - remote, hybrid or stationary - determines the answers to the questions on motivation. It seems that respondents can consciously analyse the motivating and demotivating aspects of remote working and, regardless of their colloquial or professional knowledge of the subject, choose a particular form of work, considering that the advantages outweigh the disadvantages. In turn, their attitude to a specific form of work influences their evaluation of selected motivational aspects. A particular exception to this is the indicator concerning self-motivation as a critical aspect of remote working concerning which women seem to be somewhat more aware than men. This may be because when working from home and performing a great deal of housework, they have to constantly mobilise themselves to focus on work tasks. It seems that the demotivating aspects of remote working mentioned in the literature are not significant for most of the young people surveyed, perhaps due to the characteristics of the group studied. They are mostly young people without personal commitments, highlighting the disadvantages of remote working. In addition, they may associate remote working with a form of work that is least disruptive to their current lifestyles, where they already spend a large part of their time on virtual activities. However, it may come as a surprise that the most favoured form of work is hybrid work, which is a compromise between the interests of employees and employers, trying to balance the negative aspects of fixed and fully remote work.

6. Conclusions

The limitations of the study are primarily related to the selection of the sample. It seems that extending the study group to the other two generations could give greater insight into the specificity of generation Z with regard to remote work. The results of the presented research suggest that among the representatives of generation Z, supporters of remote work will choose it because it is the closest form of work to them - trivializing "we like the songs we already know best". It is important information for future employers, as it will be difficult to build a message for this generation that will encourage future employees to work stationary based on rational premises regarding the advantages and disadvantages of remote or hybrid work. Due to its topicality and range of occurrence, the problem should, in the opinion of the author, continue to be researched and developed.

References

1. (Generation Y: needs and habits...) *POKOLENIE Y: potrzeby i nawyki wpływające na dzielenie się wiedzą*. Raport Podsumowujący Badania Prowadzone W Ramach Projektu „Ucząca Się Organizacja 2.0.” Realizowanego Przez Portal Interia.PL Oraz Wszechnicę Uniwersytetu Jagiellońskiego, http://www.wszechnica.uj.pl/_public/temp/Zalaczniki/dzielenie_sie_wiedza-raport.pdf.
2. Babbie, E. (2004). *Badania społeczne w praktyce*. Warszawa: PWN.
3. Bejtkovsky, J. (2016). The Employees of Baby Boomers Generation, Generation X, Generation Y and Generation Z. *Journal Of Competitiveness, Vol. 8, Iss. 4*, pp 105-123, DOI: 10.7441/joc.2016.04.07.
4. Bencsik, A., Machova, R. (2016). *Knowledge Sharing Problems from the Viewpoint of Intergeneration Management*. Proceedings Of The 4th International Conference On Management, Leadership And Governance (ICMLG 2016), pp. 42-50.
5. Bencsik, A., Horváth-Csikós, G., Juhász, T. (2016). Y and Z Generations at Workplaces. *Journal of Competitiveness, Vol. 8, Iss. 3*, pp. 90-106, DOI: 10.7441/joc.2016.03.06.
6. Cichobłaziński, L. (2022). *Counterproductive Aspects of Remote Work in the Context of Exchange of Knowledge*. Proceedings of the 23rd European Conference on Knowledge Management, Vol. 23, no. 1. P. Centobelli, R. Cerchione (eds.), European Conference on Knowledge Management, Neapol, DOI:10.34190/eckm.23.1.799.
7. Cronbach, L.J., Meehl, P.E. (1955). Construct Validity in Psychological Tests. *Psychological Bulletin, Vol. 52, No. 4*, pp 281-302.
8. Czakon, W. (2014). Kryteria oceny rygoru metodologicznego badań w naukach o zarządzaniu. *Organizacja i Kierowanie, Vol. 1, No. 161*, pp. 51-62.
9. Czarnecka, A., Słocińska, A. (2016). Problemy kształtowania zaangażowania zdalnych pracowników. In: E., Robak, S., Skolik (eds.) *Wyzwania wynikające z uwarunkowań polityki kadrowej przedsiębiorstw* (pp. 83-97). Częstochowa: Wydawnictwo Wydziału Zarządzania Politechniki Częstochowskiej.
10. Dolot, A. (2018). The characteristic of Generation Z. *E-mentor, No. 2(74)*, pp 44-50, <http://dx.doi.org/10.15219/em74.1351>.
11. Dries, N., Pepermans, R., De Kerpel, E. (2008). Exploring four generations' beliefs about career Is "satisfied" the new "successful"? *Journal Of Managerial Psychology, Vol. 23, Iss. 8*, pp. 907-928, DOI: 10.1108/02683940810904394.
12. Duffy, B., Shrimpton, H., Clemence, M., Thomas, F., Whyte-Smith, H., Abboud, T. (2018). *Beyond Binary. The lives and choices of Generation Z*. Ipsos MORI Social Research Institute, <https://www.ipsos.com/ipsos-mori/en-uk/generation-z-beyond-binary-new-insights-next-generation>.

13. Goh, E., Lee, C. (2018). A workforce to be reckoned with: The emerging pivotal Generation Z hospitality workforce. *International Journal Of Hospitality Management*, Vol. 73, pp. 20-28, DOI: 10.1016/j.ijhm.2018.01.016.
14. Hejnova, V. (2015). Accession Of Generation Z To Labour Market. In: P. Slavickova, J. Tomcik, *Znalosti Pro Trzni Praxi 2015: Zeny - Podnikatelky V Minulosti A Soucasnosti*. International Scientific Conference on Knowledge for Market Use - Women in Business in the Past and Present, Olomouc, Czech Republic, pp. 199-208.
15. Hijzen, A., Menyhert, B. (2016). Measuring Labour Market Security and Assessing its Implications for Individual Well-Being. *OECD Social, Employment and Migration Working Papers*, Vol. 175. Paris: OECD Publishing, <https://doi.org/10.1787/5jm58qvzd6s4-en>.
16. Kirchmayer, Z., Fratricova, J. (2018). What Motivates Generation Z at Work? Insights into Motivation Drivers of Business Students in Slovakia. *Innovation Management And Education Excellence Through Vision 2020*, Vol. I-XI, pp. 6019-6030.
17. Krzyżanowska, M. (2020). Z daleka od firmy. In: *HR praca zdalna. HR Personel & Zarządzanie, E-book*, Vol. 2.
18. Lazanyi, K., Bilan, Y. (2017). Generation Z on the labor market - do they trust others within their workplace? *Polish Journal of Management Studies*, Vol. 16(1), pp. 78-93, DOI: 10.17512/pjms.2017.16.1.07.
19. Lyons M., Lavelle, K., Smith, D. (2017). *Gen Z Rising, Accenture Strategy*, https://www.accenture.com/t20170901T080938Z__w__us-en/_acnmedia/PDF-50/Accenture-Strategy-Workforce-Gen-Z-Rising-POV.pdf, 31.03.2022.
20. Nilles, J.M. (2003). *Telepraca. Strategie kierowania wirtualną zalogą*. Warszawa: WNT.
21. O'Boyle, C., Atack, J., Monahan, K. (2017). *Generation Z enters the workforce. Generational and technological challenges in entry-level jobs*. Deloitte Insights, https://www2.deloitte.com/content/dam/insights/us/articles/4055_FoW-GenZ-entry-level-work/4055_FoW-GenZ-entry-level-work.pdf, 31.03.2022.
22. OECD (2014). *How good is your job? Measuring and assessing job quality*. OECD Employment Outlook 2014, Paris: OECD Publishing, https://doi.org/10.1787/empl_outlook-2014-6-en.
23. Pyöriä, P. (2011). Managing telework: risks, fears and rules. *Management Research Review*, Vol. 34, No. 4, pp. 386-399.
24. Robak, E. (2017). Expectations of Generation Y Connected with Shaping the Work-Life Balance. The Case of Poland. *Oeconomia Copernicana*, No. 8(4), pp. 579-594, DOI: 10.24136/oc.v8i4.35.
25. Rodriguez, M., Boyer, S., Fleming, D., Cohen, S. (2019). Managing the Next Generation of Sales, Gen Z. Millennial Cusp: An Exploration of Grit, Entrepreneurship, and Loyalty. *Journal Of Business-To-Business Marketing*, Vol. 26, Iss. 1, pp. 43-55, DOI: 10.1080/1051712X.2019.1565136.

26. Singh, A.P., Dangmei, J. (2016). Understanding the generation Z: the future workforce. *South-Asian Journal of Multidisciplinary Studies (SAJMS)*, Vol. 3(3), pp. 1-5, https://www.researchgate.net/publication/305280948_UNDERSTANDING_THE_GENERATION_Z_THE_FUTURE_WORKFORCE.
27. Ślężak, A. (2012). Przegląd badań dotyczących telepracy. *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania*, No. 30. Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, pp. 219-232.
28. Stanisław, A. (2006). *Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny, Tom 1. Statystyki podstawowe*. Kraków: StatSoft.
29. Tarnawska, M. (2020). Praca hybrydowa od czego zależy sukces wdrożenia w firmie? *HR Personel & Zarządzanie*, No. 12(369), pp. 16-21.
30. Tulgan, B. (2013). *Meet Generation Z: The second generation within the giant "Millennial" cohort*. Rainmaker Thinking Inc., <http://www.rainmakertalking.com/assets/uploads/2013/10/Gen-Z-Whitepaper.pdf>.
31. Villa, D. (2021). *Smart working dla wszystkich*. Warszawa: CeDeWu.
32. Zwart, S., Baker, M. (2018). Improving productivity and job quality of low-skilled workers in the United Kingdom. *OECD Economics Department Working Papers, 1457*. Paris: OECD Publishing, <https://doi.org/10.1787/14dfd584-en>.

CHALLENGES OF THE SMES IN THE 21ST CENTURY

Gerda BAK^{1*}, Regina REICHER²

¹ Obuda University, Doctoral School for Safety and Security Sciences; bak.gerda@uni-obuda.hu,
ORCID: 0000-0001-5912-3716

² Budapest Business School, Department of Management; reicher.regina@uni-bge.hu,
ORCID: 0000-0003-3929-6331

* Correspondence author

Purpose: This study aims to identify the challenges, difficulties and opportunities for the SME sector in the Visegrad Group (V4) countries in the 21st century in the area of innovation and development, in particular digitalization. This research is justified by the prominent economic role of the SME sector and the key importance of adapting to the rapid pace of digitalization.

Design/methodology/approach A literature review on this topic was used for the research, based on the Web of Science database. The scope of articles included in the survey was limited to peer-reviewed journal articles in English and published up to 2021. The process of selecting suitable studies for the search consisted of several steps, each of which aimed to include or exclude articles based on predefined criteria.

Findings: The literature review has revealed significant gaps in the subject area. One of these is the lack of research on SMEs in the V4 countries. Another gap is the study of the relationship between SMEs and cloud computing from a computer science perspective, but other areas, not including the economic area, are less studied.

Research limitations/implications: The limitations of the research include the database on which the study is based, the volume of the database and the criteria for the articles included in the study.

Social implications: The study provides an overview for academics of who is working on the topic, from what aspect research has been done so far, and the links between publications. However, it may also be of interest to professionals interested in the subject area, if they want to see what areas are worth addressing, taking into account or just want to get a more comprehensive picture of the V4 SMEs in relation to digitalization.

Originality/value: The importance of the study lies in the fact that it sheds light on the unanswered questions in the field and on the areas that have been little or not at all investigated by researchers. It can be used as a guideline for future studies in the field of cloud computing adoption by SMEs.

Keywords: challenges, digitalization, SMEs, literature review.

Category of the paper: Research paper.

1. Introduction

Today, information and communications technology (ICT), in particular the internet and embedded systems technologies, are evolving rapidly, giving rise to a range of new technologies such as cyber-physical systems, the internet of things, cloud computing and big data analytics (Liu, Xu, 2017), but also manufacturing automation (Miśkiewicz, Wolniak, 2020) and 3D printing.

For businesses - not just SMEs - to succeed, the industrial revolution known as Industry 4.0, based on the use of cyber-physical systems, must be a success. In order to successfully adopt and implement new technologies, companies must first address the factors that will facilitate Industry 4.0 (Cieciora et al., 2020). For example, human resources, ICT, economic and financial factors and risks (Stock, Seliger, 2016; Tokarčík et al., 2021). Industry 4.0 has also brought with it cloud-based services, which are growing in popularity among businesses and individuals. However, implementing Industry 4.0 may reveal several challenges, such as a lack of computer/IT/digital skills, which is one of the most pressing concerns (Wielki, 2017). Digital transformation is not only increasing the range of skills and competences required, but also the knowledge associated with them, as the use of new tools affects the form and way of working at all levels of the business (Gajdzik, Grebski, 2022).

The concept of cloud computing (CC) has emerged in recent years as a dynamic response to the challenges associated with shrinking IT financial resources and expanding IT requirements (Dincă et al., 2019).

On-demand self-service, broad network access, resource pooling, quick elasticity, and measurable service are the five main characteristics of cloud computing (National Institute of Standards and Technology's, 2011) that give the greatest benefits. For SMEs, cloud computing offers to bring tangible business benefits at a cheaper cost because they only pay for the resources they require, allowing them to get a decent return on their limited resources (Moeuf et al., 2017). Furthermore, SMEs can benefit from adopting CC, for example by being more responsive to business requirements and gaining global access (Avram, 2014), and also gain a competitive advantage (Luo et al., 2018).

Small- and medium-sized enterprises (SMEs) are the engine of the European Union (EU), with more than 20 million SMEs operating in the EU (Clark, 2021b), providing jobs for nearly 84 million people (Clark, 2021a). Their contribution to GDP averages around 50% (Clark, 2021b). Recognising the importance of these enterprises, the EU launches from time to time a number of initiatives and programmes to help SMEs compete (European Commission, 2022).

The SME sector is facing number of challenges (e.g. generational change, inflexible corporate governance, digitalisation) which are often not addressed by the programmes designed to support them.

In this context, the following question arises: How do articles related to the application of cloud services by SMEs in the Visegrad Group (V4) countries appear in the literature?

The relevance of the study is that it deals with a topical issue regarding the take-up of cloud services, as their application offers many opportunities and benefits, and is justified by the prominent role of SMEs.

Aim of the study:

- a) A review of the literature related to the V4 countries regarding the adoption of cloud services by SMEs, which will allow us to identify the different aspects, and
- b) to establish a literature framework as a starting point for the widest possible adoption of cloud-based services, given the rapid pace of digitization and the increasing adoption of cloud-based services, which is the direction in which many economies will increasingly shift in the future.

The study is divided into 4 main sections, which are as follows: section 1 describes the situation of SMEs in general and in the V4 countries; section 2 describes the research methodology used in this study. Section 3 presents the results of the bibliometric survey; finally, section 4 is the conclusions.

2. Small- and medium-sized enterprises (SMEs)

The SME sector is of great importance worldwide, whether in developing countries or the European Union (EU), as is demonstrated by the fact that the SME sector makes up the vast majority of businesses worldwide, providing millions of jobs and contributing significantly to economic growth (International Labour Organisation, 2019). According to the OECD (2019) study, while SMEs lag behind large companies in terms of innovation, they play an important role in innovation, especially start-ups, and are also active in major innovation breakthroughs. SMEs are also of practical importance in the sense that a large proportion of them are family-owned (European Commission, 2021d), which results in marked differences in management and operations compared to non-family-owned businesses (Steinerowska-Streb, 2021).

Table 1.
Share of SMEs in V4 countries

	EU	Czech Republic	Hungary	Poland	Slovakia
Number of enterprises	22,567,300	1,026,907	582,917	1,732,623	475,229
SMEs in Total Enterprises (%)	99,8	99,8	99,8	99,8	99,9
Total employment (%)	65,2	66,4	68,3	67,1	72,7
SMEs' employment	83,397,941	2,501,184	1,899,936	6,125,825	1,183,736
DESI score	50,7	47,4	41,2	41	43,2
Skills & innovation	-	below the EU average	well below the EU average	well below the EU average	well below the EU average
Performance of EU Member States' innovation systems	-	Moderate Innovator	Emerging Innovators	Emerging Innovators	Emerging Innovators

Source: (European Commission, 2021a, 2021b, 2021c, 2021d, 2021f, 2021g, 2021h).

Based on European Commission data, SMEs account for a significant portion of total firms in the countries listed in Table 3. SMEs have a vital role in producing jobs and enabling a competitive environment in V4 countries. It can be seen that the SME sector is clearly the basis of the economy in the V4 countries, with a share of SMEs above 95% in all the countries surveyed. The last row of the table shows the innovativeness of the countries compared to the EU average. The Czech Republic is the best performer in terms of innovation, as although it is below the EU innovation average, it is still far ahead of the V4 countries in this area, mainly due to its higher use of ICT technology.

In the context of innovation, CC technologies should also be mentioned, as research conducted in EU countries shows that CC adoption and deployment rates by enterprises are low (41%). It is also worth noting that the deployment rates of cloud services vary significantly not only across countries but also across economic sectors within a given country (Eurostat, 2021). As digitalization plays an important role in innovation, the Digital Economy and Society Index (DESI) scores are included in the table. The DESI scores show that all four countries underperform in digitalization, with the Czech Republic (47,4) being closest to the EU average (50,7) and rising above the V4 (European Commission, 2021a).

3. Cloud computing

Cloud computing (CC) or cloud-based service is transforming the way organizations and industries operate. Access to business-relevant data and analytics will not only help organizations gain a competitive advantage but will also become critical to their survival as cloud usage increases (Xu, 2012).

Cloud computing has been a widely studied topic in both industry and academia (Bayramusta, Nasir, 2016). The economical, scalable and anytime, anywhere features of shared resources are just some of the features that have fostered and increased interest in the technology (Abbas et al., 2015; Orehovački et al., 2018). Other advantages of CC technology include the fact that resources are made available to users and are released from the shared resource on demand (Abdalla, Varol, 2019). On-demand resource provisioning ensures optimal allocation of resources and it is cost-effective (Prasad, Rao, 2014). Users are thus relieved from investing heavily in IT infrastructure (National Institute of Standards and Technology's, 2011), as they use the resources provided by the cloud service provider and pay as they use them. On the other hand, cloud service providers can lease the freed resources to other users after an agreement with the user. Another advantage of cloud computing is the ease of use, as customers do not need to have high expertise in cloud services technology, as the management of technology and services is transferred from the user to the service provider (Hayes, 2008).

Cloud-based services are usually categorized in two ways, firstly by what the service covers and secondly by the model within which the user uses the service. These can be based on whether the CC is private, public, community or hybrid, or whether the user chooses to use the software (SaaS), the platform (PaaS) or the infrastructure as a service (IaaS) (Rittinghouse, Ransome, 2017).

4. Methodology

We used the Web of Science database for the bibliometric search to examine the terms related to the difficulties, challenges, advantages and disadvantages of adopting cloud services for SMEs in the title, abstract and keywords of the article. The research query yielded 1150 hits. The database was searched using the following Boolean expression: “sme cloud adopt* (Topic) or sme cloud challenge* (Topic) or sme cloud *advantage* (Topic) or sme cloud barrier* (Topic) and sme* visegrad group (Topic) or sme* v4 (Topic) or small- and medium-sized enterprise* (Topic) and English (Languages) and Slovakia OR Poland OR Hungary OR Czech Republic (Countries/Regions)”. No time range option was used in the database search, thus the articles included in the search are dated by their Web of Science results according to their publication date between 1995 and 2021.

The data were analyzed using VOSviewer software. The VOSviewer is free software and it can be used to create a bibliometric map of authors based on co-citation or keywords based on co-occurrence information (van Eck, Waltman, 2010).

The aim of the research was to identify the factors influencing the shift of SMEs towards cloud services. The main topics of the selected articles are presented in order to provide a more detailed view of the literature on cloud computing adoption by SMEs. The results of this research are presented below, highlighting the identified limiting and facilitating factors and the main points observed concerning them.

5. Results

The bibliometric search using the Web of Science (WOS) database of terms related to the difficulties, challenges, advantages and disadvantages of adopting cloud services for SMEs in the title, abstract and keywords of the article, yielded 1150 hits.

5.1. Analysis

Figure 1 shows the distribution of the papers over time. The first paper was published on this topic in 1995. However, the interest in the topic started in the early 2010s, and between 2011 and 2018 the number of studies published on the topic has relatively multiplied.

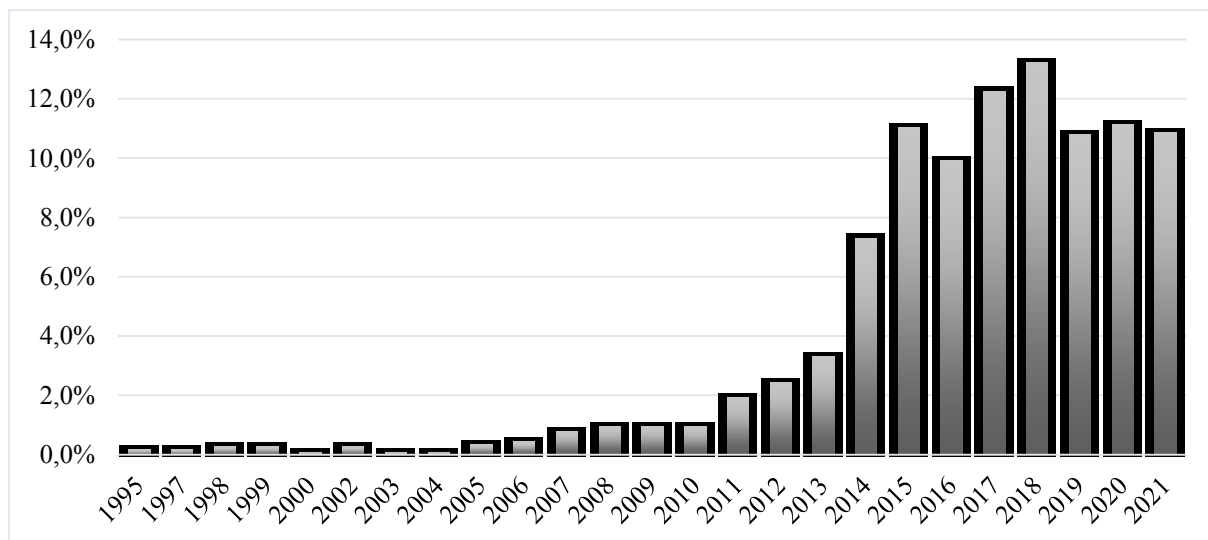


Figure 1. Publication by year between 1995-2021.

Source: Prepared by researcher based on WOS database.

Figure 2 shows that most SME CC adopting papers are published in WOS Categories of Economic (41,9%), Business (31,1%) and Management (30,3%). Surprisingly, besides the economic and financial aspects, the publications representing the IT area are far behind, although the technological aspect could justify a higher proportion of publications on the subject.

Figure 3 shows the results of the analysis applied to the keywords of the publications included in the research. The threshold we set for the analysis was that a keyword should occur at least 5 times, and 138 items met this criterion, from which VOSviewer created 13 clusters, each cluster being marked with a different color. The lines between the circles mean the links between them and the closer the circles, the stronger the link between them. As expected, SME/SMEs and Small- and medium-sized enterprises are the most frequent and most prominent terms (bigger circle means more frequent mentioning), but innovation, competitiveness, COVID and risk management also stand out. In terms of clusters, the blue, yellow, light blue and purple clusters stand out as the most prominent, proving to be the most powerful and closely related.

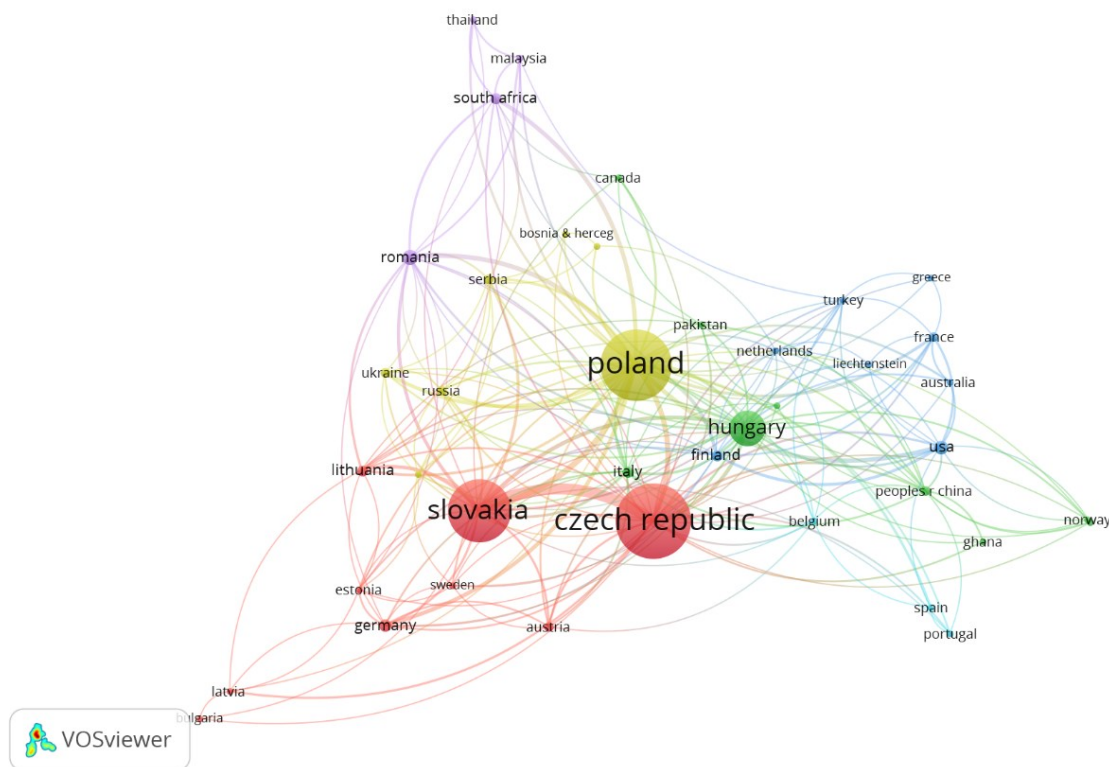


Figure 4. Main clusters co-authorship by countries.

Source: Prepared by researcher based on WOS database.

Figure 4 shows the co-authored countries in at least 2 publications. The figure shows 40 countries in 6 clusters, with 210 connections between them. It can be seen that the collaboration between the Czech Republic and Slovakia is significant, with several joint publications and a cluster. However, it can also be seen that Poland and Hungary have a smaller share of joint publications. Furthermore, while Poland is relatively close to Slovakia and the Czech Republic, Hungary appears almost isolated in terms of clusters. The latter may also be due to the small number of publications attributed to the few Hungarian authors included in the study. It is also interesting to note that Slovakia and the Czech Republic co-publish with researchers from many countries, including Germany, Bulgaria, South Africa and even China, and are almost linked to all parts of the world. Meanwhile, Hungary shows a similarly broad international cooperation, but the connectivity between the V4 is below expectations.

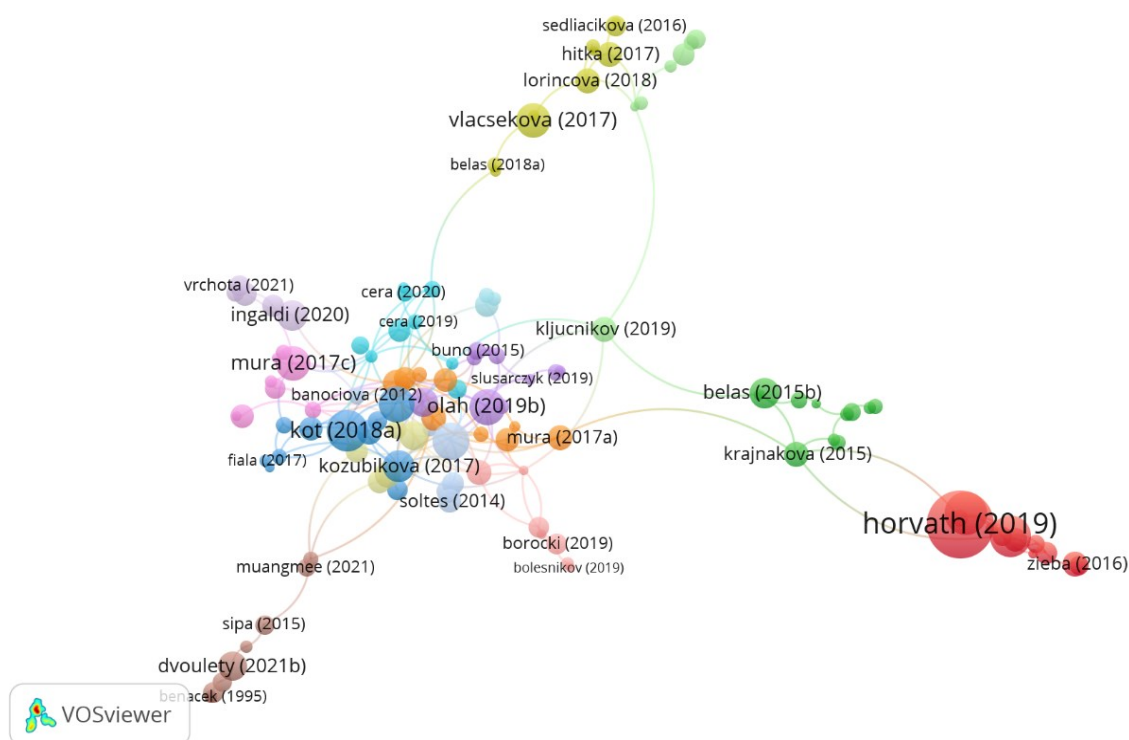


Figure 5. Citation by documents.

Source: Prepared by researcher based on WOS database.

Figure 5 shows the most cited publications and how they relate to the other publications included in the study. A threshold has also been set here to show only those studies that have been cited at least 5 times by others. This applied to 309 of the 1150 studies, but only 121 of these were closely related. As shown in the figure, one of the most cited publications (11) is by Horváth and Szabó (2019), but it can be seen that it is relatively distinct from the other studies. This is also due to the fact that this study focuses more on the implementation of Industry 4.0 and less on cloud services. This is followed by the studies by Belás and colleagues (2015), and Kozubíková and colleagues (2017) with 10-10 links. Also worth mentioning for its central role (Kot, 2018) with 6 links.

Table 2.

Top 10 most cited publications in the analysis

Authors	Publication title	Cited by	Keywords
Horváth and Szabó (2019)	Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities?	207	Industry 4.0; Digital strategy; Management functions; Lean; Qualitative; Supply chain
Laukkanen et al. (2013)	The effect of strategic orientations on business performance in SMEs A multigroup analysis comparing Hungary and Finland	88	Finland; Growth; Business performance; Hungary; Small-to-medium-sized enterprises; Strategic orientation
Haseeb, Hussain, Ślusarczyk, et al. (2019)	Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance	80	Industry 4; 0; big data; business performance; IoT; smart factory; SMEs

Cont. table 2.

Kot (2018)	Sustainable Supply Chain Management in Small and Medium Enterprises	78	Innovativeness; IT capability; Employee empowerment; Firm performance; Poland; Small to medium-sized enterprises; Information technology
Kmieciak et al. (2012)	Innovativeness, empowerment and IT capability: evidence from SMEs	75	small and medium enterprises; supply chain; sustainability
Belás et al. (2015)	The Business Environment of Small and Medium Enterprises in selected Regions of the Czech Republic and Slovakia	62	Small and medium-sized enterprises; business environment; motives for business; business risks; SMEs in society; business optimism
Haseeb, Hussain, Kot, et al. (2019)	Role of Social and Technological Challenges in Achieving a Sustainable Competitive Advantage and Sustainable Business Performance	57	entrepreneurs; economic risk; financial risk; SMEs; source of risk
Oláh et al. (2019)	Analysis and Comparison of Economic and Financial Risk Sources in SMEs of the Visegrad Group and Serbia	57	social challenges; technological challenges; strategy alignment; competitive advantage; sustainable business performance
Mura and Vlacsekova (2017)	Effect of motivational tools on employee satisfaction in small and medium enterprises	53	motivation; motivation factors; motivational tools; small and medium-sized enterprises; Slovakia
Mura et al. (2017)	Development Trends in Human Resource Management in Small and Medium Enterprises in the Visegrad Group	52	human resource management; small and medium enterprises; development and trends in human resource management; Visegrad Group

Source: Prepared by researcher based on WOS database.

Table 2 shows which are the 10 most cited. As shown in the table, the most cited publication is Horváth and Szabó (2019), which is cited in 207 papers, but it can be seen that it is relatively distinct from the other studies. This is followed by a study by Laukkanen and colleagues with 85 citations from 2013. In last place is research by Mura and colleagues (2017), which has been cited 52 times since its publication.

Table 3.

Challenges/barriers/(dis)advantages of cloud computing adoption

Barriers - Difficulties	Risk
economic - financial	Risk of a security breach
cultural	Problems accessing data or software
technical	Difficulties in unsubscribing or changing service provider
legal	Uncertainty about the location of the data
implementation	High cost of buying CC services
competencies/resources	Insufficient knowledge of CC
	low risk-taking propensity, tradition
	Uncertainty about applicable law, jurisdiction, dispute resolution mechanism

Source: Prepared by researcher based on WOS database.

Table 3 summarises the barriers, difficulties and risks found in the literature that SMEs face when adopting cloud computing. The first column of the table summarises the barriers in 6 groups of factors. The idea of grouping barriers and difficulties in this way is taken from the research carried out by Orzes et al. (2018), as well as from the literature on Industry 4.0. The economic-financial group includes factors such as financial resources and profitability,

keeping the costs at a reasonable level - cost cutting, lack of clearly defined economic benefits and tax incentives, finance planning (risk management and efficiency), and high cost of acquiring specialists, difficulties in obtaining a loan.

The legal factors are legal jurisdiction, legal data security concerns and lack of standards and uncertainty about the reliability of the systems. The competencies/resources group includes factors such as lack of evaluation of usefulness, lack of qualified staff, the resistance of employees, lack of employee training, continuous staff rotation, ignorance of its capabilities and lack of knowledge regarding cloud computing options.

The technical difficulties include slow internet connection, difficult interoperability/compatibility, security and data protection, technical issues (data management, data extraction, portability), dependence on the operation of the Internet connection and weak IT infrastructure. Implementation problems included high coordination effort, need to find a suitable research partner, change control, ownership and customization and lack of methodical approach for implementation.

And the cultural difficulties of cloud-based services include companies do not feel the need to introduce this technology, disagreement regarding the benefits of the leadership, lack of trust, low risk-taking attitude of family-owned SMEs, no need for new business models, no management preparation, and lack of supportive functional structure of the organization, managers also do not feel the necessity to change the state of the IT department, lack of local support factors were listed.

Table 4.
Contributing factors to implement cloud computing

	Contributes to implementing
Cultural	organization structure and process
	generation-change
	innovativeness
	trust for IT artefacts
Technical	IoT technology, IT capability
	privacy
	safety
	reliability of CC
Competencies/resources	usefulness, functionality, convenience
	the managers' know-how on cloud computing
Economic - financial	the knowledge and skills needed to apply CC
	cost reduction
	investments in innovation
	perceived costs of implementing the technology

Source: Prepared by researcher based on WOS database.

Table 4 presents the factors that facilitate the implementation of cloud computing and groups them according to the principle of barriers and difficulties. The publications reviewed show that, in cultural terms, the ability and willingness of a company to innovate, its attitude towards IT tools, and its confidence, but also its corporate operations, have a major impact on the adoption and diffusion of cloud computing. The attitude of managers and executives also

contributes significantly to the uptake of CC technology, as a supportive climate can help to increase the willingness to innovate and adapt quickly to market needs. The uptake of CC services by SMEs is facilitated by technical factors such as the IT infrastructure of the company, the availability of CC in the region or country, but also the perception of the technology or service in terms of functionality, utility and usability. In connection with this, the economic and financial aspects show the financial benefits of using the cloud-computing and the financial outlay that can be made.

6. Research gap(s) in the literature of V4 SMEs

In conducting the literature review, several observations and findings were made based on studies on the trends, attitudes and circumstances of SMEs in the V4 countries in the cloud services sector. These are:

- the literature on cloud services is still relatively new, so there are still many open questions,
- there is little focus on the V4 countries as a whole as a target group, although there is not much research on the individual members of the group or on comparing them with each other,
- similar situation for SMEs in the V4 countries,

Furthermore, most of the research is a literature review or quantitative research, with a low number of qualitative studies on the topic.

In addition, characteristics specific to family-owned and SMEs, such as difficulties of generational change, innovation gap vs low risk-taking behavior of SMEs as family businesses.

7. Conclusion

Our present research was triggered by the aforementioned points, which resulted in the identification of both the factors that discourage SMEs from opening up to cloud services and the factors that contribute to the adoption of CC. This paper has identified key gaps in the SME and cloud computing implementing literature, specifically considering the Visegrad Group.

The paper includes presented several key findings:

- there is a lot of potential in understanding, deploying and testing cloud services, with the market value of cloud services exceeding USD 350 billion in 2021 and forecast to grow further to 2030 (Varghese, Buyya, 2018; GVR, 2022),

- the low level of digitalisation and innovation disparities in the V4 countries is a significant barrier to the adoption of CC technology (European Commission, 2021c, 2021b),
- CC is a multidisciplinary topic due to the nature of CC technology, but publications in the economic field are predominant.

Innovation, and the willingness to innovate, also fosters competitiveness, which is essential for companies to succeed (Saunila, 2020). Small and medium-sized businesses (SMEs) are an expanding market for cloud providers since they are considered the engine of the economy. SMEs make up the majority of a developing country's business businesses. Since a result, this research has important implications for cloud providers and technology practitioners, as it will help them recognise the elements that influence cloud adoption. The results of the research indicate that the benefits of cloud computing still outweigh the difficulties associated with its adaptation. The perceived risks and the existence of different types of cloud services mostly negatively affect the adoption of cloud computing by SMEs, and the legal aspects of the service raise similarly more questions than might be expected. Cloud computing is a new technology that is still being labelled disruptive. SMEs, particularly in V4, are mostly unaware of the benefits of using cloud services. As a result, cloud providers should take a variety of steps to raise awareness of the technology's benefits. When creating cloud services for SMEs, they should focus on useful utilities and user-friendly interfaces so that consumers with low technological understanding may readily use them. Furthermore, cloud providers must provide a clear instruction or navigation system to help users in SMEs through the smooth operation of the services, increasing their confidence in cloud technology. However, in addition to the design of the software and the service, education and the right digital skills are also important, as we have already mentioned.

7.1. Limitations and future directions

As a suggestion for the future of research, a similar study involving other databases, such as ScienceDirect and Scopus, could provide further insights on the topic and provide additional insights to help us identify the drivers for the adoption and use of cloud services and to overcome barriers. Furthermore, it may be worthwhile to carry out a similar study, possibly extended to the European Union.

A major limitation of the study is that it was not possible to obtain a general classification in relation to other databases, as data for the bibliometric method in this study were only obtained from one database (Web of Science).

References

1. Abbas, A., Bilal, K., Zhang, L., Khan, S.U. (2015). A cloud based health insurance plan recommendation system: A user centered approach. *Future Generation Computer Systems*, 43-44: 99-109. doi:10.1016/j.future.2014.08.010.
2. Abdalla, P.A., Varol, A. (2019). *Advantages to Disadvantages of Cloud Computing for Small-Sized Business*. 7th International Symposium on Digital Forensics and Security (ISDFS). IEEE, pp. 1-6.
3. Avram, M G. (2014). Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective. *Procedia Technology*, 12, 529-534. doi:10.1016/j.protcy.2013.12.525.
4. Bayramusta, M., Nasir, V.A. (2016). A fad or future of IT?: A comprehensive literature review on the cloud computing research. *International Journal of Information Management*, 36(4), 635-644. doi:10.1016/j.ijinfomgt.2016.04.006.
5. Belás, J., Demjan, V., Habánik, J., Hudáková, M., Sipko, J. (2015). The business environment of small and medium-sized enterprises in selected regions of the Czech Republic and Slovakia. *E+M Ekonomie a Management*, 18(1), 95-110. doi:10.15240/tul/001/2015-1-008.
6. Cieciora, M., Bołkunow, W., Gago, P., Rzeźnik-Knotek, M. (2020). Critical success factors of ERP/CRM implementation in SMEs in Poland: pilot study. *Scientific Papers of Silesian University of Technology – Organization and Management Series*, 148, 103-116. doi:10.29119/1641-3466.2020.148.7.
7. Clark, D. (2021a). *Number of people employed by small and medium-sized enterprises (SMEs) in the European Union (EU27) from 2008 to 2021, by enterprise size*. Retrieved from <https://www.statista.com/statistics/936845/employment-by-smes-in-european-union/>, 2.04.2022.
8. Clark, D. (2021b). *Number of small and medium-sized enterprises (SMEs) in the European Union (EU27) from 2008 to 2021, by size*. Retrieved from <https://www.statista.com/statistics/878412/number-of-smes-in-europe-by-size/>, 2.04.2022.
9. Dincă, V.M., Dima, A.M., Rozsa, Z. (2019). Determinants of Cloud Computing Adoption by Romanian Smes in the Digital Economy. *Journal of Business Economics and Management*, 20(4), 798-820. doi:10.3846/jbem.2019.9856.
10. European Commission (2021a). *The Digital Economy and Society Index (DESI)*. Retrieved from <https://digital-strategy.ec.europa.eu/en/policies/desi>, 15.05.2022.
11. European Commission (2021b). *EIS 2021 Executive summary (EN)*. Retrieved from <https://ec.europa.eu/docsroom/documents/46411/attachments/1/translations/en/renditions/native>, 15.05.2022.

12. European Commission (2021c). *EU27 - SME Fact Sheet 2021*. Retrieved from <https://ec.europa.eu/docsroom/documents/46060>, 15.05.2022.
13. European Commission (2021d). *Family business*. Retrieved from https://single-market-economy.ec.europa.eu/smes/supporting-entrepreneurship/family-business_en, 25.08.2022.
14. European Commission (2022). *Entrepreneurship and small and medium-sized enterprises (SMEs)*. Retrieved from https://ec.europa.eu/growth/smes_enhttps://ec.europa.eu/growth/smes_en, 12.04.2022.
15. Eurostat (2021). *Cloud computing - statistics on the use by enterprises*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Cloud_computing_-_statistics_on_the_use_by_enterprises, 15.05.2022.
16. Gajdzik, B., Grebski, M. (2022). Human factor in Industry 4.0: about skills of operators in steelworks 4.0. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 157, 119-132. doi:<http://dx.doi.org/10.29119/1641-3466.2022.157.7>.
17. GVR (2022). *Cloud Computing Market Size, Share & Trends Analysis Report*. Retrieved from https://www.grandviewresearch.com/industry-analysis/cloud-computing-industry?utm_source=prnewswire&utm_medium=referral&utm_campaign=ict_01-sep-21&utm_term=cloud-computing-market&utm_content=rd1, 15.05.2022.
18. Haseeb, M., Hussain, H.I., Kot, S., Androniceanu, A., Jermittiparsert, K. (2019). Role of Social and Technological Challenges in Achieving a Sustainable Competitive Advantage and Sustainable Business Performance. *Sustainability*, 11(14), 3811. doi:10.3390/su11143811.
19. Haseeb, M., Hussain, H.I., Ślusarczyk, B., Jermittiparsert, K. (2019). Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance. *Social Sciences*, 8(5), 154. doi:10.3390/socsci8050154.
20. Hayes, B. (2008). Cloud computing. *Communications of the ACM*, 51(7), 9-11. doi:10.1145/1364782.1364786.
21. Horváth, D., Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change*, 146, 119-132. doi:10.1016/j.techfore.2019.05.021.
22. International Labour Organisation (2019). *The power of small: Unlocking the potential of SMEs*. Retrieved from <https://www.ilo.org/infostories/en-GB/Stories/Employment/SMEs#power-of-small>, 14.05.2022.
23. Kmiecik, R., Michna, A., Meczynska, A. (2012). Innovativeness, empowerment and IT capability: evidence from SMEs. *Industrial Management & Data Systems*, 112(5), 707-728. doi:10.1108/02635571211232280.
24. Kot, S. (2018). Sustainable Supply Chain Management in Small and Medium Enterprises. *Sustainability*, 10(4), 1143. doi:10.3390/su10041143.

25. Kozubíková, L., Homolka, L., Kristalas, D. (2017). The Effect of Business Environment and Entrepreneurs' Gender on Perception of Financial Risk in The Smes Sector. *Journal of Competitiveness*, 9(1), 36-50. doi:10.7441/joc.2017.01.03.
26. Laukkanen, T., Nagy, G., Hirvonen, S., Reijonen, H., Pasanen, M. (2013). The effect of strategic orientations on business performance in SMEs. *International Marketing Review*, 30(6), 510-535. doi:10.1108/imr-09-2011-0230.
27. Liu, Y., Xu, X. (2017). Industry 4.0 and Cloud Manufacturing: A Comparative Analysis. *Journal of Manufacturing Science and Engineering*, 139(3), 034701. doi:10.1115/1.4034667.
28. Luo, X., Zhang, W., Bose, R., Li, H., Chung, Q.B. (2018). Producing competitive advantage from an infrastructure technology: The case of cloud computing. *Information Systems Management*, 35(2), 147-160. doi:10.1080/10580530.2018.1440732.
29. Miśkiewicz, R., Wolniak, R. (2020). Practical Application of the Industry 4.0 Concept in a Steel Company. *Sustainability*, 12(14), 5776. doi:10.3390/su12145776.
30. Moeuf, A., Pellerin, R., Lamouri, S., Tamayo-Giraldo, S., Barbaray, R. (2017). The industrial management of SMEs in the era of Industry 4.0. *International Journal of Production Research*, 56(3), 1118-1136. doi:10.1080/00207543.2017.1372647.
31. Mura, L., Ključnikov, A., Tvaronavičienė, M., Androniceanu, A. (2017). Development Trends in Human Resource Management in Small and Medium Enterprises in the Visegrad Group. *Acta Polytechnica Hungarica*, 14(7), 105-122.
32. Mura, L., Vlacsekova, D. (2017). Effect of motivational tools on employee satisfaction in small and medium enterprises. *Oeconomia Copernicana*, 8(1), 111. doi:10.24136/oc.v8i1.8.
33. National Institute of Standards and Technology's. (2011). *Final Version of NIST Cloud Computing Definition Published*. Retrieved from <https://www.nist.gov/news-events/news/2011/10/final-version-nist-cloud-computing-definition-published>, 27.01.2022.
34. Oláh, J., Kovács, S., Virglerova, Z., Lakner, Z., Kovacova, M., Popp, J. (2019). Analysis and Comparison of Economic and Financial Risk Sources in SMEs of the Visegrad Group and Serbia. *Sustainability*, 11(7), 1853. doi:10.3390/su11071853.
35. Orehovački, T., Babić, S., Etinger, D. (2018). Identifying Relevance of Security, Privacy, Trust, and Adoption Dimensions Concerning Cloud Computing Applications Employed in Educational Settings. In: D. Nicholson (Ed.), *Advances in Human Factors in Cybersecurity. AHFE 2017, Vol. 593* (pp. 308-320). Springer.
36. Orzes, G., Rauch, E., Bednar, S., Poklemba, R. (2018). *Industry 4.0 Implementation Barriers in Small and Medium Sized Enterprises: A Focus Group Study*. IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), pp. 1348-1352.

37. Prasad, A.S., Rao, S. (2014). A Mechanism Design Approach to Resource Procurement in Cloud Computing. *IEEE Transactions on Computers*, 63(1), 17-30. doi:10.1109/tc.2013.106.
38. Rittinghouse, J.W., Ransome, J.F. (2017). What Is the Cloud? *Cloud Computing - Implementation, Management, and Security*. CRC press.
39. Saunila, M. (2020). Innovation capability in SMEs: A systematic review of the literature. *Journal of Innovation & Knowledge*, 5(4), 260-265. doi:10.1016/j.jik.2019.11.002.
40. Steinerowska-Streb, I. (2021). Internationalization of Polish enterprises. A comparative analysis of family and non-family businesses. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 150, 255-266. doi:10.29119/1641-3466.2021.150.19.
41. Stock, T., Seliger, G. (2016). Opportunities of Sustainable Manufacturing in Industry 4.0. *Procedia CIRP*, 40, 536-541. doi:10.1016/j.procir.2016.01.129.
42. Tokarčík, A., Pavolová, H., Bakalár, T., Bednárová, L. (2021). Impact of Innovations on the Saving of the Production Company's Working Time Fund. *Modern Management Review*, 26(4): 119-131. doi:10.7862/rz.2021.mmr.29.
43. van Eck, N.J., Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538. doi:10.1007/s11192-009-0146-3.
44. Varghese, B., Buyya, R. (2018). Next generation cloud computing: New trends and research directions. *Future Generation Computer Systems*, 79, 849-861. doi:10.1016/j.future.2017.09.020.
45. Wielki, J. (2017). The Impact of the Internet of Things Concept Development on Changes in the Operations of Modern Enterprises. *Polish Journal of Management Studies*, 15(1), 262-274. doi:10.17512/pjms.2017.15.1.25.
46. Xu, X. (2012). From cloud computing to cloud manufacturing. *Robotics and Computer-Integrated Manufacturing*, 28(1), 75-86. doi:10.1016/j.rcim.2011.07.002.

TALENT MANAGEMENT IN SPORT

Robert BALCERZYK^{1*}, Karolina GABOREK²

¹ General Tadeusz Kościuszko Military University of Land Forces in Wrocław; robert.rb@interia.pl,
ORCID: 000-0002-5462-6901

² General Tadeusz Kościuszko Military University of Land Forces in Wrocław; karoolina.budnik@gmail.com
* Correspondence author

Purpose: The main objective of the research presented in this article was to diagnose talent management in the Wrocław Taekwon – do Sports Club In order to achieve this goal, the first part of the article explains the meaning of the term „talent management" in the scientific literature on management, and then, on the basis of the research carried out, an attempt was made to answer the question: which factors are the key determinants of the talent management process.

Design/methodology/approach: For the research presented in this paper, a literature analysis in the area of talent management. The studies in literature also included secondary sources, which were communications from research of similar scope.

The combination of different research methods allowed to obtain a broader context of the studied phenomenon and ensured a higher quality of the conducted research. The diversity of methods was aimed at achieving a consistency of the empirical basis for the inference. A diagnostic survey was adopted as the leading method. The remaining methods applied in the paper were auxiliary (complementary).

Findings: „Talent management" and having talented employees in a global economy is a strategically important resource affecting the market value of the organisation itself and providing a competitive advantage. Building a significant intellectual capital of the organisation requires the use of appropriate methods and tools to support the management, systematic measurement, constant comparison with competitors, elimination of barriers and use of opportunities for development (and such becomes the current crisis).

Research limitations/implications: In the future, research will be continued on a larger research sample.

Practical implications: The article presents the results of research carried out in one of Wrocław's sports clubs. The research results are very interesting and encourage more research. They are a valuable source of information for managers and coaches responsible for schools and the development of sports players. In turn, for those responsible for recruiting athletes, the results may be useful in terms of designing individual career paths of players.

Originality/value Based on empirical research, the article proposes an original set of systemic solutions for talent management to improve organisational performance.

Keywords: talent management, talent.

Category of the paper: Research paper.

1. Introduction

We live in an era where companies are constantly outdoing themselves with new ideas to help them gain a competitive advantage. The growing importance of the human resources management process shows the direction in which these changes are taking place. Talent management, On the other hand, talent management is considered to be one of the main challenges of strategic human resources management . It turns out that it is the implementation and effective use of the talent management process in its strategy that helps to achieve high results and create a leading position of the organisation on the labour market. Therefore, in order to increase the competitiveness of companies on the market, they rely not only on their offerings, but also on proper search and then skillful use and retention of people who, thanks to their knowledge, above-average skills or natural leadership abilities, will contribute to the development of the whole company.

The concept of talent management emerged some thirty years ago, based on a concept initiated in the USA back in the 1980s. Already then, human resources started to be treated as assets and intellectual capital of a company. It was noticed that investing in the development of employees, the formation of a specific structure of employment and a constellation of personnel characteristics allows to create a competitive advantage in relation to other business entities. Despite the growing interest in this subject, a large part of companies is not aware of the existence or omits talent management when creating development strategies, not believing in the benefits resulting from their application. Thoughtful implementation of talent management processes may bring measurable effects not only in terms of income but also in terms of building a positive company image, increasing employee involvement and satisfaction which will directly contribute to obtaining a competitive advantage.

2. The essence of talent management

Talent management is considered to be one of the most important global trends which influence the human resources development policy (Knap-Stefaniuk, Karna, 2017). This trend is also visible in Poland, which results in emphasising the need to create special development programmes for employees with the highest potential (Tabor, 2013). Talent management, next to performance management and supporting the work-life balance, is also recognised as one of the three main challenges of strategic human resources management (HRM) (Brzeziński, 2015).

Talent is a complex set of expectations from both managers and their talented subordinates. Many of these expectations are undefined and most of the difficulties in managing talented people arise from that problem. There are three main streams in talent management:

- talent management equated with human resource management,
- talent management focusing on the flow of employees and their adequate deployment in the unit,
- talent management consisting in employing the most talented individuals and treating them as a superior asset (resource) for the organisation (Tabor, 2013).

In order to properly understand the concept of talent management, it is necessary to define it first. There are several definitions of talent.

In psychological terms, talent is defined as a person who has a better appearance and understanding of his or her unique interests and aptitudes than others, perceives the relationship of these attributes to educational and professional opportunities, thinks reflectively and knows how nurturing these individual characteristics can affect their future development (Achter, Lubinski, 2005).

In their publications, A. Miś and A. Poczowski define a talent as a person who „brings something to the organisation which is a kind of excess in this organisation, often not visible in its plans and strategy, due to the fact that the organisation is not aware of it until a certain moment. The features of the competence profile of a talented person are consistent with the needs of the organisation at an accepted level, but there is something that makes them special, which cannot be measured (Miś, Poczowski, 2008).

On the other hand, J. Kopeć defines the concept of talent as „innate abilities transforming, as a result of actions taken, into appropriate skills and passion thanks to which a given individual can make products or provide services that are socially useful and subject to high quality assessment, beautiful or pleasing to the senses of the receiver at a level higher than average and difficult to meet by the majority of other producers or reproducers of a given product or service (Kopeć, 2012).

Slightly different aspects in her definition of talent are pointed out by J.A. Tabor who notes in her publications that talent "is a person who combines innate skills, intelligence and a desire for self-fulfilment with the ability and willingness to continue learning and development. They may have experience, which we will judge by their high results already achieved at work, or they may be just starting their career, demonstrating competences which particularly distinguish them among candidates. Talent consists of qualifications, potential and capabilities as well as hard work to develop one's personality and professional competencies (Tabor, 2013).

It follows from the above definitions that that talents display above-average skills and a set of personal qualities such as individual effectiveness, leadership skills, entrepreneurship, passion in action and commitment to their work tasks, which allow them to achieve excellent results at work - Figure 1 (Miś, 2020).. However, it is important to remember that talent should be interpreted not only as a person outstanding in above-average skills, but as an employee who through his or her involvement and own development contributes to the success of the organisation. Talent understood in this way becomes the subject of talent management, often expressed in the literature as TM.

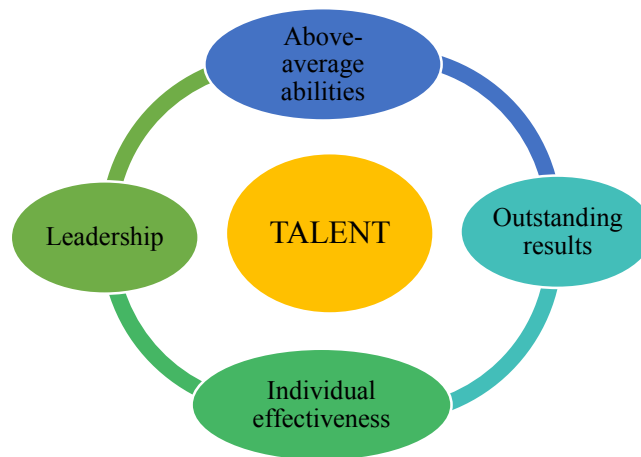


Figure 1. Set of personal characteristics defining talent.

Source: Own elaboration based on: Miś, 2020.

Considering the diversity of characteristics and individual abilities allowing for high performance at work the problem of defining the concept of talent management appears. Another issue is the lack of unanimity among management science experts. This is why, despite many attempts, it has not been possible to formulate a single definition of talent management.

M. Armstrong defines talent management as "the process of identifying, developing, recruiting, retaining and deploying talented individuals (Armstrong, 2011).

R.S. Wellins, A.B. Smith and L. McGee prefer to define talent management as "the recruitment, development, promotion and retention of talent, planned and executed in accordance with the current and future goals of the organisation (Wellins, Smith, 2006).

E.E. Lawler points out „attracting real talents and helping them understand what is expected of their work for the company. (...) It is also about providing employees with developmental experiences that create organisational strength and core competencies to retain real talent” (Lawler, 2008).

On the other hand, T. Davis states in his publications that "talent management is about recruiting and properly training and developing employees as well as retaining excellent performing employees on a continuous and consistently. A talent management strategy is a deliberate, structured approach by a company to the recruitment, retention, and training and development of talent in its organisation. and development of talented individuals in the organisation (Davis, Cutt, Flynn, Mowl, Orme, 2010).

J. Kopeć defines talent management as a process of strategic importance for the company consisting in identifying employees with above-average abilities and achieving the best results at work or their identification, attracting them to the unit and creating an appropriate organisational culture conducive to the development of this group, so that they bring maximum value to the company's stakeholders and ensuring that these staff do not leave their current place of employment (Kopeć, 2012).

Strategic talent management is also understood as activities and processes involving the systematic identification of key positions affecting organisational competitiveness, the development of a pool of high-potential and highly effective talent to fill these roles, and the development of a differentiated human resource architecture to support the filling of these positions with competent people, ensuring their commitment to the organisation. These processes and actions lead to a measurable difference in organisational effectiveness now and in the future (Miś, 2020).

The effectiveness of talent management in an organisation depends on many factors. The management literature identifies, among other things, elements such as:

- attracting outstanding individuals to the organisation,
- keeping talents in the organisation,
- effective talent management,
- talent identification (Mikuła, 2001).

The variety of interpretations of the concept makes it difficult to establish a single definition as the most appropriate one. Therefore, it seems more reasonable to distinguish several main perspectives from which talent management can be considered. J. Blass describes it as:

- process perspective - the process perspective believes that the future success of the company depends on having the right talents, so talent management and nurturing should be a part of the daily processes of organisational life. Talent management and nurturing are an integral part of the organisation's processes;
- cultural perspective - the cultural perspective considers talent management as a kind of mindset, a belief that talent is essential to the success of a company. It is a belief that talent is a key factor in achieving business success, each individual talent is important to the organisation and talent development becomes part of the work routine;
- competitive perspective - from a competitive perspective, talent management is about identifying talent and offering them what they need to prevent them from being acquired by competitors;
- development perspective - according to the development perspective, talent management is about fast-tracking high-potential employees; talent management is about creating development paths for the most outstanding;
- HR planning perspective - following the HR planning perspective ZT is about connecting the right people with the right jobs at the right time and performing the right tasks;
- change management perspective - in the change management perspective talent management is used as a driving force for change in the organisation. ZT is treated as a part of a broader strategy, initiating changes in the company (Mróz, 2015).

It is assumed that similar or sometimes the same processes are used in talent management as in human resources management (Gottwald-Białdyga, 2018). In both processes people are the subject used to achieve the organisation's competitive advantage in the market. The key aspect in talent management is the awareness of employees' self-realization with simultaneous continuous development. This will make their work much more efficient, satisfying potential employers. Talented employees use their abilities and natural aptitudes

Important concepts in relation to talent management are recruitment and selection, which enable the talent acquisition and identification process to operate efficiently. Recruitment of employees is aimed at selecting individuals who meet the requirements set for them by the company. After selection the organisation gives them the opportunity to further their education through training adapted to the needs of the company. Outstanding individuals who contribute to the organisation's profits and goals are recognised, if only through remuneration appropriate to their work. An employee appreciated by his employer has no intention of leaving for a competing company. Currently, many companies invest in human resources focusing on their quality rather than quantity. An important aspect is the choice and selection of individuals who thanks to their high competence will help achieve the company's strategic objectives.

The leader plays an important role in talent management. The role of a leader begins with getting to know the potential of the players and discovering their talents (Balcerzyk, 2021).

Summarising the above, the main premise of the talent management concept is to find ways in which the competencies and potential of employees can be revealed and then exploited.

3. Methods and characteristics of the research sample

The questionnaire concerning talent management in the Wrocław Sport Taekwon-do Club, conducted from the beginning of February to the middle of March 2022, was addressed to people actively training in the Wrocław Taekwon – do Sports Club (WTSC) who are not their competitors as well as to licensed competitors of the Club. It was divided into two sections - the first one applied to both tested groups while the second part referred only to licensed competitors of the described club. The research group consisted of 30 people (16 women and 14 men). The most numerous age group were 19-25 year olds (37%) and 15-18 year olds (33%). A less numerous group were people aged between 25 and 31 (20%). The least numerous group were people aged over 32 (only 10%).

The age of the competitors is closely related to the age category in which they compete. The Junior category is made up of players aged between 13 and 15. In this group of people, 13% of all respondents took part in the research. Juniors are 16 to 18 year olds and account for 23% of respondents to the survey. Seniors constitute the largest group of respondents - 57%.

Competitors between 19 and 35 years of age take part in it. The last age category, and at the same time the least numerous group of respondents (7%) are Veterans aged over 35 years.

Among the respondents people with high (at least 10 years) training experience dominate and they constitute 53% of all the respondents. This draws attention to the fact that many people with long-term experience train at the club which can be used in shaping young players. The second largest group (37%) is represented by people with 5-10 years of training experience. Less numerous, 7% and 3%, are respectively the groups of respondents with 2 to 5 and less than 2 years of training experience.

The aim of the conducted research was to diagnose talent management in the Wrocław Taekwon – do Sports Club.

4. Managing the talented competitors

According to research, 80% of those training at the WTSC are its licensed players, while the remaining 20% only train there. This draws attention to several aspects. The first is an extremely innovative approach to players from rival clubs, which is cooperation. The club does not close itself off to competitors; on the contrary, it makes its resources available to them. In return, it receives certain benefits, including talented players from other clubs raising the level of training - sharing their knowledge and skills. It also gives an opportunity to learn about the strengths and weaknesses of rivals, as well as the training methods of other clubs, so that appropriate tactics can be developed.

Another important issue in the context of talent management is the fact that there is an opportunity to get talented, already formed players, who may decide to leave their previous club. At this point it will be important to present the opportunities that the club offers its players. The most important factors that can determine this are availability, financial considerations, development prospects and the atmosphere at the club.

Research shows that as many as 47% of those surveyed admit to having participated in at least one training camp of the Polish National Taekwon - do Team. This means that these are (or were) well-formed athletes who maintain a very high level of performance, have extensive experience competing in national and international championships, and are constantly developing. They achieve high results and are often versatile - winning medals in various categories, both individual and team. The fact of being in the national team requires them to devote a great deal of time to preparing for sports events. Almost half (47%) of the respondents are very experienced competitors and are ready to pass on their skills and knowledge. As many as 90% of the respondents indicated that they were medallists at international tournaments and 86% said that they had won a medal at national tournaments.

Considering the above factors, this group of people should be defined as talents. It should be remembered that some of them are not players of Wrocław Taekwon - do Sports Club, but they train there every day. Thanks to that the level of training is raised and licensed players have the opportunity to draw knowledge, skills and experience from them.

The study attempted to identify factors motivating athletes to train and develop. The factors were divided into two types. The first one was self-motivation which includes factors coming from inside a person, i.e. opportunities for physical and psychological self-development (participation in trainings, courses or competitions), own satisfaction, a desire to improve motor abilities and maintain an athletic body. This type of motivation is the most important for talent development, because the definition of talent presupposes a high level of self-motivation. However, it is also important to provide other factors, which are referred to as extrinsic motivation. This group includes other influences such as pressure from coaches, parents or peers, financial benefits such as the desire for scholarships and prizes, the desire to win medals and the opportunity to meet friends at training or competitions.

Research has shown that 90% of people training at the Club train primarily for their own satisfaction and have a high level of self-motivation. They value activities that enable self-development in the form of participation in competitions and improvement of motor skills such as agility, speed or strength. Most respondents are also positively motivated by the possibility to stay in athletic shape. A small percentage of people train because of external pressures, financial gain or winning medals. However, many people treat participation in training or competitions as a great opportunity to meet with friends.

It is also important to mention the club's process of acquiring talented athletes. About 20% of the players are persons acquired by the Wrocław club from other sports clubs. Due to this, the respondents were asked about the above issues.

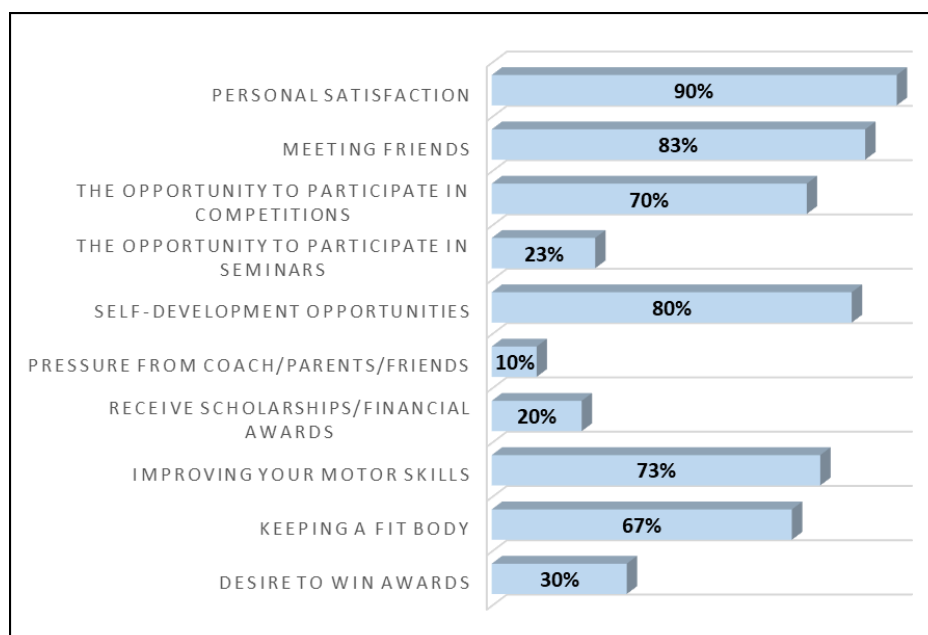


Figure 2. Diagram showing factors influencing players' motivation.

Source: Author's own analysis.

It turns out that the factor that most encourages the respondents to choose the Wrocław Club is the wide range of talented players who are successful in the national and international arena. Their achievements motivate and the talents themselves are living examples to follow. Thanks to this new icons appear and they promote the club all over Poland.

Interesting trainings and a wide and trained coaching staff are also very important factors indicated by the respondents. The first of them prevents routine which kills creativity and accelerates professional burnout, which unfortunately often affects above-average talented people. Related to this is the fact that 79% of respondents believe that the Club's coaching staff is professionally prepared to work with young people. Their participation in coaching courses or seminars develops their competences, and they themselves propose modern training solutions. This leads to a conclusion - the two above factors function inseparably with each other. Another related advantage noted by 63% of the respondents is a wide range of coaching staff, thanks to which trainings are varied, and an additional advantage of the described element is a multidimensional view obtained thanks to trainings under the supervision of several coaches. It should be noted that as many as 21% of the respondents rather did not pay attention to this issue when choosing a club.

The respondents also identified who has the greatest influence from their environment on their sporting career. All players highlighted the coach as the person who clearly contributes to shaping the path of their sporting career. About 46% of the respondents at the same time mentioned that it is the coach, through his decisions, who influences his athletes to the greatest extent. This means that according to the respondents, the coach's concepts, training selection, his or her help and support is the key to their success. More than 38% of the athletes stated that they themselves decide on the trajectory of their sports career. This demonstrates the high self-awareness of the respondents who are thoughtfully attempting to take the most important decisions concerning their careers. They are aware of their capabilities and are able to use their knowledge and skills for self-improvement. Another frequent answer was the statement that the respondents' career is strongly influenced by their friends training in the Wrocław Club. Therefore, it should be noted that joint trainings, trips to competitions or training camps with friends can motivate for self-development, introduce healthy rivalry and elements of entertainment. The influence of people outside the sports environment (parents, siblings and friends) was considered insignificant by the competitors.

The research shows that the players of Wrocław Club most value the opportunity to practice with titled players training in the club. This opportunity would positively influence as many as 91% of respondents. A great prospect for development for 88% of people would also be the opportunity to compete in various competitions. Over 80% of the respondents also indicated that participation in inter-club sparring, seminars and training would have a positive impact on improving and expanding their skills.

As part of talent management, the Club provides opportunities for players to develop by running their own sections. More than 38% of all respondents, are individuals who already have their own training sections or individuals who the coaches can support when necessary. The club makes proper use of the competences of talented players by managing them properly. By assigning them to their own training groups, the club makes it clear that it has great trust in them, while the talents can show their creativity by introducing innovative solutions.

The surveyed organisation promotes its talented players through financial support. As many as 92% of the respondents perceive that without the Club's financial support they would not be able to secure participation in competitions. The club trains a small number of people who receive awards and scholarships from various sources such as the Marshal's Office or the Municipal Office in Wrocław.

It is remarkable that more than half of the respondents do not attach importance to activity in social media. Most of the respondents also do not pay attention to the club's involvement in various promotional activities of their players. This also makes it difficult to attract potential sponsors. Slightly more than 1/3 of the respondents believe that this aspect is important for them. It should be remembered that through proper conducting of individual profiles or websites the club can effectively communicate with the surroundings. The benefit can also be the shaping a positive image of the club.

The research shows that the Wrocław club cares about monitoring the departure of talented players. Usually the reasons for such decisions are injuries or relocation. The club is positively perceived by its players and 96% of the respondents said that they would definitely recommend the club to their friends. Only 4% are unable to say whether they would recommend the club to their friends or colleagues. This shows that often, despite the decision to leave the club for various reasons, the players will remember the club very pleasantly and as a result shape a positive image of the organisation in the sports environment.

5. Conclusions

At the Wrocław Club, a group of talented players can be identified and singled out based on an analysis of their achievements. These are individuals who have a great wealth of knowledge and experience and are constantly expanding their skills and qualifications. Talented people can also include some people who are not players at the Club but train there on a daily basis. Therefore, it seems reasonable to pay attention to attracting such players. In addition to the mentioned groups of people, young, developing players should also be mentioned. Such people can also supply the existing pool of talents, so it is important to bet on their development as well.

The Management Science literature emphasises the importance of conducting a reliable, starting from strategy planning to conducting an in-depth analysis and evaluation of talent management in an organisation. The conducted research shows that talent management processes in the studied organisation are carried out automatically and consciously. Thanks to the developed system, which nevertheless requires a few improvements, the players achieve excellent results. The atmosphere in the Club is also worth mentioning. Consequently, the following conclusions emerge after the analysis:

- the Club trains talented people who have great knowledge and skills, who regularly win medals in the national and international arena and are appointed to the National Team identified as talents;
- they are highly motivated and train primarily for their own satisfaction;
- the researched organisation has adopted an extremely innovative approach to athletes from rival clubs - cooperation. The club makes its resources available to them and in return receives certain benefits: a high level of training, as well as the opportunity to learn knowledge and skills from them;
- research shows that a club takes advantage of the opportunities offered by allowing talented players from rival clubs to train with them, later acquiring them on a permanent contract;
- the factor which most encourages players to choose Wrocław Club is the wide range of talented successful players. Their achievements become a motivating factor and the talents themselves are examples to follow;
- very important elements are also interesting trainings and a wide and well-trained coaching staff indicated by the respondents. Coaching courses or seminars help widen horizons and offer modern training solutions;
- the club makes proper use of the competences of talented players by managing them properly. The club uses the skills of talented players in the right way by managing them properly, assigning them to their own training groups which shows that it has great confidence in them. The talents can show their creativity by introducing new solutions;
- the players claim that if they received a competitive offer, they would not accept it. None of the interviewees are inclined to leave the Club which shows high loyalty towards the Club and proves that the players feel comfortable and the Club meets their requirements;
- almost all players, despite having to decide to leave the club for various reasons (injuries, change of residence), stated that they would recommend the club to their friends which contributes to the formation of a positive image of the organization in the sports environment.

The analysis of the collected results allows us to formulate a conclusion that proper talent management in the researched organisation brings results in the form of successes of talented players on the national and international arena. However, the talent management process needs to be improved:

- the club should focus on the planning process and in particular the long-term planning of the players' career paths. This should include elements such as discussing previous seasons, learning from mistakes made and targeting specific goals to be achieved in future seasons;
- another element for improvement is the funding of talented players. Although it is the club that provides the most financial support to its players, it very often turns out that the burden of financing participation in sporting events falls on the athletes themselves and their families;
- it would be advisable to intensify the club's efforts to raise funds by submitting scholarship and award applications.

To sum up the research on the issue of "talent management", it should be stated that talents require appropriate conditions to reveal themselves and develop. It is necessary to know the area of activity of the employee, in which the information for talent development will be obtained. The implementation of "talent management" programmes is mainly conducive to increasing the company's competitiveness in the market, supporting organisational culture, retaining talented employees in the company, ensuring the inflow of new talented employees, creating a positive image on the external labour market.

References

1. Armstrong, M. (2011). *Zarządzanie zasobami ludzkimi*. Warsaw: Wolters Kluwer.
2. Balcerzyk, D. (2021). The Role of a Leader in Contemporary Organizations. *European Research Studies Journal*, Vol. XXIV, Iss. 1, pp. 226-240. DOI: 10.35808/ersj/1959.
3. Brzeziński, Ł. (2015). *S. Zarządzanie talentami w organizacji*. Bydgoszcz: Uniwersytet Kazimierza Wielkiego w Bydgoszczy.
4. Davis, T., Cutt, M., Flynn, N., Mowl, P., Orme S. (2010). *Ewaluacja talentu. Nowa strategia zarządzania talentami w organizacji*. Warszawa: Wolters Kluwer, p. 15.
5. Edward, E. (2008). *Talent: Making People Your Competitive Advantage*. San Francisco: Jossey-Bass
6. Gottwald-Białdyga, M. (2018). Analiza systemu zarządzania talentami w organizacjach. *Zeszyty Naukowe Wyższej Szkoły Humanitas Zarządzanie*, No. 3. Sosnowiec, pp. 141-158. DOI:10.5604/01.3001.0013.0056.

7. Knap-Stefaniuk, A., Karna, W. (2017). Zarządzanie talentami jako wyzwanie w międzynarodowym zarządzaniu zasobami ludzkimi. *Religia i świat cyfrowy, Vol. XVI, Iss. 1*. Kraków, pp. 101-120, <https://czasopisma.ignatianum.edu.pl/pk/article/view/1865>.
8. Kopeć, J. (2012). *Zarządzanie talentami w przedsiębiorstwie*. Kraków: Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie.
9. Michaels, E., Handfield-Jones, H., Axelrod, B. (2001). *The War for Talent*. Boston: Harvard Business School Press.
10. Mikuła, B. (2001). *Elementy współczesnego zarządzania. W kierunku organizacji inteligentnych*. Kraków: Antykwa, p. 56.
11. Miś, A. (2020). *Zarządzanie talentami*. Warszawa: Wolters Kluwer.
12. Mróz, J. (2015). Zarządzanie talentami – modele i podejścia badawcze. *Nauki o Zarządzaniu [Management Sciences], Vol. 2(23)*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, pp. 93-107. DOI: 10.15611/noz.2015.2.07.
13. Pochtowski, A. (2008). Istota talentu i zarządzania talentami. In: A. Pochtowski, *Zarządzanie talentami w organizacji*. Kraków: Oficyna Wolters Kluwer Buisness.
14. Sudoł, P. (2016). Pozyskiwanie i zarządzanie talentami – potencjał pracownika kapitałem firmy. *Rynek – Społeczeństwo – Kultura, no. 4(20)*, pp. 58-63. <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171474412>.
15. Tabor, J.A. (2013). *Zarządzanie talentami w przedsiębiorstwie. Koncepcje, strategie, praktyka*. Warszawa: Poltext.
16. Wellins, R.S., Smith, A.B., Mc Gee, L. (2006). *The CEO's Guide to Talent Management: Building a Global Leadership Pipeline*. Pittsburgh: Development Dimensions International.

RECONSTRUCTION AND COMPARISON OF THE APPROACHES OF INTERNATIONAL SUPPLY CHAINS AND GLOBAL VALUE CHAINS

Piotr BANASZYK

Poznan University of Economics and Business, Department of Logistics; piotr.banaszyk@ue.poznan.pl,
ORCID: 0000-0002-9457-3613

Purpose: recreating, comparing and evaluating research approaches of the supply chains management and the global value chains.

Design/methodology/approach: comparative analysis based on the reconstruction of theoretical assumptions.

Findings: e similarities and differences between the supply chains management theory and the global value chains theory.

Research limitations/implications: simplifications resulting from the level of approach generalization.

Practical implications: better understanding of tasks by managers.

Social implications: revealing the links between economically oriented management and social effects.

Originality/value: reconstruction of the theories and identification of similarities and differences.

Keywords: supply chain management, global value chain.

Category of the paper: general review.

1. Introduction

Undoubtedly, the modern world economy is to a large extent shaped by the process of globalization. It turns out that it is more difficult to find a commonly accepted answer to the question of what globalization is. For example, Gorynia and Mińska-Struzik recognize that "globalization is the most intense stage of internationalization of multidimensional relationships between different countries" (Gorynia, Mińska-Struzik, 2018, p. 52). They clarify this general definition by pointing out that "globalization in the area of the economy can be defined as a process of gradual blurring of the boundaries between individual national economies, expressed in the intensification of international trade flows, increased migration of capital, people and technology" (Gorynia, Mińska-Struzik, 2018, p. 50). These terms are

undoubtedly formulated from a macroeconomic perspective. A microeconomic approach from the point of view of business entities participating in the indicated flows allows us to see the processes of outsourcing, offshoring and networking resulting from the decisions of managers, in particular large transnational corporations. Rybiński suggests the following terms (Rybiński, 2017, p. 14-15): a) outsourcing is the transfer of orders, production or services to another company, b) offshoring is the transfer of orders, production or services outside the country, c) networking is a business strategy for organizing the production process and providing services that provides flexible access to specialized resources on a global scale. As a result of these decisions, chains of cooperating enterprises emerge, between which there is a transfer of primarily material goods, but also knowledge, information and financial resources. This way, international supply chains are created, which can also be viewed as global value chains.

International supply chains and global value chains are not, however, synonymous names for the emerging economic phenomenon. There are different analytical approaches to researching this phenomenon. The aim of this study is to reconstruct these two research approaches, compare and evaluate them. The first part of the study relates to the approach of international supply chains, and the second - to global value chains. For each of them, the shaping evolution was presented and the cognitive inspirations were reconstructed. The third element is a comparative analysis of both approaches in the genesis, goals and research problems, explored subject scope and applied research methodology. The concluding remarks provide an overall assessment of the research perspective and the output of these approaches.

It is also worth emphasizing that these different research approaches focus on the same subject that is analyzed and assessed from two different points of view. The approach of international supply chains emphasizes the issue of ensuring the collective effectiveness of the chain as a whole thanks to the integration of the enterprises that form it, i.e. it examines the competitiveness of this chain. In turn, the approaches of global value chains focus on chain management systems, the consequence of which is a different possibility of economic and social modernization of enterprises and their employees.

2. The essence and the attributes of the approach of international supply chains

The approach of international supply chains is strongly related to logistics. Although the concept of logistics is interpreted in various ways by various authors, for example, after analyzing the most significant definitional propositions, Szoltysek recommends the term "Logistics is shaping (through logistic management) material and information flows in order to achieve accessibility (to material goods or places) on the basis of agreed rules and priorities for action" (Szoltysek, 2015, p. 72). An important observation here are the statements that logistics

uses a tool in the form of logistic management and has a flow character. Logistics management is essentially managing the flow of things and information, so it can be argued that it is done through the management of supply chains¹.

The current form of supply chain management has not emerged *ex machina* (Laskowska-Rutkowska, 2014, pp. 33-46). More and more complex economic systems and increasing competitive pressure sparked the interest of managers of production enterprises in the issues of commodity chain management. The cooperating companies were willing to take care of the continuity and reliability of supplies. Over time, it has been noticed that the movement of goods can be subject to economization processes. This movement of course requires transport and storage operations. On one hand, it is possible to search for the optimum cost between transport and warehouse stocks, because the right order quantity, rational choice of means of transport and loading units, and the right frequency of transport allow to minimize the level of stocks and, consequently, the size of the warehouse infrastructure. This meant a divergence from the management of commodity chains in favor of logistic management understood as the management of transport and warehouse processes. The above-mentioned forms of management consisted in controlling supply streams and undoubtedly allowed to increase the financial results of enterprises. In the next phase of evolution, attention was drawn to the potential resulting from controlling the demand side. Experiences from market research and buyers' behavior research have revealed the importance of customer satisfaction. Obviously, this satisfaction is determined by the utility value of the product, but it can be increased by the high logistic quality of customer service. Logistics management transformed into supply chain management and contributed to building the competitiveness of this chain. Therefore, it allows: a) maintaining the continuity and reliability of supplies, b) economization of transport and storage operations, and c) maintaining the assumed quality of logistic customer service. Thus, it can be concluded that supply chain management is the most mature stage in the evolution of the control of logistics processes between cooperating companies.

The process described above was influenced by the progressing globalization of the world economy. Gołemska (Gołemska, Gołemski, 2020, pp. 19-28) points out this, characterizing the development rhythms of logistics in the perspective of the waves of globalization. The so-called second wave of globalization, which took place after the end of World War II and lasted until the end of the 1990s, was the catalyst for the first wave of globalization of logistics. The growing intensity of international exchange obviously triggered the needs of international transport and the need to create large logistics hubs enabling this transport, as well as transshipment and storage processes. So it can be argued that international supply chain management has emerged. The intensity of logistics globalization is evidenced by the level of logistics globalization, which consists of the geographical dispersion of production,

¹ Such an interpretation, however admissible, is not universally accepted, and there are other interpretations in addition to this traditional approach (Rutkowski, 2004, pp. 2-7).

the dispersion of distribution and the cultural diversity of logistics operations (Gołemska, Gołemski, 2020, p. 21). Since the end of the 1990s, the second wave of logistics globalization has been marked, which is related to the increasing use of advanced information and communication technologies. These technologies allowed for a significant increase in the degree of integration of international supply chains. This integration took place in two forms: product integration and geographic integration. Product integration means joining enterprises in supply chains in connection with the production of specific types of products, regardless of the geographic regions in which the merger took place. More often, however, this integration is geographic in nature and results in the regionalization of logistics (Gołemska, Gołemski, 2020, p. 25).

International supply chains are therefore characterized by a transnational geographical dispersion of procurement, production and distribution processes, and by a significant cultural diversity of logistics operations. Inevitably, geographical dispersion increased the length of transport corridors and the time it takes to move material goods. The problems that started to emerge influenced the formation of - as Blaik calls it - a modern concept of logistics, which consists of: a) a systemic (comprehensive) approach, b) flow and time orientation, c) customer (market) orientation (Blaik, 2017, p. 80).

A systemic approach means a comprehensive approach to logistics, which is also reflected in the highly integrated management of international supply chains. Thus, the perspective of managerial decisions takes into account the interests of the supply chain as a whole, and not the suboptimal benefits of individual companies making up this chain. Then, the process of transforming the characteristics of the potential of individual enterprises participating in the emerging supply chain and the nature of the relations between these enterprises appears. Following Bunge, it can be assumed that two mechanisms are at work here: reorganization and growth. Both of these mechanisms change the structure of the system formed by the supply chain (Bunge, 1979, pp. 248-249).

Reorganization is a change in the structure of the system as a result of different relationships and interactions between enterprises. Growth changes the structure of the system due to the increasing number of its elements, in this case, due to the emergence of more companies entering the supply chain. These two mechanisms - continuing Bunge's reasoning - are the reason why it is impossible to infer about the state and desired shaping of the supply chain operation as a whole by referring to even the best knowledge about each of the companies separately. This is due to the so-called emergence, i.e. the sudden appearance of something new and at the same time improving the state of affairs. Enterprises participating in the supply chain through the relations resulting from their cooperation create a previously non-existent structure and thus a new mechanism determining the logic of the supply chain operation as a real system. Therefore, a question arises about the essence of economic optimization of each of the companies that make up the supply chain and this chain as a whole, and the relationship between these two mechanisms. It is fairly agreed that maximizing EVA (economic added value for

shareholders) is the goal of any company that conducts economic activity under competitive conditions. The mechanism of supply chain management, unlike the mechanism of managing the enterprise forming this chain, is focused on shaping competitiveness on the final market served by this chain. In turn, the competitiveness of the chain as a whole is a condition for the effectiveness of each of the enterprises participating in the chain. Therefore, the goal (s) of managing the (also international) supply chain should be different from the goal (s) of managing the companies that make it up (Banaszyk, 2020, pp. 2-9).

The desired sequence of dependencies is therefore the following: a) each of the companies forming the supply chain obtains economic and financial benefits that increase the EVA value, which satisfies the financial capital suppliers, b) these companies discipline the costs of their activities or distinguish their products and thus can be competitive increasing the utility value of its product offer, which satisfies buyers, c) the supply chain as a whole rationalizes infrastructure investments and uses cheaper sources of their financing, building its competitive potential, which satisfies both suppliers of financial capital and buyers, e) the supply chain as a whole improves its competitiveness by creating both a positive working climate and its reputation, which satisfies employees and customers.

The flow orientation emphasizes the importance of the continuity and reliability of the movement of goods and information along the supply chain. Blaik cites the phrase that "the concept of flow orientation is understood as such detailed shaping of processes (...) which is oriented towards fast, cross-sectional and turbulent-free flows of materials, goods and information (...) along [the entire supply chain], manifested, among others, by minimizing inventories and shortening the storage time of these goods, and the desired and efficient system of benefits on a scale [of the entire supply chain]" (Blaik, 2017, p. 125). This term clearly suggests that it is about the so-called supply chain thinning. Manzouri and Rahman (Manzouri, Rahman, 2013, pp. 38-54) analyzed a large number of definitions and characteristics of Lean Supply Chain Management to conclude that the system aims to shorten lead times while improving the quality of the final product. As a result, the economic performance of enterprises and the competitiveness of the supply chain as a whole increase. According to Liu et al. (2013, pp. 2123-2135), applying lean philosophy to supply chain management required a serious intellectual effort and innovative courage, as it is much easier for one enterprise to implement preferred policies and methods of operation compared to the community of enterprises that make up the supply chain. The participants of such a chain are managed by management teams that differ in terms of experience, competences and views, and this makes it difficult or even impossible to apply a coherent management system. The success of Lean Supply Chain Management is highly dependent on the close collaboration of the chain management personnel. Lean supply chain management is an operational and strategic philosophy that enables the continuous improvement of the activities of the network of suppliers and service partners.

Nimeh and co-authors have shown that the most common methods of lean chain and supply chain management are five basic methods: on-time delivery, information flows, supplier relationships, customer relationships, and waste reduction. The just-in-time delivery system has at least two important effects - cost and efficiency. From the cost point of view, it is about reducing the volume of inventories and thus reducing the financing needs of both the operating capital necessary to finance these inventories and the fixed capital financing the warehouse infrastructure. In turn, from the efficiency point of view, the observations resulting from Toyota's experience are emphasized. These observations are based on the belief that, thanks to smaller reserves, it is easier to see the sources of waste and remove them (the metaphor of ocean tides was used - all dangerous rocks are better visible at low tide) (Skaficka, 2003, pp. 663-672). It is crucial that all production is launched only when there is a need for its results. Therefore, the basic link that initiates production processes is demand on the final market. Thanks to this, there is no need to maintain either stocks of materials and raw materials, products in progress or finished products. Of course, the challenge is to ensure business continuity in the face of the lack of safety stocks buffering any disruptions. In addition, the principle is also the perfect adaptation of the final products to customer requirements. Thanks to this, there is no need to produce any details that do not create utility value for recipients.

The customer (market) orientation of an enterprise can be tested in the context of the impact of the supply chain. Lim, Darley, and Marion argue that there are many publications showing that high levels of economic efficiency in market-oriented companies are only achieved with strong support from the supply chain. If we divide the market orientation into responsive (i.e. preferring responses to requirements generated by existing markets) and prospective (i.e. identifying potential, future requirements in non-existent and already existing markets), the support from the supply chain facilitates the impact on the customer thanks to better customer service and stronger relationships with him. This is because of the support provided by the deliveries and more rational inventory management (Lim, Darley, Marion, 2017, p. 915). The authors quoted clearly believe that the supply chain can affect the effectiveness of market orientation in terms of customer satisfaction, as well as shorten product development time, generate more reliable products, and improve the quality and use value of a new product (Lim, Darley, Marion, 2017, p. 914). Min, Metzger and Lad, in turn, explain that supply chain support involves the exchange of information between the companies that make up the supply chain in the field of technological and market opportunities and about potential cooperation to take advantage of these opportunities. That is, the cooperation of partners in the supply chain enables the acquisition of external resources necessary to offer products that retain and acquire customers, which provides enterprises with better economic and financial results than competitors (Min, Metzger, Lad, 2007, p. 508).

Supply chain management usually results from a specific philosophy behind the top management. This philosophy can be reduced to one of two models (ideal types) of supply chain management, also international.

The framework scheme for the construction of the supply chain management model is constituted by the following parameters (Banaszyk, Fimińska-Banaszyk, 2016, pp. 455-464):

- a) The basic premise of strategic managerial decisions: It concerns the choice of the basic criterion for shaping the supply chain. The existence of the supply chain means that managers have given up building an autarkic, vertically integrated conglomerate in which hierarchy is the main tool of coordination. Striving to concentrate financial and human potential on the so-called core business results in the implementation of an outsourcing strategy. The argument of Oliver Williamson that the phenomenon of the specificity of assets causes that the greater the degree of complementarity of the attributes of the action potential to the partner's potential, the less possibility of alternative use of these assets is of great importance here. The supplier therefore has an economic interest in maintaining and nurturing cooperation with its recipient. "Thanks to the supply chain management model, the goal is to maximize profit by increasing competitiveness on the market of final products, and this competitiveness is achieved by reducing operating costs and carrying out economic tasks in the shortest possible time. This is possible when the supply chain is tightly coordinated along its entire length, so that total inventory is minimized, bottlenecks are eliminated, time is compressed and quality problems are eliminated" (Waters, Rinsler, 2010, p. 3). Thus, the relation of competition migrates from the level between enterprises (as in M. Porter's model) to the level between supply chains.
- b) Dominant information system: It is about how entities in the supply chain and network communicate with each other. Three main methods can be identified here: formalized, transactional and relational. The formalized information system uses a paper carrier and is coded individually for each cooperation agreement. The contract simply contains very detailed arrangements between the parties defining the expected product and the conditions for its acceptance by the recipient. The transactional information system uses IT software of the EDI class, which enables the transfer of standardized data sets between autonomous information systems, which eliminates the multiplication of information gathering and processing activities and accelerates their use. The relational information system is, of course, also of an IT nature, but the database is centralized, i.e. in the form of a data warehouse, to which certain employees with granted permission rights have access at any time.
- c) Income statement used: It consists of choosing the preferred method of calculating the costs of business activity. Of course, in each case, it is about creating reliable information about the costs incurred and shaping the premises for a decision on how to minimize them. There are at least three methods of identifying and accounting for costs, namely cost accounting, activity cost and life cycle cost. Classic cost accounting uses their structure, either by type and by function calculation based, and provides aggregated information on the costs of operations of each participant in the supply chain separately.

It is a full cost account, usually the settlement is made in relation to a specific product or product groups (Skarżyńska, 2012, p. 44). As each participant in the supply chain differently defines its products and the total cost of production includes not only direct costs, but also indirect costs, therefore the knowledge about the production costs of the final product delivered to the consumer is very approximate. From the point of view of the reliability of information on the actual cost of manufacturing the final product, activity-based costing is more useful. In this account, products are only the source of the activities necessary for their production. Thus, individual activities or groups of activities become the unit of account (Skarżyńska, 2012, p. 45). Of course, monitoring the costs of activities in a comprehensive supply chain requires full access to economic information from each of the participants in this chain. It is particularly difficult to include in the bill those costs that are incurred after the sale of products to recipients and finally to the consumer. Currently, logisticians emphasize the last activities known as reverse logistics. This, of course, has a strong ecological and ethical justification. In a way corresponding to this, the postulates of running a product life cycle costing appeared. This account is about the total settlement of both the so-called costs of the marketing cycle (product development, placing on the market and keeping it on the market and its withdrawal from the market), as well as costs of the environmental cycle, i.e. costs related to negative, external economic effects occurring in each phase of the marketing cycle (Joachimiak-Lechman, 2014, pp. 82-84).

The symbiotic model of the supply chain assumes the implementation of the strategy of outsourcing all economic activities that third parties are able to perform more effectively. This is how the network configuration of the chain organization is shaped, and in the case of more complex chains - even the cluster one. Coordination of the activities of chain participants requires intensive information exchange, therefore EDI systems may turn out to be insufficient, therefore the practice of using data warehouses, often allowing for cloud processing, is becoming more common. In essence, this means rights to mutual access to strategic information by all or most of the participants in the network. Cost management should take place across the entire supply chain in order to optimize their size from the point of view of the final product directed to the consumer, taking into account the costs of reverse logistics. The key is to work out an equitable distribution of the financial surplus among all participants in the chain.

The parasitic supply chain model also assumes the implementation of an outsourcing strategy. However, a linear organization of the supply chain dominates, with only elements of a not very extensive network. Coordination of economic activities of the chain and network participants is primarily of a formal and contractual nature with the possibility of a limited use of EDI systems. Access to information of strategic importance is severely limited, and only the information absolutely necessary for the satisfactory operation of the supply chain is exchanged. Each of the participants in the chain runs its own cost account and is interested in

strengthening its bargaining power in order to gain an advantage over the partner and grab the greater part of the generated financial surplus.

3. The essence and attributes of the global value chains approach

The motivation for adopting the global value chain approach is the assessment that the modern world economy has been shaped precisely by those chains that have a large share in international trade, create a significant part of global GDP and employ a large number of people around the world. About 1/3 of world trade takes place inside geographically fragmented transnational corporations, and yet a large part of this trade is carried out between formally autonomous enterprises, but included in global value chains. Companies leading in global value chains strive to improve their own competitiveness and increase the efficiency of their activities, and therefore they decide to offshoring and outsourcing (Petrobelli, Rabellotti, 2008, p. 2).

The concept of value is the central point of reference (Lewicka, 2014, pp. 64-72). There are three most important understandings of it. Firstly, the understanding of value as a benefit created for the supplier of capital to the enterprise, which understanding is closely correlated with the realized and potential economic profit that can be counted on in connection with the company's operations. Second, it is the market-shaped exchange value of a commodity, that is, the price of that product. Thirdly, it is the utility value of the offered goods that creates the satisfaction of the buyer. Global value chains apply to some extent to each of these terms. The enterprises that make up this chain always have some share in the created benefit for the capital supplier, proportional to the profit made. Its size depends on the difference between the sales revenues and the costs of obtaining these revenues, i.e. the exchange value of the goods. After all, the volume of sales revenues is also determined by the satisfaction of buyers, i.e. the utility value of the products. Sometimes this surplus value is interpreted as a kind of economic rent. For example, Coe pushes the view that "in addition to creating value in the work process, value may take the form of technological pensions through access to specific products or process technologies, or it may manifest as relational rents based on inter-organizational linkages improving know-how, transfer and collective labor learning" (Coe et al., 2004, p. 474).

Gereffi and Fernandez-Stark emphasize that the methodology of this approach allows the study of (Gereffi, Fernandez-Stark, 2011, p. 4): a) the structure of inter-industry flows and thus it becomes possible to characterize the process of processing raw materials into final products, b) geographical conditions that determine location benefits and access to human and natural resources, c) a governance structure that explains how the value chain is controlled, d) the institutional context in which the value chain is embedded. This research is carried out by analyzing (Gereffi, Fernandez-Stark, 2011, pp. 5-12): a) the input-output dependencies in

the chain from the producer to the consumer and thus revealing the connections between value chains, b) geographical scope, which enables the identification of the so-called leading companies in each segment of the chain, and then the participation of individual countries in this chain, c) management, which shows the location of the chain's authorities, control and coordination, d) institutional context, i.e. embedding in local economic, social and legal dynamics.

The global value chain is built by cooperative relationships between enterprises. The terminology used uses the terms node and chain segment. A node is a point in the value chain where a product is replaced or undergoes a major transformation. In turn, a chain segment is its module composed of two nodes and interactions between them. This value chain is managed, i.e. the leading company organizes its activities in order to achieve a functional division of labor, resulting in a specific allocation of resources and distribution of profits among the enterprises of the chain, as well as defining the conditions of participation in the chain (Bolwing et al., 2010, pp. 175-176). The leading company is usually a large transnational corporation with the potential to manage the global value chain. This is because such corporations initiate the process of fragmentation and geographical relocation of production, taking a strategic position in the emerging chain. Its sources are: monopoly, proximity to the target market, knowledge, technology, resources and the ability to generate innovation (Campling, Selwyn, 2018, p. 418). Leading firms focus on appropriating the lion's share of the value generated in the chain and expanding their dominant position (Campling, Selwyn, 2018, p. 419). Leading companies drive the business and development of global value chains. This drive can be twofold (Humphrey, Schmitz, 2001, pp. 6-7): a) by buyers, which takes place when the chain is organized and managed by retailers (companies closest to the final outlets) or by owners of particularly valuable and recognizable brands, b) by producers, when the organization and chain management is the domain of the owners of product or process technologies.

Coordination of the activities of enterprises in the value chain does not require ownership control. Gereffi presented the regularity - the greater the specificity of resources in Williamsonian interpretation of the production, the greater the exclusion of outsourcing, i.e. the management takes place in a hierarchical manner, due to the risk of opportunism. When there is no such danger, then enterprises included in the value chain may be autonomous units on the basis of established rules (Gereffi, Humphrey, Sturgeon, 2005, pp. 80-81). To mitigate opportunism, it uses the reputation of companies, social norms, and certification of activities and their effects, social norms and certification of activities and its effects. The choice of the management system depends on (Gereffi, Humphrey, Sturgeon, 2005, pp. 84-85): a) the complexity of the transaction - the more non-standard the production, the higher the transaction costs, but they can be reduced by implementing the standardization of processes and products, b) the degree of codification of information - this degree can also be reduced by

using the standardization of messages sent as part of chain, c) the ability of suppliers to meet norms and standards.

Leading companies create a global value chain management system, locating it somewhere between two extremities - a fully competitive market that communicates data for decisions using the price mechanism and strict vertical integration making production units dependent on ownership, i.e. through hierarchical dependencies. An intermediate solution is to create a network based on compatibility resulting from advanced resource specificity. (Gereffi, Humphrey, Sturgeon, 2005, p. 83) Depending on the choice of the above-mentioned methods of coordination, the real types of global value chain management are (Gereffi, Humphrey, Sturgeon, 2005, pp. 84, 86-87): a) markets - full freedom to conclude transactions due to the search for partners operating on the basis of low costs (easily codified transactions, simple product specifications, low resource specificity), b) modular value chains - production fully adapted to customer requirements requiring high technical and technological flexibility (codification concerns complex products, technical standards simplify production, exchange of technical information is required), c) relational value chains - delivery and collection require a lot high resource specificity, i.e. partners focus on long-term cooperation (lack of product codification, high complexity of transactions, necessary information exchange, the existence of specialized producers leads to outsourcing, the costs of change are high), d) slave value chains - small suppliers are highly dependent on large recipients, i.e. the costs of changing the recipient are very high and this is the source of slavery (codification requirements and product specifications are high, the production potential of suppliers is low, which forces a leading company to engage in their operations), e) hierarchy - management control dominates in vertically integrated production systems (lack of codification of the product and specialized suppliers, which discourages outsourcing and results in operating in own units).

As a result of the analysis and evaluation of the methods of coordination and management used by leading companies, the approach of global value chains allows to estimate the chances of so-called modernization. Petrobelli and Rabellotti define it as an innovation aimed at increasing the added value created by the manufacturer (Petrobelli, Rabellotti, 2008, p. 4). In other words, modernization is a possibility for producers to move up the value chain (Bolwing et al., 2010, pp. 176-177) and is the result of an analysis of the global value chain, in a way, from the bottom up. However, it allows a smooth transition from the micro level to the macro level, i.e. from enterprises striving to improve their position to the economic policy implemented by individual countries, which is intended to support the aspirations of enterprises. Modernization can take place in four ways (Gereffi, Fernandez-Stark, 2011, pp. 12-13): a) process modernization, i.e. striving for more effective transformation of raw materials into final products, b) product modernization, i.e. increasing their quality or technological complexity, c) functional modernization, i.e. adding or abandoning selected production operations, d) chain or cross-sector modernization, i.e. the company's transition to another industry.

The chain of addictions is as follows (Humphrey, Schmitz, 2001, pp. 3-6): a) low-level suppliers need a leading company to have access to outlets, b) cooperation with a leading company enables modernization, i.e. a steep learning path, c) suppliers are trapped by their production specialization and without an external impulse (from the lead company or from the economic policy) are unable to carry out the modernization.

The modernization presented above is of an economic nature. If it is implemented, it creates the possibility of social modernization. Moving a company higher in the value chain usually means an increase in the qualifications of its employees and higher wages. The latter are possible because the generated sales revenues and, consequently, the profits are higher. Much, however, depends on management decisions made in leading companies, which unfortunately most often capture at least some, and sometimes all of the benefits of economic modernization in dependent (slavishly) downstream suppliers (Selwyn, Musiolek, Ijarja, 2019, pp. 5-6).

4. Compare and evaluate the approach of international supply chains and the approach of global value chains

The comparative analysis will be carried out on the basis of the following criteria: genesis, goals and problems, subject scope and research methodology.

Obviously, it is difficult to pinpoint the origins of the supply chain concept. Nevertheless, many researchers point out the importance of the work of Forrester (Witkowski, 2003, pp. 2-5; Szymczak, 2015, pp. 15-16), who is the creator of the concept of systems dynamics. Forrester succeeded in transferring a reasoning typical for engineers into the field of management sciences. Thanks to the dynamics of systems, it became possible, as Forrester put it, "to find the management principles and organizational structures that lead to greater success", which initiated the research trend called Industrial Dynamics (Lane, Sterman, 2011, p. 368). In terms of logistics, the idea of the bullwhip has been proven particularly popular². Industrial Dynamics is an approach to understanding the nonlinear time behavior of complex systems using states, flows, internal feedback loops, table functions, and time delays. Forrester pointed out that the decision-maker's mental model is of significant importance (Lane, Sterman, 2011, pp. 368-369).

Initially, chain management was reduced first to the flow of goods, and then to the coordination of transport and warehouse processes. The configuration of the flow of goods is strongly related to the achievements of marketing research. This applies to issues relating to the shaping of distribution channels and the principles of physical distribution of goods.

² The phenomenon of excessively increasing inventories moving up the supply chain as a result of distorting information about effective demand.

From a logistical point of view, Alderson's achievements in terms of the benefits of deferring services and inventory management at subsequent levels of goods distribution are usually appreciated (Szymczak 2015, p. 16). For this reason, inspiration for research on supply chains can also be found in the so-called business economics. It is a science that describes the economic activity of enterprises, in particular the conditions of this activity and the directions of making rational managerial decisions that shape this activity (Ekonomika, 2021). Internationally, inspiration for the study of supply chains was also drawn from the achievements of the Industrial Economics because (Howe, 1978, pp. 2-3): a) taking into account the benefits of the experience effect, the reasoning typical in microeconomics for the company's optimum, when the marginal costs equal the marginal revenue, it ceases to be a management guideline - diversification, growth or mergers, as well as outsourcing and offshoring become more important, b) modeling activity of an abstract economic unit loses its importance for the study of the institutional conditions of this activity and the importance of the behavior of people who make important managerial decisions.

With time, the importance of the quality of logistic service to the buyer began to be emphasized due to the customer's satisfaction. This approach resulted directly from the theory of consumer choice and was related to the issues of competitiveness. The focus is on the value in use of the product, which can be increased thanks to the logistics service. The rationale behind this assessment is Porter's value chain and the observation that adding value takes place through many operations carried out in the course of business activity. The perspective of shaping the utility value can, however, also be derived from the so-called resource concepts. In particular, the provisions that each company should develop its key competences, and the basic or peripheral competences should be reduced mainly thanks to outsourcing, is the directive of creating a supply chain. Therefore, the genesis of the supply chain concept can also be found within the theory of the company's competitiveness.

The concept of global value chains, however, has other roots. The first inspirations are based on the discussion between classical economists and representatives of the marginalist school, and they concern factors creating value. The contradiction between market views (value depends on the relationship between supply and demand) and labor views (value depends on labor cost) was resolved by the marginalists by pointing to the importance of the relationship between consumer preferences and the state of production technology. By introducing the concepts of consumer utility and production function, they proved that the marginal cost of production and the marginal utility of the consumer determine the exchange value of any good. (Rodrik, 2019, pp. 107-108) The concept of global value chains was inspired by an observation that whoever controls production costs, and in particular who uses the possibility of substituting physical and human capital, and who determines the level of consumer utility, can capture a large part of the value generated. Porter's achievements also had an impact. His concept of the value chain helped with realizing that having certain intellectual and financial capital, thanks to outsourcing functions performed effectively by others, one can leverage the achieved

productivity. On the one hand, outsourcing and offshoring in the era of globalization makes it possible to geographically disperse production in order to reduce its costs, and on the other hand - thanks to taking the position of a leading company, it is possible to guarantee a larger part of the value generated.

A special feature of the global value chain approach is the international nature of the research. This guarantees scientific explorations close to the theories of international trade and development economics. An important cognitive contribution was made by Krugman, whose new theory of international trade clearly indicated that classical theories are not adequate to the changed economic reality because they explain the regularities of inter-state trade and do not take into account the increasing trade at the level of transnational and intra-industry corporations (Krugman, 1981, pp. 959-973). This reasoning is continued by the creators of the new theory of international trade, who note the importance of intra-sector differentiation of firms, i.e. the inability to make realistic explanations using the idea of a representative enterprise (Serwach, 2011, p. 50). On the other hand, the development economy that studies the causes of the division of the world into poor and rich countries and the possibilities of overcoming poverty, made it possible to highlight the existence of countries with an underdeveloped economy with relatively cheap resources, be it labor or raw materials (Piasecki, 2008, p. 225). The allocation of production units in these regions by leading companies facilitated the implementation of such coordination mechanisms and management systems that inhibited local economic and social modernization and ensured the possibility of capturing a large part of the surplus value generated.

Sometimes it is also pointed out that the genesis of research on global value chains has also arisen from the scientific exploration of clusters understood as a way of organizing the industry and internal management, which imply the so-called collective efficiency. An important factor was also the problems formulated by the International Labor Research Institute at the International Labor Organization consisting in an attempt to understand why the liberalization of international economic relations and privatization are not sufficient for economic and social modernization in economically underdeveloped countries (Werner, Bair, Fernandez, 2014, pp. 1234-1236). The approach of global value chains developed the concept of collective efficiency internationally and explained the reasons why such modernization was not possible.

Finally, it is worth mentioning the conceptual sources that arose from the idea of managing cultural differences. Undoubtedly, the most influential are the achievements of Hofstede, who defined culture as a way of programming the mind and defined the dimensions of national cultures and organizational cultures, which made it possible to realize the different behavior of employees coming from different national cultures and organizational cultures determined by them (Hofstede, 2000). Researchers of global value chains pay attention to the so-called institutional embeddedness, which is closely related to the local cultures.

The universal goal of any scientific discipline is, of course, to discover the truth by identifying the regularities that explain the observed events and processes. When it comes to researching international supply chains, this goal can be interpreted as getting to know the regularities governing the cooperation of enterprises connected by cooperative relations. The practical result is the formulation of rules and methods for shaping this cooperation in order to achieve collective efficiency, which is measured by their competitiveness in relation to supply chains. The internationalization of the supply chain does not change the essence of research intentions, at best it increases the list of obstacles in building this competitiveness. The purpose of researching global value chains is to reveal regularities related to the capture of the created surplus value. Coordination mechanisms and management systems are explored to reveal the principles and methods of this interception. The international dimension is important here, as it allows us to learn about previously unnoticed reasons for the permanent poverty of some countries. With regard to international supply chains, the main research problem is to look for an answer to the question - how to rationalize the cooperation of enterprises forming the supply chain, so that its competitiveness is as high as possible. In the case of global value chains, the research question is - why is it possible to appropriate the added value created by the so-called leading companies at the expense of suppliers located further down the value chain.

The subject scope of the research on international supply chains is: a) from the content point of view - the mechanisms and conditions of economic cooperation of enterprises in the areas of movement of tangible goods, information exchange and financing of trade in goods and infrastructure investments, b) from the object point of view - collective sets of enterprises connected by ties of economic cooperation, c) from the time-spatial point of view - contemporary mechanisms and conditions in the international dimension.

The subject scope of the research on global value chains is: a) from the content point of view - leading companies' taking over methods of a large part of the added value a large part of the added value generated by the chain enterprises and the mechanisms of economic and social modernization of enterprises from the "tail" of the chain, b) from the object point of view - collective collections of enterprises connected by the bonds of global economic cooperation and the transition of companies from one industry to another, c) from the time and space point of view, these are contemporary methods and mechanisms of global coordination and management.

Both the international supply chain approach and the global value chain approach can be qualified as empirical applied disciplines. Scientific research is carried out in them on the basis of data collected with various techniques in order to formulate utilitarian assessments and practical directives addressed to managers and politicians. According to Craighead and co-authors, logistics studies of supply chains can mostly be regarded as characteristic of logical empiricism, i.e. they result from the collected facts. These, in turn, are independent of theories built through deduction. The inductive research strategy allows for the isolation of observations

considered important, and on this basis, hypotheses are formulated, which are then empirically tested (Craighead et al., 2007, pp. 22-40) This neo-positivist nature of the research is also emphasized by Gammelgaard, who emphasizes that it guarantees the objectivity of the results and the possibility of identifying cause-effect relationships (Gammelgaard, 2004, p. 480). On the other hand, research on global value chains is more closely related to economics than to management science. It can be argued that they look for the causes of the enrichment of nations and individual people. A very important role is played by the methodology of sectoral analyzes, which, according to Werner and co-authors, allows to link macroeconomic issues, such as international trade and investments, with microeconomic issues, such as employment, wage dynamics and livelihoods. (Werner, Bair, Fernandez, 2014, pp. 1224) In addition, this approach is characterized by institutional and territorial anchoring, which reveals the way in which the forces exogenous to the chain affect the activities of enterprises (Campling, Selwyn, 2018, pp. 419-420). Such approaches allow the use of modeling methodology typical in economics. The proposed models require verification of internal coherence and external validity (Rodrik, 2019, pp. 87-103), i.e. they are specific hypotheses confronted with the realities, which determines the use of a methodology typical of empirical positivism.

It is also worth noting that both approaches also use a methodology derived from an interpretative research strategy, which often uses case studies and is primarily focused on the analysis and assessment of human behavior, which behavior is reconstructed from participant observations and research on the statements of the main actors (Craighead et al., 2007, p. 26). The international supply chain approach often uses case studies to empirically illustrate its concepts (empirical examples that were typical of Peter Drucker's research) or to treat these cases as sources of historical generalizations that may inspire new hypotheses. The Global Value Chains approach also relies on qualitative field research due to data constraints on business operations (Dallas, 2015). Many researchers using this approach, however, have limited confidence in this method, highlighting the errors resulting from the wrong selection of the analyzed cases and the resulting generalization errors (Dallas, 2015).

5. Final remarks

Both approaches can be assessed as a great contribution to the understanding of both the management of collective collections of economically related enterprises and the importance of the globalization process in the context of the international exchange of goods and services and the economy of development. These two approaches should be treated as complementary to a large extent.

A positive assessment also applies to the research methodology used. As indicated above, the general methodological strategy is similar and is based on the assumptions of empirical positivism and in part on interpretative research. Thanks to this, the source of primary data is always empirical, and the proposed scientific theories are the result of the intellectual courage and ingenuity of researchers who formulate hypotheses explaining the observed facts and then test them in accordance with the methodological regime. However, also, to some extent, the use of both approaches allows for the triangulation of research, because the approach of international supply chains usually uses either the survey technique or a multiple case study of a representative sample of companies. On the other hand, the global value chain approach mostly uses both quantitative and qualitative modeling techniques. Research findings on the international behavior of cooperating companies are therefore bilaterally justified.

The common denominator of the research results of both approaches are the arrangements for the management of cooperating enterprises in the international setting. The supply chain approach additionally formulates clarifications and directives regarding the economization of the flow and storage processes on the supply side and increasing the satisfaction of buyers on the demand side. The approach of global value chains allows us to understand the impact of globalization on international trade and the reasons for inhibiting economic and social modernization of economically underdeveloped countries.

Together, therefore, both approaches significantly contribute to the enrichment of contemporary economic knowledge and contribute to the expansion of the scope of contemporary economic sciences.

References

1. Banaszyk, P. (2020). The effectiveness criteria from the enterprise management and supply chain management perspective. *Gospodarka Materialowa i Logistyka*, nr 6.
2. Banaszyk, P., Fimińska-Banaszyk, R. (2016). Symbiotic and Parasitic Supply Chains. *Research in Logistics & Production*, Vol. 6, no. 5.
3. Blaik, P. (2017). *Logistyka. Koncepcja zintegrowanego zarządzania*. Warszawa: PWE.
4. Bolwig, S., Ponte, S., du Toit, A., Riisgaard, L., Halberg, N. (2010). Integrating Poverty and Environmental Concerns into Value-Chain Analysis: A Conceptual Framework. *Development Policy Review*, no. 28(2).
5. Bunge, M. (1979). *Treatise on Basic Philosophy. Volume 4. Ontology II: A World of Systems*. Dordrecht-Boston-London: D. Reidel Publishing Company.
6. Campling, L., Selwyn, B. (2018). Value chains and the world economy: genealogies and reformulations. In: A. Nölke, C. May (eds.), *Handbook of the International Political Economy of the Corporation*. London: E. Elgar Publishing.

7. Coe, M. et al. (2004). Globalizing regional development: a global production networks perspective. *Transactions of the Institute of British Geography*, 29(4).
8. Craighead, Ch. Et al. (2007). Research approaches in logistics. Trends and alternative future directions. *The International Journal of Logistics Management*, Vol. 18, no. 1.
9. Dallas, M. (2015). *International Fragmented Production: Conceptualization, Measurement and Policy across Disciplines*, <http://dx.doi.org/10.2139/ssrn.2501839>, 31.03.2021.
10. *Ekonomika*, hasło w Encyklopedii Zarządzania, <https://mfiles.pl/pl/index.php/Ekonomika>, 25.03.2021.
11. Gammelgaard, B. (2004). Schools in logistics research? A methodological framework for analysis of the discipline. *International Journal of Physical Distribution & Logistics Management*, Vol. 34, no. 6.
12. Gereffi, G., Fernandez-Stark, K. (2011). *Global Value Chain Analysis: A Primer, Center of Globalization. Governance and Competitiveness*.
13. Gereffi, G., Humphrey, J., Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, 12, 1 February.
14. Gołemska, E., Gołembski, M. (2020). *Transport w logistyce*. Warszawa: CeDeWu.
15. Gorynia, M., Mińska-Struzik, E. (2018). Globalizacja versus deglobalizacja – co jest lepsze dla świata i Polski? *Biuletyn PTE*, nr 3(82), sierpień.
16. Hofstede, G. (2000). *Kultury i organizacje*. Warszawa: PWE.
17. Howe, S. (1978). *Industrial Economics. An Applied Approach*. New York: Springer.
18. Humphrey, J., Schmitz, H. (2001). Governance in Global Value Chains. *Bulletin Institute of Development Studies*, 32.3.
19. Joachimiak-Lechman, K. (2014). Środowiskowa ocena cyklu życia (LCA) i rachunek kosztów cyklu życia (LCC) - aspekty porównawcze. *Ekonomia i Środowisko*, t. 1.
20. Krugman, P. (1981). Intra-industry Specialization and the Gains from Trade. *Journal of Political Economy*, Vol. 89, no. 5.
21. Lane, D., Stermann, J. (2011). *Jay Wright Forrester, Profiles in Operations Research: Pioneers and Innovators*. S. Gass, A. Assad (eds.). New York: Springer.
22. Laskowska-Rutkowska, A. (2014). Logistyka, jej ewolucja i interdyscyplinarność - próba syntezy. *Studia i Prace Kolegium Zarządzania i Finansów*, z. 136. Szkoła Główna Handlowa.
23. Lewicka, H. (2014). Wartość jako kluczowe pojęcie w dziedzinie nauk ekonomicznych. *Społeczeństwo i Ekonomia*, nr 2(2).
24. Lim, J-S., Darley, W., Marion, D. (2017). Market orientation, innovation commercialization capability and firm performance relationships: the moderating role of supply chain influence. *Journal of Business & Industrial Marketing*, 32/7.
25. Liu, S. et al. (2013). A decision focused knowledge management framework to support collaborative decision making for lean supply chain management. *International Journal of Production Research*, vol. 51, no. 7.

26. Manzouri, M., Rahman, M. (2013). Adaptation of theories of supply chain management to the lean supply chain management. *International Journal of Logistics Systems and Management*, vol. 14.
27. Min, S., Metzger, J., Lad, R. (2007). A market orientation in supply chain management. *Journal of the Academy of Marketing Science*, no. 35.
28. Nimeh, H. et al. (2018). Lean supply chain management practices and performance: empirical evidence from manufacturing companies. *International Journal of Supply Chain Management*, vol. 7, no. 1.
29. Petrobelli, C., Rabellotti, R. (2008). *Innovation Systems and Global Value Chains*. Paper presented in the IV Globelics Conference at Mexico City, September 22-24.
30. Piasecki, R. (2008). Ekonomia rozwoju wobec problemów nędzy i nierówności społecznych na świecie. *Annales. Etyka w życiu gospodarczym*, Vol. 11, no. 1.
31. Rodrik, D. (2019). *Rządy ekonomii*. Warszawa: PWN.
32. Rutkowski, K. (2004). Zarządzanie łańcuchem dostaw - próba sprecyzowania terminu i określenia związków z logistyką. *Gospodarka materiałowa i logistyka*, nr 12.
33. Rybiński, K. (2017). *Globalizacja w trzech odsłonach*. Warszawa: Difin.
34. Selwyn, B., Musiolek, B., Ijarja, A. (2019). Making a global poverty chain: export footwear production and gendered labor exploitation in Eastern and Central Europe. *Review of International Political Economy*, <https://www.tandfonline.com/doi/full/10.1080/09692290.2019.1640124>, 24.03.2021.
35. Serwach, T. (2011). Od handlu między państwami do handlu na poziomie przedsiębiorstw. *Gospodarka Narodowa*, nr 3.
36. Skąlecka, L. (2003). Zasady i korzyści stosowania systemu sterowania „akurat na czas”. *Annales Universitatis Mariae Curie-Skłodowska. Sectio H, Oeconomia*, 37.
37. Skarżyńska, A. (2012). Rachunek kosztów działań – nowe spojrzenie. *Zagadnienia Ekonomiki rolnej*, nr 3(332).
38. Szoltysek, J. (2015). Pryncypium logistyki. *Logistyka*, nr 1.
39. Szymczak, M. (2015). *Ewolucja łańcuchów dostaw*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
40. Waters, D., Rinsler, S. (2010). *Global logistics. New directions in supply chain management*. London: Kogan Page.
41. Werner, M., Bair, J., Fernández, V. (2014). Linking Up to Development? Global Value Chains and the Making of a Post-Washington Consensus. *Development and Change*, Vol. 45, iss. 6.
42. Witkowski, J. (2003). Prekursorzy logistyki i zarządzania łańcuchem dostaw. *Gospodarka Materiałowa i Logistyka*, nr 9.

THE IMPACT OF HUMAN CAPITAL ON THE EFFECTIVENESS OF ENTERPRISES IN THE V4

Katarzyna BROŻEK

Jan Kochanowski University of Kielce, Faculty of Law and Social Sciences, Department of Management;
katarzyna.brozek@ujk.edu.pl, ORCID: 0000-0001-8031-6766

Purpose: Identification and assessment of the impact of human capital on the effectiveness of enterprises of the Visegrad Group (V4).

Design/methodology/approach: In the theoretical part, content analysis was used - a library query on the Google Scholar website. In the empirical part, a statistical analysis was applied, which included the characteristics of the sample of selected features, the analysis of a series of correlations examining the matching of features, and the analysis of the results obtained. The collected data was compiled using descriptive statistics - average values, dynamics of changes, trend function and Pearson's correlation coefficient.

Findings: In each V4 country, as the turnover of enterprises increased, the number of unemployed people with higher education decreased, and vice versa. The increase in the turnover of enterprises determined the increase in the number of research and development personnel in each country of the Visegrad Group (and vice versa). In turn, the turnover of V4 enterprises turned out to be strongly correlated with labor costs. Along with the decrease in the number of research and development personnel, as well as labor costs, the gross operating index of companies from the Visegrad Group increased.

Practical implications: It was attempted to show which of the examined attributes of human capital had the greatest impact on the effectiveness of enterprises in individual V4 countries. This gives a certain field, on the one hand, to combat unemployment by applying a targeted state policy aimed at reducing its level, and on the other hand, to introduce incentives promoting the employment of R&D personnel.

Limitations: Short time series containing the attributes of human capital and enterprise efficiency, as well as the lack of current and complete statistical data, which resulted in a reduced number of predictors tested.

Keywords: human capital, enterprise efficiency, Visegrad Group.

Category of the paper: Research paper.

1. Introduction

Looking at different educational and economic processes, it is possible to observe a complex and constant interaction between them. This issue has been discussed since the 1960s in both politics and economics, which suggests a strong relationship between education and work. It is assumed that knowledge is a kind of economic capital. At the same time it is emphasized that education is perceived as preparation for work (Marginson, 2019). The economy plays a key role in maintaining and developing the education system. Each element of the economic system (e.g. education) in turn has an impact on society. The qualification potential, as well as the intellectual potential most often generated in the education system, plays an important role in the economy. The concept of human capital, proposed by the Nobel Prize winners T. Schultz, J. Mincer and G. Becker, proves that knowledge, abilities, skills and motivations are the elements of individual human capital (Galiakberova, 2019).

The importance of the discussed subject results from the fact that the characteristics of both the employee, the employer and the job itself are changing dynamically. In order for people employed in the organization to feel satisfaction from joint activities, it is necessary to know a number of factors that affect these entities (for example on the part of the organization it can be the way of organizing work, and on the part of the employee the characteristics of a given generation). This is particularly important for Polish business entities, which for many years have been one of the weakest innovators in the European Union, especially in terms of the number of patents both filed and granted (Eurostat, 2022).

As efficiency does not exist without competences, and competences are an important element of human capital, it is worth looking at the extent to which human capital affects the effectiveness of enterprises. Although the professional literature in this field is rich both in foreign works (Andriessen, 2004; Iazzolino, Laise, 2013; Pulić, 2005; Tan et al., 2008; Kozera, Kalinowski, 2012), as well as in Polish entries (Król, Ludwiczynski, 2014; Mentel et al., 2014); the research gap, however, identified on the basis of the analysis of the literature (Jamal, Saif, 2011; Seleim et al., 2007; Singh, 2004; Channar et al., 2015; Josan, 2013; Oforegbunam, Okorafor, 2010) covers the determinants describing the effectiveness of enterprises in the Visegrad Group countries, which have not yet been examined in this context. Taking into account the presented premises, the main research problem was formulated in the form of the following question: Is there a relationship between the attributes of human capital and the effectiveness of enterprises in the Visegrad Group countries? The aim of the considerations was to identify and assess the impact of human capital on the effectiveness of the Visegrad Group enterprises.

The following research hypotheses were adopted:

H1: The effectiveness of enterprises in the Visegrad Group countries is determined by the variables defining the R&D personnel, the unemployed with higher education, and labor costs.

H2: There is a strong relationship between the attributes of human capital and gross turnover and operating ratios of enterprises in the Visegrad Group countries.

2. Human capital in the context of enterprise efficiency in the light of literature studies

The aspect of guaranteeing, maintaining and improving the efficiency of the organization is particularly important in a modern business environment. This is due to the fact that nowadays this environment is characterized by heterogeneity, complexity, unpredictability and dynamics (Kareska, Davcev, 2016; Stepanova, Melnikova, 2020). For many economic operators, the challenge is already how to achieve this issue, let alone improve it. When it comes to efficiency improvement, it refers to production efficiency (i.e. productivity), cost efficiency (i.e. profitability) and the efficiency of using the company's assets and capital (i.e. profit gaining). In other words, we can talk about production efficiency (productivity and cost efficiency) and trade efficiency (profitability) (Domanović, Janjić, 2018).

P.A. Samuelson and W.D. Nordhaus (2019) saw efficiency as using economic resources in the most efficient way possible. However, what should be considered is what happens when the availability of resources is limited or the dynamics of changes in the business environment is so great that it requires constant changes in operation. R.S. Kaplan and D.P. Norton (1992) proposed using a balanced score-card approach to deal with the need for multiple performance metrics. However, their approach tends to link stakeholder groups to impact categories (economic or social). It includes measuring performance from four perspectives: financial, customer, internal processes and growth and innovation. A.A. Atkinson et al. (1997) argued that this approach ignores some key stakeholder groups (particularly suppliers, employees and the wider community within which the organization operates and may have indirect but significant impacts).

Effective organization is important in the long-term development of business entities. It allows organizations to run more smoothly while focusing on their goals. The benefits of an effective organization include: increasing productivity and employee involvement, improving management communication, ensuring budget savings by eliminating areas of waste, improving the use of technology, maximizing customer value.

The guarantee of an increase in the competitiveness of a given organization is the close cooperation of all components of intellectual capital, human capital included (Dziwulski, Skowron, 2019). In the literature, human capital is defined in various ways. It can be seen

through the prism of economics and psychology. From an economic perspective, we are talking about the knowledge, skills and health in which people invest and accumulate throughout their lives, and which allow them to realize their potential as productive members of society (World Bank, 2022). In the second half of the 20th century, the term ‘knowledge-based economy’ was coined. The advent of the knowledge economy has strengthened the link between the acquisition of human capital and institutionalized education, in particular in higher education (Aparicio et al., 2021). Entering prestigious professions (such as, for example, professor, lawyer, doctor etc.) requires appropriate references, which are obtained only after years of study (Kell et al., 2018). The economic return to education is large, both at an individual and national level. From the psychological point of view, human capital is closely related to such aspects as, for example, motivation and perseverance, which have a significant impact on learning success, which, in turn, may translate itself into professional success (Credé, Kuncel, 2008).

The literature on the subject recognizes the importance of human capital for improving the company performance (Crook et al., 2011). Given the different disciplinary approaches, it is not surprising that different studies focus on slightly different aspects and levels of human capital in organizations. There exists a strong relationship between human capital and economic growth. This is due to the fact that people join the enterprise with various skills and knowledge. This relationship can be measured by how much money is spent on educating people or how many of them are employed in different research and/or development activities (Weil, 2014; Sultana et al., 2022). Some governments recognize that this link between human capital and the economy is particularly important, and therefore provide subsidies for education and/or R&D. People employed with higher education often have higher salaries, which means that they can spend more, which translates itself into the economic situation.

When the potential of human capital increases in areas such as science, education and management, it leads to increased innovation, social well-being, equality, increased productivity and the improvement of various indicators, all of which contribute to economic growth. An improvement in the economic situation usually translates itself into an improvement in the quality of life of the population. Z. Ziolo (2015) also noticed that the efficiency of a company may have an impact on social and cultural efficiency. Activation of the labor force is achieved as a result of employment growth and contributes to minimizing unemployment, improving or changing professional qualifications. Such activities contribute to the reduction of social pathology and the reduction of social benefits paid out.

Considering the issues of industry, it should be noted that it has a direct impact on the level and pace of economic development. Goods produced by industry are used to meet human needs and increase the quality of life. The development of this sector also affects the absorption of consumer goods, increasing financial resources and investments. The development of enterprises, in turn, determines the demand for qualified staff.

Changes taking place on the market and, in particular, the increasingly widely implemented concept of Industry 4.0, mean that the effectiveness of the organization will be based to an even greater extent on the qualifications of employees. With the introduction of Industry 4.0 technologies, organizations can capture and analyze more information than they managed in the past. In terms of human resources, this is a challenge that involves investing in efficient information systems for human resource management. Such a solution will allow not only large organizations, but also those from the SME sector to improve their business activities. As noted by A. Kucharčíková et al. (2021), this applies in particular to Big Data analysis, where the obtained data can, among others, reduce the costs of employee rotation, employee acquisition (departure from printed CVs (look Piwovar-Sulej, 2020), or monitor work efficiency and interactions between the most effective employees and teams (Kucharčíková et al., 2021). In turn, J.E. Agolla (2018) drew attention to such competences as social/interpersonal, related to action, domain ones, which are particularly important in the case of cooperation between human capital and Industry 4.0. So what one see here is a user-centered approach with focus on tasks and situations.

3. Research methodology

The article uses a critical analysis of the literature and a library query to develop the theoretical part, while the analysis of empirical data uses the methods of descriptive statistics. First, in order to explore the considerations undertaken in the literature, a library query was conducted on the Google Scholar website (more Lotko, 2022). Three phrases were searched on the website, namely: "human capital", "enterprise", and "effectiveness". The literature survey was conducted on October 20-21, 2022. The results from the first pages returned by the search engine were selected for the literature analysis. In total, 10 theoretical and theoretical-empirical studies were analyzed. Next, a qualitative analysis of the text was carried out. The obtained knowledge was compared with the results obtained by other researchers, which contributed to the expansion of knowledge in the discipline.

In the development of the empirical part, the only research method that was used was statistical analysis, which included the following elements:

- characteristics of the sample of selected features,
- analysis of a series of correlations examining the matching of features,
- analysis of the obtained results.

Public statistics were used as the source of the empirical data. The data was obtained from the European Statistical Office "Eurostat". The collected data was compiled using descriptive statistics. For this purpose, calculations of the average and the dynamics of changes in selected values and the trend function were used. In addition, the relationship between the selected

measures was examined with the help of the Pearson correlation. The obtained dependencies can be interpreted as strong, moderate, or weak. However, such an interpretation is arbitrary. It was assumed that the correlation strength: $[r] < 0.2$ – no linear relationship; $0.2 \leq [r] < 0.4$ – weak dependency; $0.4 \leq [r] < 0.7$ – moderate dependence; $0.7 \leq [r] < 0.9$ – quite strong dependence; and $[r] \geq 0.9$ – very strong dependence.

4. Analysis of the results of the empirical study

The further part of the considerations was devoted to the analysis of statistical data of selected measures in the field of the effectiveness of enterprises in the Visegrad Group. First, the gross turnover of enterprises was discussed. They are presented in Table 1.

Table 1.

Gross turnover of enterprises from the industrial sector in the Visegrad Group against the EU average in 2016-2020 (in million euros)

	2016	2017	2018	2019	2020	Arithmetic average [in million euros]	Changes compared to 2016 [%]	Trend function
Czech Republic	160973.30	178105.90	189692.90	193964.70	174511.20	179449.60	108.41	8727.40
Hungary	102005.20	109581.70	115018.10	120423.40	111825.00	111770.68	109.63	117866.90
Poland	288672.30	321925.90	355226.80	372321.70	348759.10	337381.16	120.81	371495.00
Slovakia	72080.50	76382.20	82180.20	82432.00	74 767.30	77568.44	103.73	79853.12
V4	155932.83	171498.93	185529.50	192285.45	177465.65	176542.47	113.22	189312.90
UE average	248762.77	267777.78	285185.69	290605.34	260440.91	270554.50	108.76	279791.30

Source: Own elaboration and calculations after the Eurostat data.

The highest gross turnover of enterprises from the industrial sector in the Visegrad Group in 2016-2020 was recorded in Poland - on average it was EUR 337.38 billion; while the lowest average was observed in Slovakia, - EUR 77.56 billion. In terms of the growth rate of this indicator, the highest was recorded for Polish enterprises (20.81% - from EUR 288.67 billion in 2016 to EUR 348.75 billion in 2020). Hungarian enterprises recorded an increase by 9.63%, Czech enterprises by 8.41%, and Slovak enterprises by 3.73%. In turn, the V4 recorded an increase of 13.22%, i.e. by 4.46 p.p. more than the EU-27.

Table 2 presents the data related to the ratio of gross turnover of enterprises from the industrial sector in Poland to other countries in the Visegrad Group in 2016-2020.

Table 2.

The ratio of gross turnover of enterprises from the industrial sector in Poland to other countries in the Visegrad Group and the EU average in 2016-2020 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	55.76	55.33	53.40	52.10	50.04	50.40
Hungary	35.34	34.04	32.38	32.34	32.06	31.60
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	24.97	23.73	23.13	22.14	21.44	21.30
V4	54.02	53.27	52.23	51.64	50.88	50.80
EU average	86.17	83.18	80.28	78.05	74.68	74.80

Source: Own elaboration and calculations after the Eurostat data.

It can be observed that in this respect Polish enterprises performed very well against the background of other V4 countries. They generated almost half as much gross turnover as Czech enterprises from the industrial sector (on average: 53.33%). Hungarian business entities obtained on average 33.23% of the turnover of Polish enterprises, while Slovak ones – 23.08%. The gross turnover of Polish enterprises from the industrial sector was also higher than the average values for the V4 and EU-27. Another analyzed indicator of the effectiveness of enterprises is the apparent work efficiency. The data are presented in Table 3.

Table 3.

Apparent labor productivity of enterprises from the industrial sector (gross value added per person employed) in the Visegrad Group against the EU average in 2016-2019 (in EUR thousand)

	2016	2017	2018	2019	2020	Arithmetic average [in thousands. euros]	Changed compared to 2016 [%]	Trend function
Czech Rep.	29.00	30.30	32.00	33.40	n/a	31.17	115.17	33.40
Hungary	29.50	31.90	32.90	33.10	n/a	31.85	112.20	33.60
Poland	24.80	26.50	27.90	29.60	n/a	27.20	119.35	29.60
Slovakia	26.90	28.10	28.90	28.20	n/a	28.02	104.83	28.70
V4	27.55	29.20	30.43	31.08	n/a	29.56	112.79	31.30
EU average	61.00	64.00	65.00	66.30	n/a	64.07	108.69	66.60

Legend: n/a - no data.

Source: Own elaboration and calculations after the Eurostat data.

The highest average indicator of apparent work efficiency of enterprises from the industrial sector was recorded in Hungary (EUR 31.85 thousand). The second in this respect were Czech business entities (EUR 31.17 thousand). The worst in this respect were economic entities from Poland, whose apparent labor productivity in the analyzed period amounted to an average of 27.2 thousand euro. However, it should be emphasized that Polish enterprises showed the fastest growth rate of this indicator (19.35%). Czech entities recorded a growth dynamics of 15.17%, Hungarian 12.20%, and Slovak 4.83%. Labor productivity was definitely higher in the EU-27 (EUR 64.07 thousand on average) than in the Visegrad Group (EUR 29.56 thousand). Then, the ratio of the apparent work efficiency of enterprises from the industrial sector in Poland to other countries of the Visegrad Group was analyzed (Table 4).

Table 4.

The ratio of the apparent labor productivity of enterprises from the industrial sector in Poland to other countries of the Visegrad Group and the EU average in 2016-2019 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	116.94	114.34	114.70	112.84	n/a	112.90
Hungary	118.95	120.38	117.92	111.82	n/a	113.70
Poland	100.00	100.00	100.00	100.00	n/a	
Slovakia	108.47	106.04	103.58	95.27	n/a	97.00
V4	111.09	110.19	109.05	104.98	n/a	105.90
EU average	226.77	227.76	224.91	235.11	n/a	232.00

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

Polish enterprises from the industrial sector showed the largest loss in this respect in relation to Hungarian entities (average loss of 17.27 p.p.). The loss to Czech economic entities was 14.7 p.p., while to Slovak ones it was 3.34 p.p., but in 2019 Polish enterprises had a higher apparent labor productivity index (by 4.73 p.p.) than Slovak ones. The ratio of apparent labor productivity of enterprises from the industrial sector in Poland was definitely lower than the EU-27 average in each analyzed year. In the course of the analysis, the data related to the gross operating index of enterprises from the industrial sector in the Visegrad Group were also approximated (Table 5).

Table 5.

Gross operating index of enterprises from the industrial sector in the Visegrad Group compared to the EU average in 2016-2019

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016. [%]	Trend function
Czech Rep.	11.30	10.30	9.70	9.50	n/a	10.20	84.07	9.30
Hungary	11.30	11.70	11.70	10.70	n/a	11.35	94.69	11.80
Poland	11.70	11.30	11.30	11.40	n/a	11.42	97.44	11.30
Slovakia	8.00	8.10	7.40	6.50	n/a	7.50	81.25	6.70
V4	10.60	10.30	10.00	9.50	n/a	10.12	90.08	9.60
EU average	9.80	9.80	9.60	9.50	n/a	9.70	96.94	9.50

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

The highest average gross operating index in 2016-2019 was recorded by Polish enterprises from the industrial sector (11.42). Business entities from Hungary were not much worse in this respect (11.35); Czech entities generated an average gross operating ratio of 10.2, while Slovak entities generated 7.5. Unfortunately, in each analyzed case a decrease was recorded between 2016 and 2019. The highest drop was in Slovakia (-18.75%), while the lowest was in Poland (-2.56%). In line with the linear trend, the operating ratio will increase in Slovakia and Hungary (to 6.7 and 11.8, respectively), while in the case of the Czech Republic and Poland it will decrease (to 9.3 and 11.3, respectively). Comparing the gross operating index in the Visegrad Group with the EU-27 index, it can be observed that it was slightly higher in the V4.

As in previous cases, the ratio of the gross operating index of Polish enterprises from the industrial sector was examined compared to other countries in the Visegrad Group (Table 6).

Table 6.

Ratio of the gross operating index of Polish enterprises from the industrial sector compared to other countries in the Visegrad Group and the EU average in 2016-2019 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	96.58	91.15	85.84	83.33	n/a	82.50
Hungary	96.58	103.54	103.54	93.86	n/a	98.20
Poland	100.00	100.00	100.00	100.00	n/a	
Slovakia	68.38	71.68	65.49	57.02	n/a	59.60
V4	90.38	91.59	88.72	83.55	n/a	85.10
EU average	83.76	86.73	84.96	83.33	n.a	84.20

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

In most cases, Polish enterprises were the leader in terms of the operating index. Only in 2017 and 2018 Hungarian entities showed a higher ratio than that describing Poland. In both cases, by 3.54 p.p. In general, Hungarian enterprises lost 0.62 pp to Polish enterprises. In the case of a difference between Czech and Polish enterprises, the difference was 10.78 pp, while between Slovak and Polish enterprises it was 34.36 pp. According to the calculations of the linear trend, only in the case of Slovakia the ratio of the gross operating ratio to Poland will increase to 59.6%.

The analysis of human capital issues in the Visegrad Group began with checking the LCI labor costs incurred by industrial enterprises in 2016-2020. The data are presented in Table 7.

Table 7.

Labor costs in industrial companies in the Visegrad Group countries compared to the EU average in 2016-2020

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016 [%]	Trend function
Czech Rep.	4.20	8.40	8.70	8.70	5.00	7.00	119.05	7.40
Hungary	5.50	9.20	9.40	9.40	6.60	8.00	120.00	8.50
Poland	4.60	6.40	7.80	7.80	5.60	6.40	121.74	7.10
Slovakia	4.20	7.60	8.40	8.40	4.80	6.70	114.29	7.10
V4	4.60	7.90	8.60	8.60	5.50	7.00	118.92	7.50
EU average	1.80	2.40	2.70	3.00	2.30	2.40	127.78	2.80

Source: Own elaboration and calculations after the Eurostat data.

Based on the analysis of the data in Table 7, it can be seen that the highest average labor costs in 2016-2020 were incurred by industrial enterprises from Hungary (8.0 LCI). The second in this respect were economic entities from the Czech Republic (7.0 LCI). Slightly lower average labor costs were incurred by industrial enterprises from Slovakia (6.7 LCI). In terms of labor costs, the smallest burden in the V4 was borne by Polish enterprises (6.4 LCI). The fastest increase in LCI labor costs was observed in Poland (21.74%), while the slowest in Slovakia (14.29%), which in this case should be interpreted positively. Then, the ratio of LCI labor costs

in Polish enterprises from the industrial sector to enterprises in other countries of the Visegrad Group in the years 2016-2020 was examined (Table 8).

Table 8.

The ratio of LCI labor costs in Polish enterprises from the industrial sector to enterprises from the industrial sector in the Visegrad Group countries and the EU average in 2016-2020

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	91.30	131.25	111.54	111.54	89.29	102.20
Hungary	119.57	143.75	120.51	120.51	117.86	119.10
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	91.30	118.75	107.69	107.69	85.71	97.80
V4	100.54	123.44	109.94	109.94	98.21	104.80
EU average	39.13	37.50	34.62	38.46	41.07	39.10

Source: Own elaboration and calculations after Eurostat data.

Only in two cases, LCI labor costs in Polish enterprises from the industrial sector were higher than in enterprises from the industrial sector in other countries of the Visegrad Group. This concerned the years 2016 and 2020, and specifically the situation observed in the Czech Republic and Slovakia. The highest difference was recorded in 2017 between Poland and Hungary. In the course of the analysis, the number of research and development personnel employed in enterprises from the industrial sector in the Visegrad Group countries in 2016-2020 was also examined (Table 9).

Table 9.

Research and development personnel employed in industrial companies in the Visegrad Group countries compared to the EU average in 2016-2020 (thousands)

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016 [%]	Trend function
Czech Rep.	336.00	358.50	359.00	360.90	360.10	354.90	107.17	365.00
Hungary	183.30	205.20	196.80	206.60	225.60	203.50	123.08	220.70
Poland	886.20	957.00	995.70	1 005.30	991.00	967.04	111.83	1018.60
Slovakia	121.40	125.40	137.50	151.10	166.80	140.44	137.40	163.70
V4	381.70	411.50	422.30	431.00	435.90	416.47	114.20	442.00
EU average	374.30	384.50	392.70	403.10	417.60	394.46	111.60	415.50

Source: Own elaboration and calculations after Eurostat data.

The largest number of research and development personnel employed in enterprises from the industrial sector was observed in Poland (967.04 thousand on average). This value was definitely higher than other countries, but it should be noted that these are absolute values. A definitely more reliable indicator would be at least comparing R&D personnel in relation to the number of inhabitants of a given V4 country, then the classification would be completely different. However, in the proposed analysis, due to the fact that absolute values provide a different type of knowledge, it was decided to use them. The highest dynamics of changes between 2016 and 2020 took place in Slovakia (37.40%), and the lowest in the Czech Republic (7.17%). Poland showed an increase in research and development personnel employed in industrial enterprises at the level of 11.83%. The ratio of research and development personnel

employed in Polish enterprises from the industrial sector to enterprises from other Visegrad Group countries in 2016-2020 was also analyzed (Table 10).

Table 10.

The ratio of research and development personnel employed in Polish enterprises from the industrial sector to enterprises from the Visegrad Group countries and the EU average in 2016-2020

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	37.91	37.46	36.06	35.90	36.34	35.80
Hungary	20.68	21.44	19.76	20.55	22.76	21.70
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	13.70	13.10	13.81	15.03	16.83	16.10
V4	43.07	43.00	42.41	42.87	43.98	43.40
EU average	42.24	40.18	39.44	40.09	42.14	40.80

Source: Own elaboration and calculations after Eurostat data.

The difference in the number of research and development personnel employed in Polish enterprises from the industrial sector in relation to enterprises from the Visegrad Group countries is visible - in favor of Polish enterprises (when absolute values are being analyzed). The highest difference was in Slovakia in 2017 (13.10 p.p.), and the lowest in Czech economic entities in 2016 (37.91 p.p.). The last researched indicator in the field of human capital was the number of unemployed with higher education in the Visegrad Group countries in 2016-2020 (Table 11).

Table 11.

Unemployed with higher education in the Visegrad Group countries against the EU average in 2016-2020 (in thousands)

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016 [%]	Trend function
Czech Rep.	23.60	19.30	15.90	13.10	19.00	18.18	80.51	15.10
Hungary	20.90	18.90	17.80	19.50	24.30	20.28	116.27	21.80
Poland	183.90	141.90	119.70	121.90	121.10	137.70	65.85	108.60
Slovakia	35.20	27.10	21.20	18.20	26.00	25.54	73.86	20.10
V4	65.90	51.80	43.65	43.175	47.60	50.425	72.73	41.40
EU average	135.10	122.20	115.20	112.00	129.00	122.697	95.50	118.20

Source: Own elaboration and calculations after Eurostat data.

The highest number of unemployed with higher education in the analyzed period was in Poland in 2016; it was 183.9 thousand. people in the indicated year. The lowest rate was in the Czech Republic in 2019 and it was 13.1 thousand. unemployed with higher education. In the entire V4, the average number of unemployed with higher education in 2016-2020 was 50.43 thousand. people. Only in Hungary an increase of this indicator by 16.27% was observed. On the other hand, in Poland the number of the unemployed with higher education decreased the fastest (-34.15%). The ratio of the number of unemployed with higher education in Poland to the countries of the Visegrad Group in 2016-2020 was also analyzed (Table 12).

Table 12.

The ratio of the number of unemployed with higher education in Poland to the countries of the Visegrad Group and the EU average in 2016-2020

	2016	2017	2018	2019	2020	Trend function
Czechy	12.83	13.60	13.28	10.75	15.69	13.80
Węgry	11.36	13.32	14.87	16.00	20.07	19.10
Polska	100.00	100.00	100.00	100.00	100.00	
Słowacja	19.14	19.10	17.71	14.93	21.47	18.60
V4	0.56	0.66	0.74	0.79	0.99	37.90
Średnia dla UE	4.96	4.96	4.96	4.95	4.95	105.20

Source: Own elaboration and calculations after Eurostat data.

The ratio of the unemployed with higher education in Poland to other countries of the Visegrad Group exceeded 20% only in two cases. This concerned both cases of 2020, specifically Hungary (20.07%) and Slovakia (21.47%). The next step in the study was to analyze the relationship between the selected measures of organizational effectiveness and the measures of human capital. The first stage of the research concerned the determination of the relationship between the turnover of industrial enterprises and the selected measures of human capital. The obtained results are presented in Table 13 below.

Table 1.

Relationship between turnover and particular indicators of human capital

	Turnover and the unemployed with higher education	Turnover and research and development personnel	Turnover and labor costs
Czech Rep.	-0.98	0.81	0.83
Hungary	-0.26	0.47	0.86
Poland	-0.94	0.97	0.75
Slovakia	-0.94	0.25	0.87

Source: Own calculations.

When analyzing the relationship between the gross operating index and the number of unemployed with higher education, it can be seen that among the V4 countries only in Hungary a negative correlation was obtained, with a moderate strength of the relationship, i.e. $r = -0.48$. In the Czech Republic, Poland and Slovakia, the correlation was positive, with at least a strong relationship (in the case of the Czech Republic, even a very strong relationship). The relationship between the gross operating ratio and R&D personnel in each V4 country was characterized by a negative correlation result. In Hungary, there is no linear relationship ($r = -0.18$), while in other countries this relationship should be considered very strong (except for Poland, which was described by a fairly strong relationship). Also in the case of examining the relationship between the gross operating index and labor costs, negative values of the correlation coefficient were obtained for all V4 countries. In Hungary and Slovakia, the relationship turned out to be weak, respectively ($r = -0.21$; $r = -0.37$). On the other hand, in the Czech Republic, a strong correlation between the analyzed features was noted in this case, and in Poland the relationship should be interpreted even as very strong.

5. Discussion of the results

The obtained results allow to conclude that with the increase in the number of research and development personnel, the operational index decreases, which may be related to the fact that employment costs are high due to the high qualifications of R&D employees. Of course, enterprises can use various subsidies for research and development, however, S.-O. Daunfeldt et al. (2022) found no evidence that targeted R&D subsidy programs had any positive and statistically significant impact on the number of employees employed in these SMEs, or that subsidies are associated with an increase in demand for high-human capital workers. Interestingly, the study conducted by L. Lanahan et al. (2021) suggests that grants do not increase the employment of R&D personnel, as companies receiving grants look for external partners to implement the project.

The conducted analysis suggests that the operating index decreases with the increase in labor costs. Similar results were obtained by R. Chład (2012), who pointed out that a large share of remuneration costs in relation to the obtained revenues is reflected in the achieved income, the lower the income, the lower the income tax is paid, but also the lower the net profit. In addition, D.S. Hamermesh (2021) pointed out that higher labor costs, unaccompanied by technological changes that increase productivity, reduce the willingness of employers to hire workers and reduce the total amount of work performed in each economy. Less work means less production.

In addition, the obtained results suggest that the number of unemployed people with higher education increases along with the increase in the gross operating index. This situation may be the result of the fact that the education systems in the Visegrad Group produce too many people with higher education, which, in turn, may be related to the low quality of education in these countries. This theory may be supported by the fact that the best university from the Czech Republic, Charles University, was ranked 209th in the world ranking, while the next in the ranking was the University of Warsaw, which was ranked 342nd. In turn, the best Hungarian university, Loránd Eötvös University took 438th place, and the Slovak one, Comenius University was ranked the 765th place (Ranking WEB of Universities, 2022). A. Pelle and E. Kurczeleki (2016) paid particular attention to this problem.

6. Conclusions

Human capital is one of the most important resources of an organization in the fight to maintain/strengthen its competitive position and organizational effectiveness. The ability of enterprises to compete in highly competitive markets depends on the accumulation of

knowledge and skills of their employees. People are the ultimate resource of an organization, therefore there is no doubt that the ability of enterprises to compete in markets by creating value-added products and services depends on the accumulation of knowledge and skills of their employees, in other words, depends on the effectiveness of human capital. The analysis made it possible to achieve the assumed aim of the work and to verify both research hypotheses positively. In addition, it enabled the formulation of the following conclusions:

- along with the increase in the turnover of enterprises, the number of unemployed people with higher education decreases in each V4 country, and vice versa,
- the increase in the turnover of enterprises determined the increase in the number of research and development personnel in each country of the Visegrad Group (and vice versa),
- turnover of V4 enterprises turned out to be strongly correlated with labor costs,
- along with the decrease in the number of research and development personnel, the gross operating index of enterprises from the Visegrad Group increases,
- along with the decrease in labor costs, the gross operating index of enterprises from the Visegrad Group increases, and vice versa.

Identification of the strength of the relationship between the examined relationships may, at least partially, contribute to focusing on those activities that have the greatest impact on improving the situation of business entities in terms of their efficiency. However, due to the limitations encountered in the research process, it was unfortunately not possible to conduct a multi-faceted analysis. This noticed imperfection of the research results from the limitations, which primarily include:

- insufficient length of time series containing the attributes of human capital and enterprise efficiency,
- lack of current and complete statistical data, which results in a significantly reduced number of analyzed predictors.

The proposed considerations should be treated as an introduction to much deeper research in the future. Firstly, it is planned to extend the analysis by examining further predictors, especially in the field of:

- efficiency of enterprises (e.g. return on capital, assets, sales),
- staff education (share of adult learners, number of people with higher education employed in science and technology, number of scientists and engineers),
- intellectual property rights (number of applications for EU trademarks, number of applications for Community designs, number of patents granted).

Secondly, the directions of further research will include the extension of research facilities to other EU countries, as well as NUTS 2 regions forming the Visegrad Group. The aim of the intensified research will be an attempt to develop a few practical recommendations addressed especially to business entities.

References

1. Agolla, J.E. (2018). Human Capital in the Smart Manufacturing and Industry 4.0 Revolution. In: A. Petrillo, R. Cioffi, F. De Felice (Eds.), *Digital Transformation in Smart Manufacturing*. IntechOpen, doi: 10.5772/intechopen.69336.
2. Andriessen, D. (2004). *Making sense of intellectual capital. Designing a method for the valuation of intangibles*. Oxford: Elsevier Butterworth Heinemann.
3. Aparicio, G., Iturralde, T., Rodriguez, A.V. (2021). Developments in the knowledge-based economy research field: a bibliometric literature review. *Management Review Quarterly*, doi:10.1007/s11301-021-00241-w.
4. Atkinson, A.A., Balakrishnan, R., Booth, P., Cote, J.M., Grout, T., Mali, T., Roberts, H., Ulan, E., Wu, A. (1997). New Directions in Management Accounting Research. *Journal of Management Accounting Research*, Vol. 9, Iss. 1, pp. 80-108.
5. Channar, Z.A., Talreja, S., Bai, M. (2015). Impact of Human Capital Variables on the Effectiveness of the Organizations. *Pakistan Journal of Commerce and Social Sciences*, Vol. 9(1), pp. 228-240.
6. Chład, R. (2012). Koszty wynagrodzeń i ich wpływ na osiągnięcie przychodów w przedsiębiorstwie [Remuneration costs and their impact on the company's revenues]. *Zeszyty Naukowe Politechniki Częstochowskiej. Zarządzanie [Scientific Journals of the Częstochowa University of Technology. Management]*, No. 8, pp. 7-16.
7. Credé, M., Kuncel, N.R. (2008). Study habits, skills, and attitudes: The third pillar supporting collegiate academic performance. *Perspectives on Psychological Science*, Vol. 3, Iss. 6, pp. 425-453, doi: 10.1111/j.1745-6924.2008.00089.x.
8. Crook, T.R., Todd, S.Y., Combs, J.G., Woehr, D.J., Ketchen, D.J. (2011). Does human capital matter? A meta-analysis of the relationship between human capital and firm performance. *Journal of Applied Psychology*, Vol. 96, Iss.3, pp. 443-456, doi: 10.1037/a0022147
9. Daunfeldt, S.-O., Halvarsson, D., Tingvall, P.G., McKelvie, A. (2020). Do Targeted R&D Grants toward SMEs Increase Employment and Demand for High Human Capital Workers? In: K. Wennberg, Ch. Sandström (Eds.), *Questioning the Entrepreneurial State: Status-quo, Pitfalls, and the Need for Credible Innovation Policy*. *International Studies in Entrepreneurship*, Vol. 53, pp. 175-198, doi: 10.1007/978-3-030-94273-1_10.
10. Domanović, V., Janjić, V. (2018). Enterprise Efficiency Sources in the Contemporary Business Environment. *Economic Themes*, Vol. 56, Iss. 3, pp. 321-334, doi: 10.2478/ethemes-2018-0019.
11. Dziwulski, J., Skowron, S. (2019). Kapitał ludzki w perspektywie strategicznej i operacyjnej – aspekty metodologii badań [Human capital in strategic and operational perspective - aspects of research methodology]. *Studia i Prace Kolegium Zarządzania*

- i Finansów. Szkoła Główna Handlowa [Studies and Works of the College of Management and Finance. Warsaw School of Economics]*, No. 175, pp. 35-48, doi: 10.33119/SIP.2019.175.3.
12. Eurostat. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/pat_ep_ntot/default/table?lang=en, 20.10.2022.
13. Galiakberova, A.A. (2019). Conceptual Analysis of Education Role in Economics: The Human Capital Theory. *Journal of History Culture and Art Research*, Vol. 8, Iss. 3, pp. 410-421, doi: 10.7596/taksad.v8i3.2256.
14. Hamermesh, D.S. (2021). Do labor costs affect companies' demand for labor? *IZA World of Labour*, doi: 10.15185/izawol.3.v2.
15. Iazzolino, G., Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. *Journal of Intellectual Capital*, Vol. 14, No. 4, pp. 547-563, doi: 10.1108/JIC-12-2012-0107.
16. Jamal, W., Saif, M.I. (2011). Impact of Human Capital Management on Organizational Performance. *European Journal of Economics, Finance and Administrative Sciences*, Vol. 34, pp. 55-69.
17. Josan, I.J. (2013). Human Capital and Organizational Effectiveness. *Manager Journal*, Vol. 17, No. 1, pp. 39-45.
18. Kaplan, R.S., Norton, D.P. (1992). The Balanced Scorecard – Measures that Drive Performance. *Harvard Business Review*, No. 79, pp. 1-11.
19. Kareska, K., Davcev, L. (2016). Challenges in modern management and modern business that Macedonian organizations face in gaining competitive advantage. *Journal of Economics*, Vol. 1, No. 2, p. 2.
20. Kell, H.J., Robbins, S.B., Su, R., Brenneman, M. (2018). A Psychological Approach to Human Capital. *ETS Research Report Series*, Iss. 1, p. 1, doi: 10.1002/ets2.12218.
21. Kozera, M., Kalinowski, S. (2012). *Intellectual capital – non-material element of farm businesses economic success*. Proceedings of the International Conference on Management of Human Resources, Management – Leadership – Strategy – Competitiveness, Szent Istvan University. Hungary: Godollo, pp. 405-413.
22. Król, H., Ludwiczynski, A. (2014). *Zarządzanie zasobami ludzkimi. Tworzenie kapitału ludzkiego organizacji [Human Resource Management. Creating the Human Capital of the Organization]*. Warsaw: PWN.
23. Kucharčíková, A., Mičiak, M., Bartošová, A., Budzeľová, M., Bugajová, S., Maslíková, A., Pisoňová, S. (2021). Human Capital Management and Industry 4.0. *SHS Web of Conferences*, Vol. 90, Iss. 4, pp. 1-8, doi: 10.1051/shsconf/20219001010.
24. Lanahan, L., Joshi, A.M., Johnson, E. (2021). Do public R&D subsidies produce jobs? Evidence from the SBIR/STTR program. *Research Policy*, Vol. 50, Iss. 7, doi: 10.1016/j.respol.2021.104286.

25. Lotko, A. (2022). The Identity of the Selected Automotive Brand Based on the Analysis of Advertisements. *Scientific Papers of Silesian University of Technology, series: Organization and Management, No. 157*, p. 301, doi: 10.29119/1641-3466.2022.157.19.
26. Marginson, S. (2019). Limitations of human capital theory. *Studies in Higher Education, Vol. 44, Iss. 2*, p. 287, doi: 10.1080/03075079.2017.1359823.
27. Mentel, G., Migala-Warchoł, A., Sobolewski, M. (2014). Wpływ kapitału ludzkiego na wyniki finansowe organizacji [The impact of human capital on the financial results of the organization]. *Zeszyty Naukowe Uniwersytetu Szczecińskiego [Scientific Journals of the University of Szczecin], No. 803, Finanse, Rynki Finansowe, Ubezpieczenia [Finance, Financial Markets, Insurance], No. 66*, pp. 395-408.
28. Oforegbunam, E.T., Okorafor, G.T. (2010). Effects of Human Capital Development on the performance of Small & Medium Scaled Enterprises in the Southeastern Region of Nigeria. *Journal of Sustainable Development in Africa, Vol. 12, No. 8*, pp. 49-58.
29. Pelle, A., Kurczeleki, E. (2016). Education policies and performance of the Visegrad countries in light of their OECD membership: a comparative study. *Yearbook of the Institute of East-Central Europe, Vol. 14, Iss.4*, pp. 174-207.
30. Piwowar-Sulej, K. (2020). Human resource management in the context of Industry 4.0. *Scientific Quarterly Organization and Management, Vol. 1, No. 49*, pp. 103-113, doi: 10.29119/1899-6116.2020.49.7.
31. Pulić, A., (2005). Value creation efficiency at national and regional levels: case study – Croatia and the European Union. In: A. Bounfour, L. Edvinsson (Eds.), *Intellectual Capital for Communities. Nations, Regions, and Cities*. Oxford: Elsevier, pp. 197-211, doi: 10.1016/B978-0-7506-7773-8.50015-7.
32. *Ranking WEB of Universities*. Retrieved from https://www.webometrics.info/en/Ranking_Europe?page=3, 20.10.2022.
33. Samuelson, P.A., Nordhaus, W.D. (2019). *Ekonomia [Economy]*. Poznań: Rebis.
34. Seleim, A., Ashour, A., Bontis, N. (2007). Human capital and organizational performance: a study of Egyptian software companies. *Management Decision, Vol. 45, Iss. 4*, pp. 789-801, doi: 10.1108/00251740710746033.
35. Singh, K. (2004). Impact of HR practices on perceived firm performance in India. *Asia Pacific Journal of Human Resources, Vol. 42, Iss. 3*, pp. 301-317, doi: 10.1177/1038411104048170.
36. Stepanova, L.M., Melnikova, N.M. (2020). Modern problems of Management efficiency in a Joint Stock Company. *Advances in Economics, Business and Management Research, Vol. 128*, p. 1971, doi: 10.2991/aebmr.k.200312.274.
37. Sultana, T., Dey, S.R., Tareque, M. (2022). Exploring the linkage between human capital and economic growth: A look at 141 developing and developed countries. *Economic Systems, Vol. 46, Iss. 3*, doi: 10.1016/j.ecosys.2022.101017.

38. Tan, H.P., Plowman, D., Hancock, P. (2008). The evolving research on intellectual capital. *Journal of Intellectual Capital*, Vol. 9, Iss. 4, pp. 585-608, doi: 10.1108/14691930810913177.
39. Weil, D.N. (2014). *Economic Growth*. New York: Routledge, doi: 10.4324/9781315510453.
40. World Bank, *The Human Capital Project: Frequently Asked Questions*. Retrieved from <https://www.worldbank.org/en/publication/human-capital/brief/the-human-capital-project-frequently-asked-questions>, 10.10.2022.
41. Ziolo, Z. (2015). Przedsiębiorczość jako czynnik rozwoju społeczno-gospodarczego układów przestrzennych [Entrepreneurship as a factor of socio-economic development of spatial systems]. *Przedsiębiorczość – Edukacja [Entrepreneurship – Education]*, Vol. 11, p. 15, doi: 10.24917/20833296.11.2.

DATA COMPLETION AND VERIFICATION IN SOCIAL RESEARCH PROJECTS BASED ON THE THIRD METHODOLOGICAL PATH

Paweł CHLIPALA^{1*}, Agnieszka ŻBIKOWSKA²

¹ Department of Marketing, Cracow University of Economics; Pawel.Chlipala@uek.krakow.pl,
ORCID: 0000-0003-2496-8617

² Department of Marketing, Cracow University of Economics; Agnieszka.Zbikowska@uek.krakow.pl,
ORCID: 0000-0003-4216-1817

* Correspondence author

Purpose: The main goal of the paper is to provide an overview of possible applications of the integration of methodological approaches in research projects that aim to complete and verify data.

Design/methodology/approach: The paper is methodological. Critical literature analysis was used. The range of possibilities of methodological integration was based on the achievements of Creswell & Plano Clark and Harrison & Reilly. The authors' own research experience allowed outlining the ways of data integration, both in parallel procedures of data collection, where quantitative research in the positivist trend and qualitative research in the interpretative trend were conducted separately and in sequential research, where quantitative research was first carried out, then the results were interpreted and designed, and qualitative research was carried out. The embedded approach was also illustrated, where quantitative data constituted a valuable extension and confirmation of conclusions obtained in qualitative research.

Findings: Methodological analysis shows that the third path allows the accumulation of broader and deeper knowledge in research projects than using a single methodological approach. Considering various ways of integrating research approaches, the authors show that the best results in completing and verifying data are achieved using a sequential approach.

Practical implications: The article is a methodological guide to the application of an integrated approach in research practice in social sciences, particularly in consumer behavior.

Originality/value: The third methodological path is beyond the dominant research trend in social sciences, and in the field of consumer behavior, it is a niche approach. The possible use of this approach is the original contribution of the authors.

Keywords: data completion; data verification; third methodological path; mixed methods.

Category of the paper: General review.

1. Introduction

The core aim of this paper is to draw up the possibilities of the usage of integrated methodology in conducting a research project in social sciences. The referenced idea of integration methodologies is presented in literature on social research studies and is called the third research paradigm (Johnson, Onwuegbuzie 2004), the third methodological movement research paradigm (Teddlie, Tashakkori 2009), the third path (Gorard, Taylor 2004) and most commonly mixed methods research (Creswell, Plano Clark, 2007; Creswell, 2009; Leech, Onwuegbuzie, 2009; Tashakkori, Teddlie, 2010; Plow-Right, 2011).

The paper uses the phrase the third methodological path, because, according to the authors, the name mixed methods does not reflect the broad spectrum of integration possibilities. However, due to the substantive content presented in the literature, all these terms should be treated as synonyms. Regardless of the terminology used, the idea of methodological integration covers combining approaches, concepts, methods, techniques, or language into a single study (Johnson, Onwuegbuzie, 2004). The issues of integration of research methodologies for data verification, which are important from the point of view of the topic of this paper, are also taken up within the scope of mixed methods (De Leeuw 2005; De Leeuw, Hox, 2008).

Joining methodological approaches is a way to complete and verify data. The mixed data collected in the integrated methodological research process helps to gain deeper and wider knowledge compared to a single methodological attitude, so it enriches the cognition perspective. Integration of methodological approaches enables the development of data obtained in the research project. Using different methodologies in one project is a way of improving research efficiency. This is particularly important in the social sciences, based on inductive, empirical cognition. Social science has a different character from that of natural science, which is based on experimentation and observation to provide some hard evidence. The specificity of social sciences is such that a much wider range of re-search methods is used, and the task of many of them is to provide data for interpretation, sometimes even only to describe the reality under study. The nature of the evidence and theorems in sociology, economics, management and marketing sciences can never be as precise and formalized as in the natural sciences. However, the rich methodological range allows for choices in terms of methodological approaches and their integration (Burrell, Morgan, 2005; Martens, 2007).

Integration of methodologies is a proposal aimed at improving the efficiency of re-search processes. The concept of integrated research methodologies in social sciences de-rives from the limitations of each separate methodology of data gathering. There are no perfect methods of cognition, therefore one methodological approach should use the possibilities of different approaches. Integrating methodological approaches has many limitations discussed in the next

part, but this option is worth considering as the quality of data in social research is crucial for creating constructs and building theories.

In the first part, the paper focuses on the methodological issue. It presents assumptions underlying of data integration according to the third methodological path. In the second part, empirical examples of data completion and verification are provided. The authors illustrate this issue based on their research projects on the integrated methodology. This way, the scope and methods of completion and verifying data are shown. Own experiences are the basis for formulating conclusions in the field of data integration in social research. In the discussion, the advantages and limitations of data completion and verification in the third methodological path were compared.

2. Data completion and verification - methodological insight

The use of the third methodological path as a way to verify and complete data is an important and current issue. The idea of combining methodological approaches has been presented in literature over the past three decades (Bazeley, 2017; Bergman, 2008; Creswell, 2009; Creswell, Plano Clark, 2007; Gorard, Taylor, 2004; Plano Clark, Creswell, 2008; Teddlie, Tashakkori, 2009; Tashakkori, Teddlie, 2010).

Despite significant theoretical and methodological achievements, the third methodological path is treated as a new methodological paradigm. As shown by the analyses of research carried out in the field of social sciences, the practice of integrated research is much less frequently used than research using a single methodological path. The positivist approach remains a meaningful approach to learning about reality, and it is often the dominant orientation when the integrated methodology is used. (Grimmer and Hannson 2009; Hanson and Grimmer 2007; Harrison and Reilly 2011; Snelson, 2016).

In the analysis and evaluation of the application of the integrated research procedure in research projects in social sciences, the main methodological assumptions and an overview of the scope and level of data integration were presented.

2.1. Concept of integrated methodological approaches in social research

The main assumption of the third methodological path is that each methodology of cognition is limited. The social researcher can use different methodological approaches, so the disadvantages of one methodology could be reduced by another. One of the manifestations of combining methodology in social research is triangulation. This concept was taken from navigation and military strategy, where it was applied to using many points to accurately determine the position of an object (Jick, 1979). Triangulation assumes the combination of approaches, orientation, or research methods and techniques in different stages of

research. The essence of triangulation is to look at issues from different, at least two points of view (Flick, 2011). The term triangulation used in social studies differs from that used in navigation. The meaning of this concept is not fully identical to its origin (Blaikie, 2008; Hammersley, 2008).

Triangulation is a broad concept, related to the research's general concepts, paradigms, and approaches strategy, but also research procedures, methods, and techniques of studies, sources of information (Perlesz, Lindsay 2003). Each type of triangulation that goes beyond one methodological orientation in the research project can be thought of as an illustration of the methodological integration in research. Triangulation aims to expand and supplement knowledge by transcending the epistemological limitations of each method of research.

Combining methodologies can involve different approaches from a wide variety of cognitive possibilities in social research (Burrell, Morgan, 2005). However, in the literature on mixed methods, the issues of methodological integration are most often reduced to combining quantitative and qualitative research and two cognitive paradigms in one research project: positivist or post-positivist and constructivist or interpretivist (Newman et al., 2003; Mertens, 2007; Teddlie, Tashakkori, 2009).

Combining different methodologies in one research project may give valuable effects in the form of reducing the limitations of individual methodologies, however, research integration is associated with significant restrictions. In the third methodological path, no new cognition methods were developed, but an attempt was made to combine opposing views on the creation of a research project, information gathering, analysis, interpretation, and presentation. It is an attempt to base the research on completely different methodological trends with different axiological, epistemological, and methodological assumptions. The advantage of mixed methods is the ability to create knowledge of a diverse nature, broad and deep, although it should be remembered that not every type of integration of approaches and data broadens the research perspective and knowledge. Methodological integration is a valid assumption at the level of the general concept but raises practical difficulties in its implementation (Hammersley, 2008). Choosing a methodology based on the third methodological path in a research project creates many difficulties for the re-searcher because the issues of research integration at the operational level are not de-scribed in detail or are ignored. This is the case, for example, in the field of surveys. Methodological publications on how to secure methodological quality in mixed-mode surveys are scarce, and most handbooks do not even discuss mixed-mode designs (de Leeuw, 2005). The problem with choosing an integrated methodology is that there are significant antagonisms between quantitative and qualitative researchers (Silverman, 2001). Many quantitative researchers do not consider qualitative information gathering as equivalent, and vice versa. Decisions regarding the choice of research methodology are not limited to the forms of integrating the methodology, but also, in many cases, to opting for research in one methodological path: quantitative or qualitative (Flick, 2011).

The use of an integrated methodology requires an approach based on pluralism, syncretism, i.e. a constant compromise and balancing between facts and values, knowledge and wisdom, rationality and emotional approach, idealism and materialism, etc. (Johnson, Gray, 2010). There are no clear guidelines and procedures for the application of fully integrated social research, which is why the broad horizons of the researcher, both in theoretical, methodological, and practical aspects, are so important.

2.2. Essence, levels, and scope of data integration in the third methodological path

The essence of the integration of methodological approaches in a research project is the acquisition of more comprehensive and reliable knowledge than in a single methodological path. This assumption, while correct, cannot be treated completely indiscriminately. The issues of assessing the precision of research methods and sources of information obtained in various methodological paths raise difficulties. The accuracy of the sources varies, and the method validation process is uncertain and speculative. It is im-possible to assume that one data source is completely independent of another, and the problem of conflicting data arises. It is practically impossible to answer the question of which data are reliable and which are not (Hammersley, 2008). In this sense, repeatedly collating data with information from other sources is a never-ending procedure.

In terms of the problems of triangulation and research accuracy, it is pointed out that it is not easy, and sometimes impossible, to achieve a broader perspective than in the case of using one research method. The collection of data from various sources does not yet mean that a more comprehensive picture of reality will be obtained (Hammersley, Atkinson, 1995). Even in the case of data consistency from different methods, it cannot be definitively certain that all datasets of data are not erroneous. Triangulation is not about verifying the quality of the empirical material from various sources, but about determining which conclusions drawn from these data are accurate. As a result, the desire to create general universal truths should be limited, adopting different perspectives and points of reference for the created knowledge (Silverman, 2009). Triangulation is also not favoured by the fact that when using different methods embedded in different epistemological approaches, researchers use different systems of concepts and categories that are difficult to reduce to a common denominator (Hammersley, 2008).

Due to the use of various methodological approaches in the project, two basic functions can be fulfilled, which can be described as controlling and synergistic. The control function allows verifying the knowledge gathered in one research procedure with data collected in a separate research procedure. Regarding the critique of the possibility of verifying the accuracy and reliability of data presented above, it should be stated that this verification may partially take place and that it is not the main task of social research. Certainly, there are examples of situations in which a control function can be successfully implemented:

- Finding discrepancies between the results collected in the positivist and interpretative research (e.g., the results of observations are inconsistent with the declarations of the survey respondents) does not have to mean the elimination of data – the statement which data is incorrect is risky and may be biased; it may, however, lead to decisions on further research to identify sources of data discrepancies and make the correct interpretation.
- Each dichotomy of data from different research methods prompts the researcher to ask additional questions, verify the process of obtaining data, and seek explanations as to how the respondents answered.
- Confronting the research results of various research methods may favour the assessment of the possibilities and limitations of these methods. However, conclusions should be drawn in the long term, based on the analysis of many completed research projects, as the conclusions of single studies may be misleading.

In the third methodological path, apart from the control function, the synergistic function is important. It consists of broadening the research horizon and enriching knowledge. Knowledge built based on the integration of methodological approaches goes beyond the knowledge acquired in only one research procedure. Knowledge integration skills are important to build a coherent and extended picture of reality.

There are different levels and scopes of data integration in the third methodological path. The mixed methodology most often involves combining procedures at the design stage and during the processing of results. The research subjects (researchers) and objects could be integrated. Despite the diverse nomenclature, the presented approach means joining the methodology of qualitative research with quantitative research at different levels. Understood in this way, the methodology is an alternative for research conducted according to the assumptions of one methodological approach: positivism or interpretation-ism. However, when considering the problem of data integration, one should look through the prism of integration in research of various philosophies, orientations, and values.

Data integration under the third methodological path is based on The Transformative Paradigm of Research, covering ontological, epistemological, methodological, and axiological assumptions (Mertens, 2007). The levels of integration include various philosophical and methodological orientations and methods, which has been called mixed method research integration trilogy (Greene, 2015; Fetters, Molina-Azorin, 2017). Within the triad, there is an integration of philosophy, theory, and various aspects related to the re-search procedure, including sample selection, and the integration of researchers. Considering the subject of this paper, it is worth focusing on two dimensions of integration, which are data collection and data analysis. Data from different research procedures are integrated using different integration strategies of data collection, e.g., comparing, matching, diffracting, expanding, constructing a case, connecting, building, generating, and validating a model, or embedding, and data analysis, e.g. qualitative to quantitative data transformation, quantitative to qualitative data transformation, creating joint displays, social network analysis, qualitative comparative

analysis, repertory grid/other scale development techniques, geographic information systems mapping techniques, and iterative and longitudinal queries of the data (Fetters, Molina-Azorin, 2017).

According to Molina-Azorin (2016), two key factors facilitate the determination of the type of mixed methods design that is best suited to their study: priority and implementation of data collection. As far as priority is concerned, the mixed methods researcher can give equal priority to both quantitative and qualitative parts, emphasize qualitative more, or emphasize quantitative more. The options consist of gathering the information at the same time (concurrent design) or introducing the information in phases (sequential design). Teddlie and Tashakkori (2009) have presented the Qualitative – Mixed Method – Quantitative Continuum depicting priority of data collection. They distinguished two separate, independent poles corresponding to qualitative or quantitative research. They also presented the sphere of integration of approaches on the continuum. It comes in three versions:

- primarily qualitative research with some quantitative components,
- fully integrated mixed method research,
- primarily quantitative research with some qualitative components.

Creswell (2003) has distinguished three forms of mixed method design implementation referring to data collection:

- phase designs in which qualitative and quantitative methods are applied separately, one after the other. Order is not important in this kind of integration. Such designs can include two or more phases;
- dominant/less-dominant design, which is mainly committed to one of the approaches and uses the other only marginally;
- mixed methodology designs, which link the two approaches in all phases of the research process.

Leech and Onwuegbuzie (2009) have distinguished three dimensions of mixed methods research designs:

- mixing dimension, which explains the degree of integration (partially mixed methods or fully mixed methods),
- time dimension (concurrent or sequential),
- emphasis dimension (equal status or dominant status).

Combining these variables gives eight integration solutions, from partially mixed concurrent equal status designs up to fully mixed sequential dominant status designs.

Regardless of the terminology used by the above-mentioned authors, combining methodological approaches consists of planning to spread integrated research over time, which gives the possibility of simultaneous or sequential research and the degree of linking the methodological paths, from small to full integration. The time and scope of integration depend on research funding and research issues, but also on the researchers' approach to integration.

The dominance of approaches is very often a derivative of the re-researcher's experiences and preferences. Table 1 presents the main types of integration strategies, which summarizes the considerations.

Table 1.
Major mixed methods design types

Design type	Variants	Timing	Weighting	Mixing	Notation ¹
Concurrent	Convergence	Concurrent: quantitative and qualitative at the same time	Usually equal	Merging of data during interpretation and analysis	QUAN + QUAL
Embedded	Embedded experimental Embedded correlation	Concurrent or sequential	Unequal	Embedded one type of data within the larger design using the other type of data	QUAN (qual) or QUAL (quan)
Explanatory	Follow-up explanations	Sequential: quantitative followed by qualitative	Usually quantitative	Connect the data between the two phases	QUAN → qual
Exploratory	Instrument development Taxonomy	Sequential: qualitative followed by quantitative	Usually qualitative	Connect the data between the two phases	QUAL → quan

¹ Legend:

QUAL - qualitative research

QUAN - quantitative research

→ sequential test procedure

+ parallel research procedure

QUAL / qual - the importance of research: uppercase letters indicate dominant approach, lowercase letters - complementary approach

Source: based on (Creswell, Plano Clark, 2007; Harrison, Reilly, 2011).

When considering the time and depth of integration, most integration models use sequential procedures as well as limited scope of integration. Typically, there is one dominant approach, the other being complementary. This applies to all situations in Table 1, except for the named converged integration. Convergent integration distinguishes between the unification type, which aims to reduce the quantitative and qualitative data to a "common denominator" to enable their interpretation, and the transformative type, in which the qualitative data are transformed into quantitative data to allow the application of statistical analysis.

The embedded research design has two types of integration: experimental and correlation. The experimental type concerns research using the experimental or quasi-experimental methods belonging to the quantitative methodological attitude. These studies are supplemented with qualitative studies at various stages of the process: at the time of designing the first measurement (pre-test), after the second measurement (post-test), or during the experiment. The goals of supporting experimental research by qualitative research can be different: helping in the construction of a measurement questionnaire, explaining the answers, or explaining the behavior of the respondents during the operation of the experimental stimulus. Embedded correlation is the use of qualitative data in the process of explaining explanatory variables in quantitative research or interpreting the results. In exploratory model, quantitative research is carried out first, scientists first collect and analyze quantitative data, and then, based on research

result, qualitative research is conducted to provide a better understanding of the quantitative results. Building can involve using quantitative data to select cases or identifying questions that require further research in the qualitative phase. In the exploratory model, the instrument development variant has the following sequence of activities: qualitative research is conducted to create research categories and to create research tools for quantitative research. The taxonomic type is that conducting qualitative research based on quantitative research aimed at verifying the theoretical model, searching for variables that classify specific categories.

3. Data completion and verification – empirical insight

The empirical exemplification of data completion and verification issues has been presented in two parts. The first one presents selected research projects showing major mixed methods design types, described in Table 1. The projects were selected from those that were used in methodological integration analyses by Harrison and Reilly (2011) and Chlipała (2018). The selected projects illustrate well the different ways of combining methodological approaches. The second part presents original research projects that illustrate the completion and verification of the data. Research experience in the field of methodological integration allows us to formulate conclusions about the possibilities and limitations of integrating methodological approaches in social research and indicate future areas of research.

3.1. Essence, levels, and scope of data integration in the third methodological path

Figures 1 and 2 present models of convergent integration of market research methods. Both examples illustrate the relationship between quantitative and qualitative research. Due to the separateness of both types of tests, both test procedures were performed separately. Integration took place at the stage of compiling the knowledge obtained from both methodological approaches. There is an apparent contradiction in the nomenclature of the model of both research projects, which requires explanation. Both research projects were classified as convergent. In such a model of integration, it is assumed that the research approaches used have an equivalent status. The description shows that in the first example of convergent integration, the qualitative approach was dominant, and in the second - the quantitative one. Indeed, in each of these projects it is possible to indicate the dominant research orientation, but the structure of the research and the way of combining data correspond best with the convergent model. Based on the descriptions of the research methodology, it can also be concluded that both research procedures (positivistic and interpretative) were carried out in accordance with the assumptions of a given methodology. In terms of research assumptions and the manner of conducting research, both paths were treated equal.

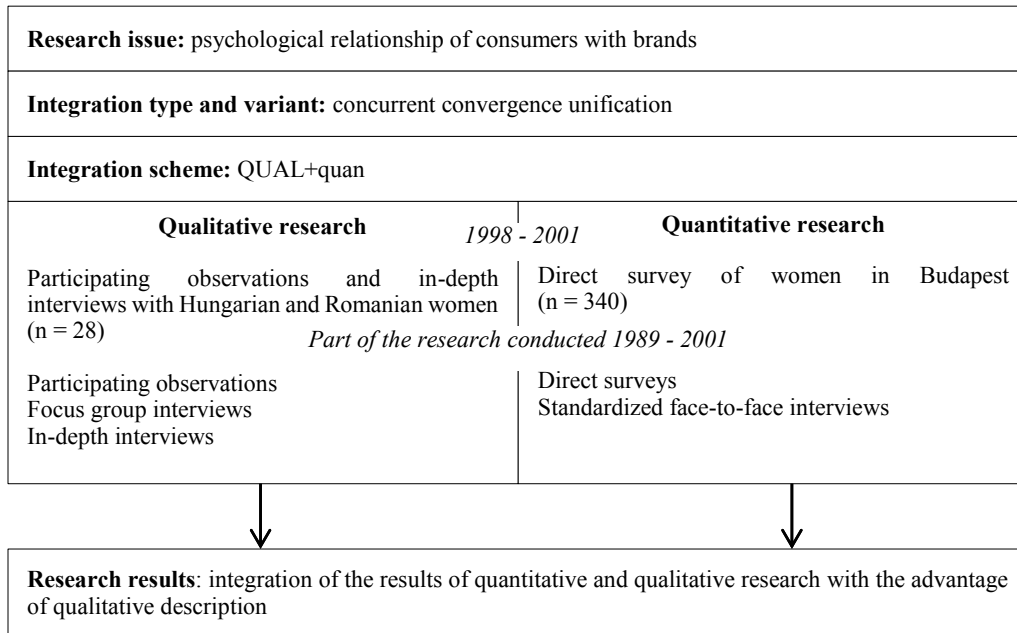


Figure 1. Methodological integration – an example of convergence unification model.

Source: based on (Coulter et al., 2003).

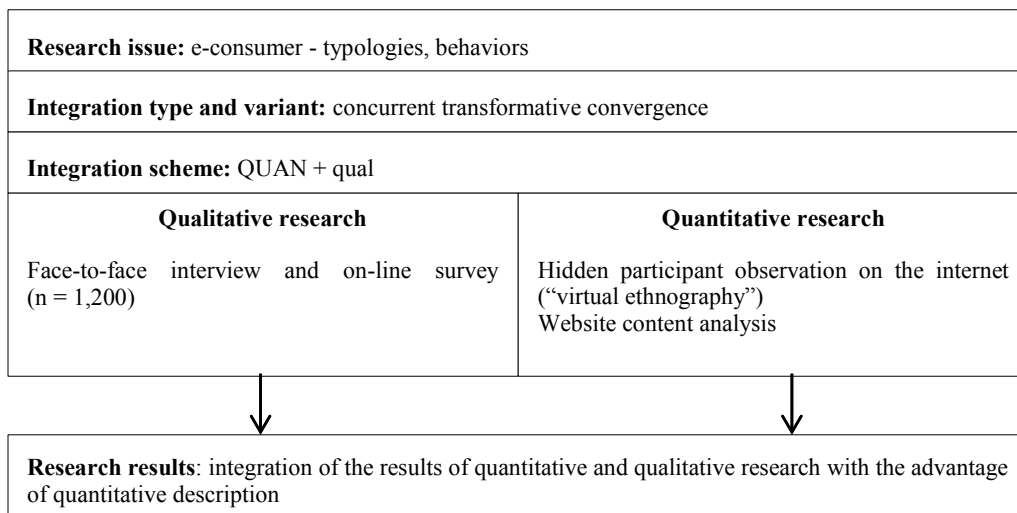


Figure 2. Methodological integration – an example of convergence transformative model

Source: based on (Jaciow, 2011).

In the studies by Coulter et al. (2003) the interpretative approach was dominant. Throughout the project, the qualitative research consumed more time and cost. The research adopted the concept of the consumer as an interpreter of reality, it was recognized that his personal history, environment, undertaken life activities and lifestyle determine the way he assesses reality. This concept is characteristic of interpretive research. Transformative convergence integration was used in the study of e-consumer behavior (Jaciow, Wolny, 2011). The data collected in ethnographic research have been recorded in a form that allows for their statistical analysis and presentation with the dominant features of a description characteristic of research carried out in the positivist trend. It is worth emphasizing once again that the occurrence of the dominant approach in the examples discussed is a derivative of the adopted research assumptions and the

methodological orientation of researchers. The research procedure using two different methodological paths in both cases (Figures 1 and 2) makes it possible to characterize the research results in a completely equivalent manner.

Figures 3 and 4 show embedded integration models. The first example was based on the sequential test procedure, the second was a parallel test. In both, the dominance of the positivist approach can be indicated. In the study by Dahl and Moreau (2007), in-depth interviews were performed in the first stage, and experiments in the next two. Due to the sequencing of subsequent studies within the framework of the discussed project, this research scheme can be compared to integrated exploratory studies, however, some differences resulted in a different assignment. Firstly, due to the way of interpreting empirical material and drawing conclusions, qualitative research was subordinated to quantitative. Secondly, despite the sequence, the relationships of quantitative research in the construction of research tools are limited (that is why the arrows in Figure 3 are drawn with a broken line). This relationship manifested itself in the formulation of some research hypotheses. Qualitative research was used to find out about the motives of consumer behavior purchasing goods and services that require creation from consumers (artistic, hobby products, etc.), which were confronted with the results of experimental research, seeking to draw general conclusions about consumer attitudes, behaviors and preferences in terms of the autonomy of creation.

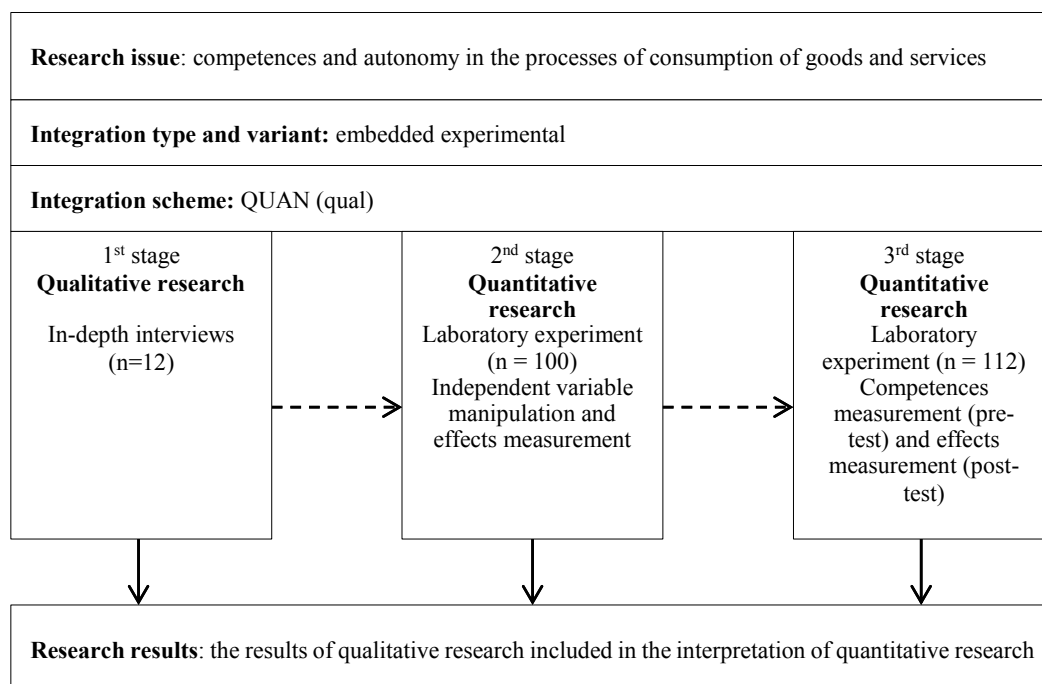


Figure 3. Methodological integration – an example of embedded experimental model.

Source: based on (Jaciow, 2011).

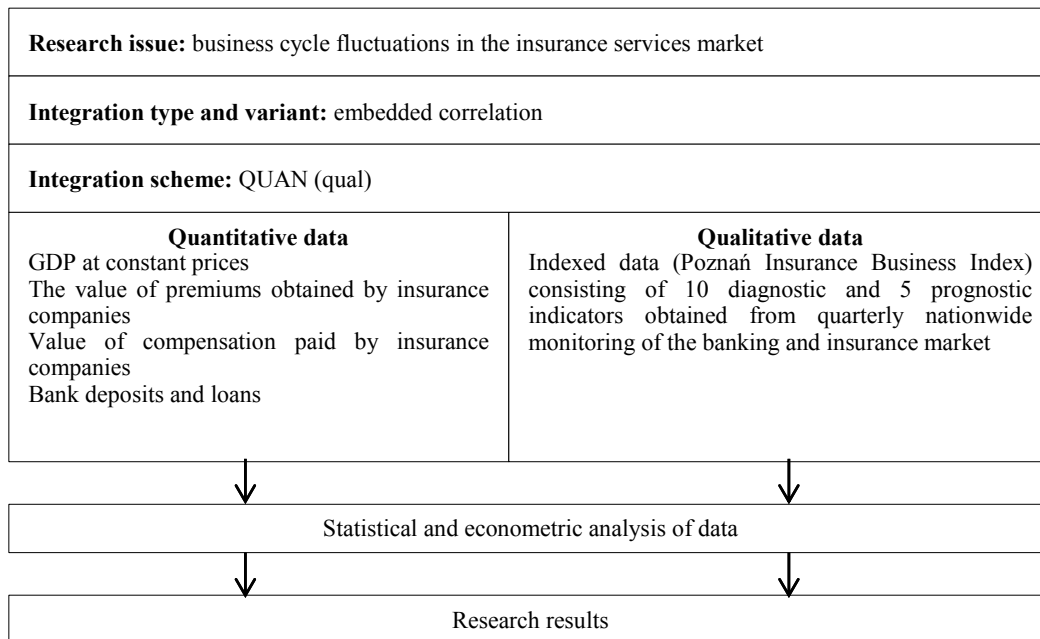


Figure 4. Methodological integration – an example of the embedded correlation model.

Source: based on (Garczarczyk, Mocek, 2014).

Figure 4 illustrates a parallel immersion model of methodological integration. Garczarczyk and Mocek (2014) applied the methodology of researching business fluctuations in the banking and insurance services market. Methodological integration takes place by linking various sources in a research project. The qualitative data were processed in such a way as to be able to subject them to statistical and econometric analysis together with the quantitative data. Thus, qualitative data are used to diagnose and forecast economic phenomena. In this way, they were included in the current analysis and interpretation characteristic of positivist research.

Figure 5 shows an example of sequential explanatory studies. In the research by Hewett et al. (2006) on the relationship between national culture and the quality and strength of relations on the industrial goods market, in the first stage of the project, questionnaire studies were carried out using the survey method or face-to-face interview, and then in the second stage individual in-depth interviews were conducted. The research was dominated by a positivist approach, and this dominance was manifested in the approach to the research material. The authors' task was not to create local knowledge, they did not carry out in-depth studies of anthropological problems, the material from in-depth interviews was used to better understand or explain the conclusions of the survey study, therefore, the type of integration used was defined as follow-up explanations. For example, in these studies, the data presenting the verification of the hypotheses regarding the dependence of the durability of the relationship on organizational culture were supplemented with statements from managers from Latin America and the United States. This integration was a way of confirming the validity of the categorization made by the authors in previous quantitative studies.

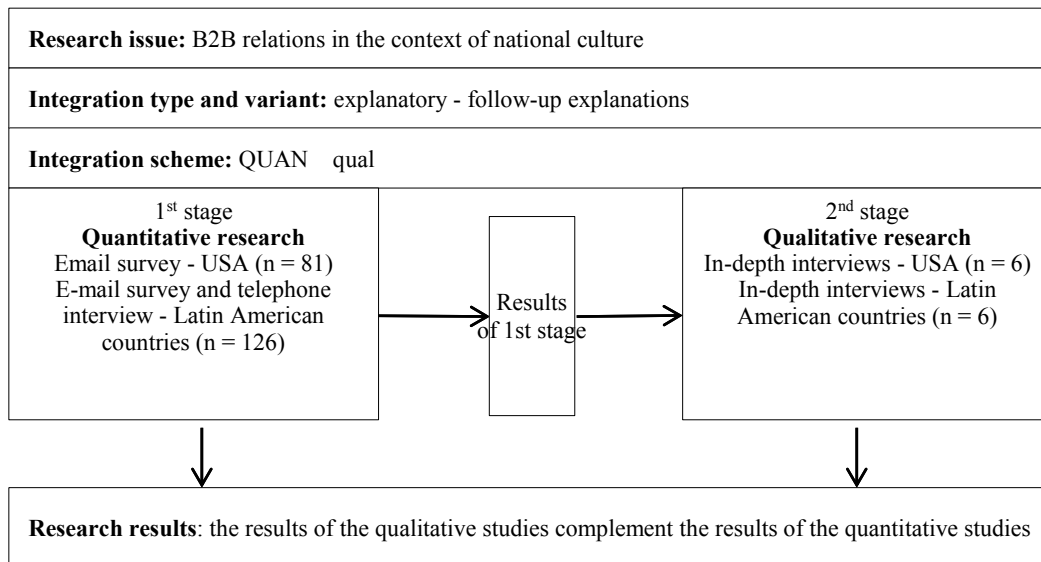


Figure 5. Methodological integration – an example of follow up explanations model.

Source: based on (Hewett et al., 2006).

Figures 6 and 7 show two interesting exploratory research designs. In a study by Walsh & Beatty (2007) on the identification and operationalization of the components of service company reputation, qualitative research was used to develop research tools for further quantitative research. In the first stage of the research, survey methods with open questions were used to identify as many features of the problem as possible. Then the material was analyzed and evaluated by experts. The qualitative material was used to build the survey questionnaire, which was tested in further stages of the research. In the studies by Gorbaniuk et al. (2014) on the shaping of consumers' perceptions of themselves under the influence of brand purchases, qualitative research identified the components of the categories under research for later use in quantitative research. In the first and second stages of the research, an identical research method and technique were used, which was a direct interview. However, it differed significantly in the degree of structuring.

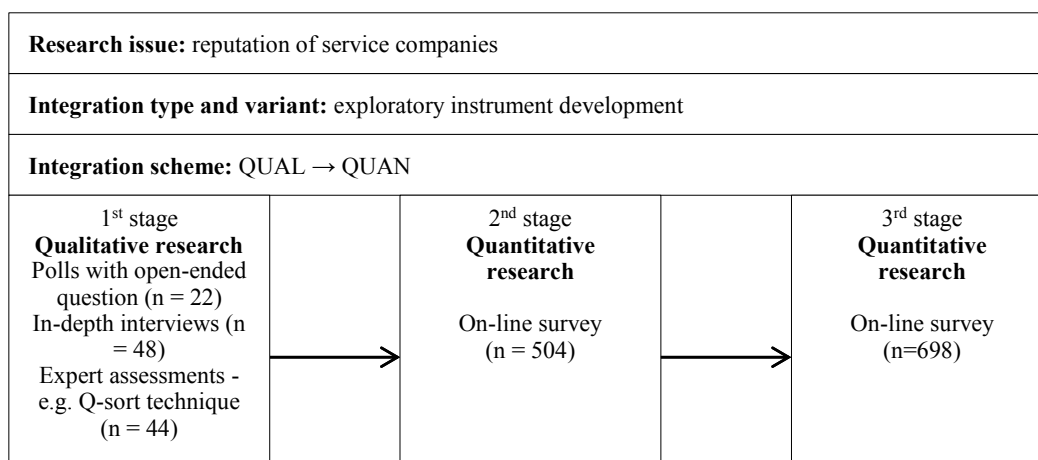


Figure 6. Methodological integration – an example of exploratory instrument development model.

Source: based on (Walsh, Beatty, 2007).

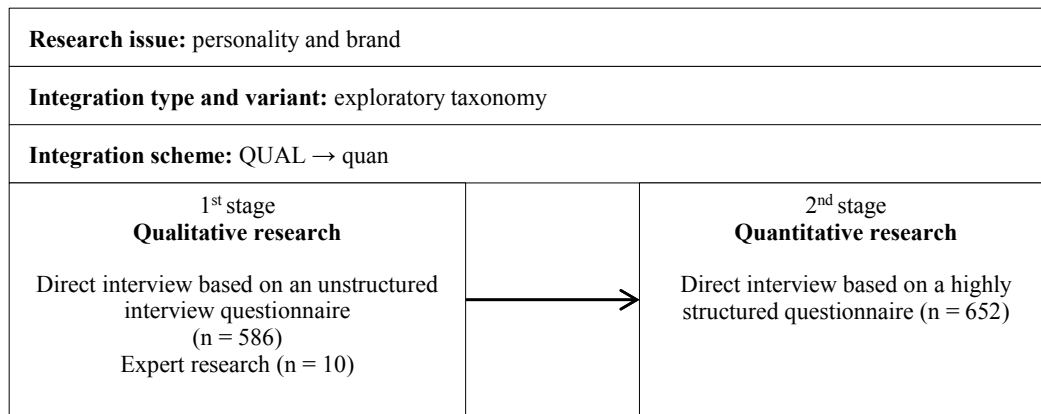


Figure 7. Methodological integration – an example of exploratory taxonomy model.

Source: based on (Gorbaniuk et al., 2014).

3.2. Data integration in the light of own research experience

Mixed methods issues are the subject of this paper authors' experience. Below is a description of the methodology of four proprietary research projects implemented in convergent, embedded, and explanatory models. Each of the descriptions presents a range of data integration. Two initial examples of parallel research with two independent methods are presented below. The data obtained with the use of various methods can be complementary and allow for a more complete picture of the reality under study. Integration takes place at the stage of combining the results. It should be noted that research paths lead to different data that can hardly be reduced to a common denominator. The data obtained by both methods describe the reality from completely different perspectives.

The first example of the use of various methodological approaches is a research project conducted by Czubała, Wiktor, Chlipała, Jonas, Smoleń, and Żbikowska (Wiktor, Chlipała, 2012). The authors analyzed the marketing strategies of Polish companies on international markets. The research was aimed at achieving cognitive, methodological and application objectives. In the cognitive context, an attempt was made to identify and assess the marketing strategies implemented by Polish exporters on international markets. Regarding methodology, the research objectives included the identification of methods for analysing marketing strategies in international markets, as well as a proposal for the methodology of research on marketing strategies of exporting companies. Studies indicate the absence of a multi-aspect and multidimensional methodological approach to the analysis of corporate international marketing strategies. Therefore, the authors suggested a different approach that combines two independent procedures based on positivist and interpretive research. The results of the research that allowed identifying the success factors in the process of implementing international marketing strategies and indicating possible areas for improvement had also the application purpose. This is because they have allowed the management of exporting companies to confront their international marketing strategies with the research in question.

Cont. table 2.

Sources of competitive advantage on international markets – an example of a thick description
<p>The presidents and executives of companies A, B, C, and D are proud of their offerings. “I’ve never tasted such delicious, pickled cucumbers”, says the president of company A, referring to an opinion expressed by one of their Russian clients. This is truly the best reference. The quality of the company’s processed fruit and vegetable products is confirmed by traditional recipes, high quality materials, and pre-selected natural aroma spices. The labels placed on the products shipped to France stress their Polish origin. The president claims that the Polish origin of goods is a source of competitive advantage in the fruit and vegetable processing industry. Company D, on the other hand, which operates on the market of household goods, does not stress the Polish origin of its products. Our interviewee stresses that “it matters more to Russian customers that a given product is manufactured in the EU, in the West”. The company’s president, who has spent several years in Russia and still travels there in connection with the currently developed sales network, makes the following statement: “Many prospective clients in Russia do not have any association with Poland as a country”. The offering of company D is a technical device, and in this context, the Polish origin of the goods is not considered one of the company’s strengths. The company name is often associated with German origin and, consequently, its products with German ‘reliability and accuracy’ (the company does not make any official statements). Regarding quality, the equipment of company D is reliable and durable. It gives the company an edge on the Russian and Ukrainian markets. If the products break down, they are promptly repaired.</p> <p>The quality of company B’s offering, wooden board games, is based on solid materials and good workmanship. A significant role is played by the type of wood and the drying and polishing processes. Good workmanship places these products among upper-market goods as compared with plastics and inferior competitive products (e.g. from China), but they do not match products manufactured in India. It is the raw materials, not the production process, that matter the most. Hard, nicely painted wood such as rosewood, commonly used in India for the manufacture of chessboards, does not require impregnation or painting. Company B’s “figures” are painted, but it is an advantage from the point of view of customization. Black, brown, or white (cream) sets are earmarked for the Polish and Russian markets, while the French market prefers the blue and navy-blue colours.</p> <p>Company C manufactures traditional and natural products without preservatives, which is significant in the case of foodstuffs. In addition, they have lower prices than similar products offered on western European markets. No one should be ashamed of high quality and reasonably priced products. They can target middle-class customers. Currently, as our interviewee stressed, the company’s main challenge is distribution and promotion. The products have the appropriate characteristics to be accepted in foreign markets.</p>

Note. Company A. The core activity – fruit and vegetable processing. The company has 120 employees (seasonally up to 200). About 70% of the company’s turnover is generated by export activities. The company operates in European markets, in Canada and the United States.

Company B. The company offers wooden board games to individual and institutional clients. The company is a family business with more than 100 employees; it operates its production facility which prepares raw materials and manufactures ready products. Most of the broad assortment of goods are destined for overseas markets, especially the Russian market.

Company C. The company’s offering includes fruit and vegetable processed products, tinctures as well as bread and cold cuts. The company has been operating on the Polish market for several years, creating a recognisable brand. In the last two years, the company has made its first attempts to go international, and it has great expectations related to pursuing this policy in the future.

Company D. The company manufactures household goods. It has nearly 2,000 employees. Almost half of the company’s sales volume is generated by export activities. The company has a well-established position in the Polish market and for the past few years, it has recorded a rapid increase in sales in overseas markets, especially in the CEE countries.

Source: based on (Wiktor, Chlipała, 2012; Żbikowska, 2012).

The data obtained as part of the positivist path was supplemented with data obtained during interpretative research. According to the example presented in Table 3, the distribution of answers to the questions about the competitive advantages of enterprises is enriched with the description of possible motives and reasons for gaining such and not another competitive advantage. This allows for a more complete knowledge of the marketing strategies of enterprises in international markets.

In the next example of convergent integration, Chlipała (2011) analyzed the process of creating value for the customer in the tourism services market. The research was conducted based on two independent methodological approaches: positivistic and interpretive. Research conducted with the use of both methodological paths was carried out on two samples: customers and companies (Figure 9).

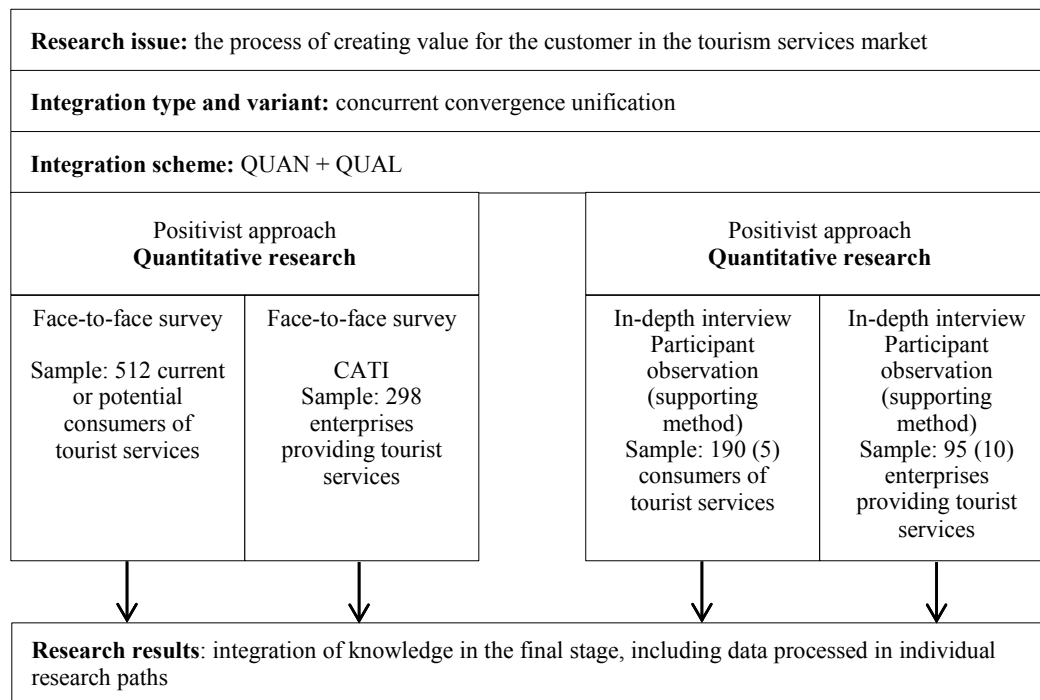


Figure 9. Methodology of analyzing value creation for the customer using the concurrent convergence integration model.

Source: based on (Chlipała, 2011).

Table 3 presents samples of the research results conducted with the use of the concurrent convergence integration model.

Table 3.

Data completion by integration of positivist and interpretive approaches on the example of research on value creation for the customer in the tourism service market

Benefits for the consumer resulting from the use of a tourist trip - sample conclusions from positivist research
<p>According to consumers, the most important benefits of tourist trips were as follows:</p> <ul style="list-style-type: none"> – the opportunity to meet new places, people, and culture – 70.8% of responses, – “Peace of mind” - detachment, carefree, relaxation – 52.1%, – being with people you love – 43.2% – the possibility of improving your physical condition and health – 34.6% – being an explorer – 26.8%.

Cont. table 3.

Buyer needs as the basis for differentiating the value for the consumer - an example of a thick description
<p>The instructor working in the holiday center divided the clients into two groups: “fitness” and “slimming”. People in the first group are athletic, active, live in harmony with nature, enjoy hiking in the mountains, are not so restrictive as to their diet, for example, they allow themselves to eat a delicious apple pie at the shelter, as a reward for the effort to reach the destination of the trip. Losing weight aims to lose weight. They want to achieve the desired effect at all costs, but they do not enjoy increased physical activity. Movement is only a way for them to lose unnecessary kilograms.</p> <p>Zuzanna can be included in the “condition” group. You can see it at first glance. This is evidenced by the silhouette - simple and shapely; gait and movements - spring and vigorous, good physical condition. When we climb the steepest slope, we don't change the pace, I struggle to keep pace and most of the group is left behind. Maybe she wants to show off a bit, but she is in good physical and mental shape. She jokes a lot; you can see that she feels good surrounded by mountains and forests. She devoted many days off from work to hiking in the mountains, taking, as she declares, great pleasure from it.</p> <p>Adrian represents the group of ‘slimming’ people. He is a law student at Jagiellonian University, spent a year mainly studying, and, as he admits, “I neglected to concentrate solely on learning”. He has a lot of determination. He can climb the slope with great difficulty, he often rests, stresses that he does not like this type of activity. He says: “If it weren't for my overweight problem, I would have gone elsewhere”. Where? “To Zakopane, but I wouldn't lose weight there”.</p>

Source: based on (Chlipała, 2011).

The embedded model is a valuable way to integrate methodology pathways into research. Quantitative research can supplement and explain the conclusions of qualitative research. Figure 10 presents the description of own research with the use of this integration. The research was methodical and its goal was to identify the possibilities and limitations of the implementation of "online" and "offline" in-depth interviews for both the interviewees and the interviewer.

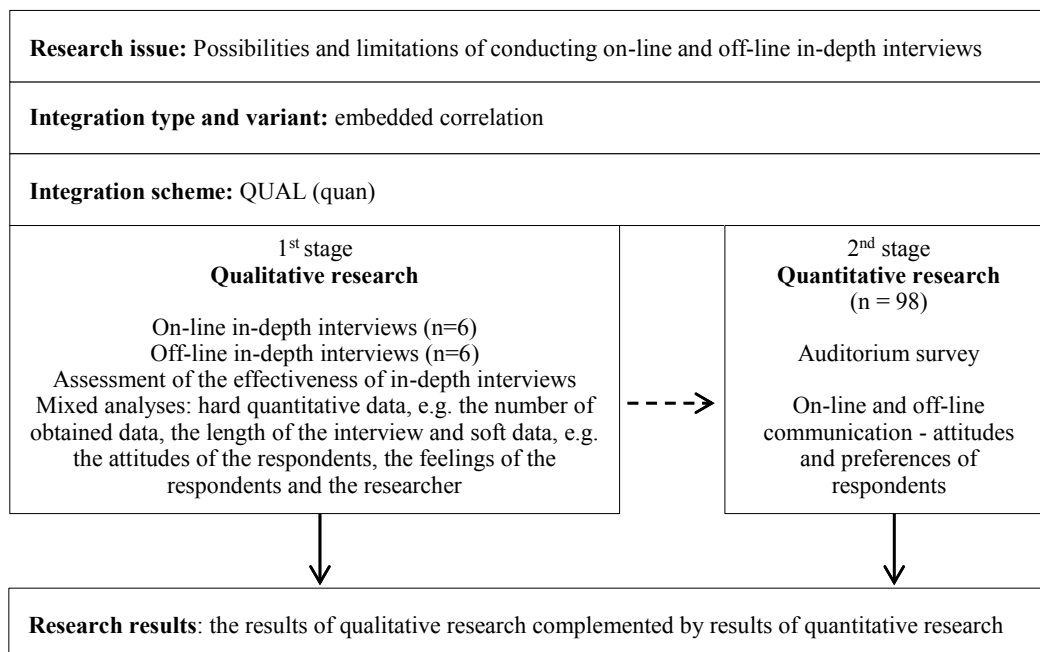


Figure 10. Methodology of studying possibilities and limitations of conducting online and off-line in-depth interviews using the embedded correlation integration model.

Source: based on (Chlipała, 2020).

The development of technology makes it possible to carry out in-depth interviews with the use of communication technologies based on VOIP (Voice-Over Internet Protocol). Today, at the beginning of the twenty-first century, in-depth interview „face-to-face” is not a complete substitute for in-depth interview using the VOIP protocol. Decisions about the form of conducting an interview directly or on the Internet should be treated not so much as a dichotomous choice, but rather as a supplement to one way of talking to the respondents, to another. Combining "online" with "offline" was presented by Sade-Beck (2004) as a way to reach a wider group of respondents and build more complete results of in-depth qualitative studies. Leander and McKim (2003) posed the problem of whether it is correct to distinguish the Internet space from other spaces in which the respondent functions in social research. Virtual reality becomes an integral part of modern human life. Qualitative research in the "online" and "offline" versions has numerous advantages and disadvantages; it is important to pay attention to the human factor when choosing the method of conducting in-depth interviews. Conversation via communicator using the VOIP protocol is a natural environment for people who have skills in the use of equipment, positive experiences in conducting this type of conversation, and a positive attitude towards Internet communication. Many people cannot use technology efficiently. Also, among people who have such skills, many people do not like this form of communication. Thus, the predispositions and preferences of the interviewees should determine the choice of the interview form.

To determine the way of assessing the effectiveness of in-depth interviews in real and virtual space, research was designed. For empirical verification, in November and December 2019, 12 in-depth interviews were organized and conducted with 6 people. Each person was interviewed twice, one interview was conducted during a face-to-face meeting, the other via Skype. Each interview lasted 25 to 45 minutes. The interviews were conducted with students of the University of Economics in Krakow. The topics of the talks were the issues of the functioning of the individual in the times of consumerism, and the talks were inspired by the issues of the consumerist society in the times of "liquid life" and "liquid modernity", characterized by the postmodernist Bauman (2000; 2005; 2007). At the end of each second interview, both interviews were discussed and compared with each other. The interlocutor was asked to rate and explain his answers. The results of the interviews became an inspiration for designing questionnaires in which the preferences of potential respondents were implemented regarding the form of interviewing, in a virtual environment or under natural conditions. The research was carried out in January 2020 with 98 students. The results of the quantitative research embodied in the qualitative research are presented in Table 4. Considering the problem of the effectiveness of the in-depth interview, it can be concluded that it is determined by the scope and quality of the empirical material collected. This material should answer the research questions posed. The quality of the collected material is therefore very difficult to assess, it can only be done on the basis of the researcher's knowledge, experience, and intuition. Such an assessment will always be subjective. Certainly, however, the scope and depth of the material

are determined by the freedom of communication and the degree of the respondent's openness to the issues under consideration. These two parameters became the basis for the evaluation of real and virtual interviews.

Table 4.

Quantitative data embedded in the qualitative data on the example of a study of possibilities and limitations of conducting online and off-line in-depth interviews

Conducting online and off-line in-depth interviews – interviewees and interviewer perspective
<p>When organizing the first research project, it was assumed that two in-depth interviews would be conducted with each respondent: during a face-to-face meeting and via an Internet messenger. This was not a condition, but all face-to-face interviews took place first. Certainly, such a sequence may influence the assessment of the interviews. In a broader study of the issues discussed, it should be ensured that some of the interviews be conducted in reverse order. Face-to-face meetings were held in a room where the conversation could be conducted freely and uninterrupted. In two cases, the conversation was conducted over coffee (the other participants did not take advantage of the offer), which was conducive to a good atmosphere of dialogue. In general, face-to-face interviews were shorter, but it should be noted that in addition to the content, the form was also discussed for a few minutes during the second interview. During the interviews in the Internet version, photos were sent to the respondents with a request for their interpretation. The photos can also be shown during the interviews "face to face", but in the Internet version, it seemed natural, somehow fitting into the interview. It should be noted that the interviews via Skype were conducted in two versions: with the use of the audio function, or also with video. In one case, the use of the camera was disturbed by technical problems - a too weak Internet connection of the interviewee. The choice of audio or audio-video communication during an in-depth interview, as can be seen in light of personal experience, has large consequences. The use of video options can sometimes interfere with the verbal communication process due to technical distortions. A purely verbal message makes it impossible to observe the subject but allows one to focus more on the content of the message. Much also depends on the preferences of the respondents. For Zuzanna and Maksymilian, as well as for Mikolaj, declaratively, the camera was not a problem. Agata and Józef pointed out that they would rather focus on the content of the interview than worry about how they appear, what they look like in front of the camera. A face-to-face meeting does not pose such a dilemma for them. It is probably related to the fact that in social media people build their image not necessarily consistent with their identity, which penetrates the general consciousness and leaves a mark on it. The evaluation of individual interviews by the teacher was determined by freedom of communication and degree of openness, which influenced the scope of the collected research material. These assessments can be confronted with the feelings of the respondents. They are in line with the interviewer's assessments. In four cases, the direct interview was rated higher than the indirect interview. In two cases it was the other way around. The results on the preferences regarding the form of the interview were a surprise to the author of the text and an inspiration to research a wider audience.</p> <p>98 students, 73 women, and 36 men were examined. A survey of CUE's students showed that young people do not necessarily prefer indirect communication, and the virtual world is not their dominant environment. The claim that the virtual world is closer to them than the real one cannot be completely rejected. The responses show that the respondents long for natural, direct communication. Most of the respondents would prefer to conduct an in-depth interview directly, not through the Internet. It should be noted that the research was carried out before the Covid-19 pandemic, direct contact restrictions did not affect the responses.</p>

Source: based on (Chlipała, 2020).

The main objective of the research was to identify changes in consumer behavior related to the consumption cycle (purchase, use, disposal of products) as a result of the epidemiological and socioeconomic crisis caused by the Covid 19 pandemic. The aim of the research was a derivative of the research problem expressed by the question: whether and how did consumer behavior change during the pandemic in the context of various variables: gender, age, income, changes in material and professional status.

The positivist research included an analysis of secondary sources of information (literature review on the subject, reports of research agencies, and the Central Statistical Office on consumer behavior during the Covid-19 pandemic) and an online survey. The analysis made it possible to gain knowledge about the distribution of attitudes, preferences, and behaviors of households and individual entities in terms of the scale and direction of changes in consumption. Interpretative research constituted the second stage of the study. Its purpose was to verify, supplement and explain consumer behavior, the situation of their households, professional situation, lifestyle, education, and most of all attitudes towards Covid-19 and personal experiences with the disease caused by the virus. In-depth interviews were conducted.

Research on changes in consumer behavior in light of the Covid-19 pandemic was conducted sequentially. The results of the first stage of the research, based on the assumptions of the positivist approach, were the starting point for qualitative research.

Research problems were set to supplement, explain, or confront the data obtained in qualitative research through the results of quantitative research. The research procedure is presented in Figure 11. The method of data completion and verification is presented in Table 5.

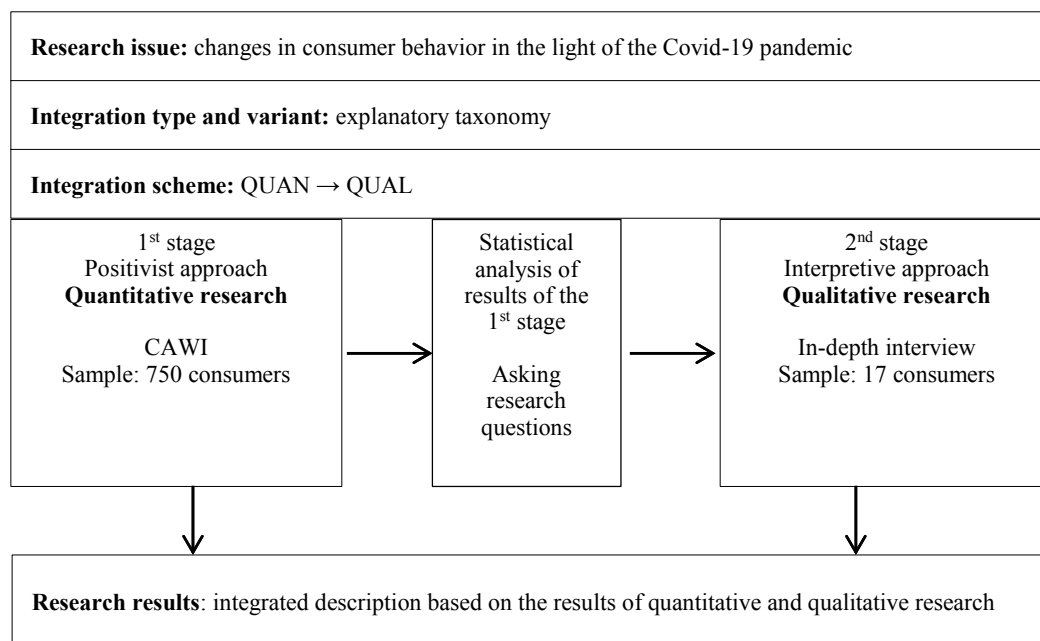


Figure 11. Methodology of analysing changes in consumer behavior during the Covid-19 pandemic – explanatory taxonomy model of integration.

Source: own research.

Table 5.

Data completion and verification by integration of positivist and interpretive approaches on the example of research on consumer behavior during the Covid-19 pandemic

Results of the 1st stage of research – examples of quantitative research results	
The respondents indicated whether they are thinking more about purchasing goods during the pandemic. Nearly 72% of consumers agreed that during the pandemic they wondered about the problem of overpurchasing and consuming goods (percentages of responses 'definitely yes' and 'probably yes'). More than 51% of consumers agreed that after the pandemic is over, they will buy fewer products than before the pandemic (percentages of answers 'definitely yes' and 'probably yes').	Significant changes in consumption occurred in a few assortment groups. Only in two product categories - clothing and footwear - consumers significantly reduced their purchases (62% and 57% of respondents, respectively). During the pandemic, the respondents did not significantly change the number of purchased products such as bread, cereals, and pasta, preserves and canned food, frozen food, meat and sausages, dairy products, fruits and vegetables, water and drinks, personal hygiene products and cleaning products.
Examples of research questions inspired by the results of the 1st stage of research	
What conclusions have consumers drawn when considering consumption during the pandemic? What are the reasons for changing consumer habits?	Is such a structure of expenditure and consumption a rule? What are the manifestations of cognitive consumer responses and affective consumer responses during the pandemic?
Source: based on (Chlipała, 2020).	
<p>With the Covid-19 pandemic, the pace of life and the way consumers function have changed. Free time, breaking out of the daily routine caused reflection on the scale and manner of consumption. The need to give up habits has contributed to changes in consumer behavior, which is confirmed in the following descriptions.</p> <p>Weronika, a marketing student, who works professionally, said: I sleep more now, earlier, before the pandemic, I slept 4 hours a day. Now I eat more regularly – it happened that I ate one meal during the day – I live calmer, more consciously, in greater harmony – I have fewer health problems, I could take care of myself in a pandemic. Weronika makes careful purchases to strive for harmony. - Will it stay that way? I will try, I don't know if I can fully hold on to it, but I will fight.</p> <p>Magda, mother of two daughters, 55 years old: In the pandemic, I went to the countryside - I spent 3 months with my daughter, it was a completely different life that I had not known - greater harmony, peace - we baked bread, ate healthily - based on vegetables. Please believe me that recently, after a dozen or so months, I bought meat - previously I did it 2 or 3 times a week. - Will you put these changes into practice? I don't think too much about it, but something has changed, certain habits have involuntarily entered my behavior.</p> <p>Karol, a 40-year-old sales representative: we bought Termomix – I fulfil myself in the kitchen, now, even when we can, we give up restaurants and bars, e.g. I prepare and bake pizzas myself –</p>	<p>When evaluating the behavior of Polish consumers in quantitative research, it was found that statistically there were no significant changes in consumption, apart from the categories indicated above. However, it should be noted that the changes are evolutionary rather than revolutionary. Also, there are many exceptions to the rule.</p> <p>A 50-year-old accountant says that in the first stage of the pandemic, the family panicked a little, bought more rice, pasta - a few packages. They cut consumption because it was not known what the future held. Until now, they cooked a packet of pasta and then threw away half of it because the pasta is too cheap. Now he only cooks half a packet. He restricted himself from buying 'stupid things'. "I go to the market and buy a lot of unnecessary things, such as chocolate". However, he does not spend less on shopping, because he increased the internet shopping. He bought many Wólczanka shirts because he dresses more classically due to his age. These shirts previously cost 200 PLN, and during the pandemic, they were available for 39 PLN. He probably doesn't need as many shirts as he bought. "Ultimately, consumption increased a little during the pandemic". There was a moment of slowdown at the beginning of the pandemic, but "you click, and there is free shipping from 300 PLN, so I choose one more thing".</p> <p>Anna, a 29-year-old secretary: I do not have to limit myself; my situation has not changed - I go to work, I am single, I consume as before. - Didn't you wonder if this consumption is needed on such a scale? Didn't you come to the conclusion in Covid times that we needed much less to live on? No, I am a young person - you must enjoy life, although I am not very wasteful at all.</p>

<p>previously we used ready-made products, now we eat healthier and better – no improvers, preservatives – I still bake the bread myself and I don't think I will get bored of it.</p> <p>Gabriela, 36-year-old customer advisor at the bank: I walked through the gallery, but it did not give me pleasure as before; after all, I don't need any of this. - How will it be when business meetings come back, will you have to have something new for each one, as before? - It is hard to say, but it may not be the norm that you need something new for an appointment. Maybe these popular trends: second life of clothes, second-hand shops, etc. will make most of us change our approach.</p> <p>Sebastian, 47 years old supplier: I use fewer shoes and clothes, but not as much, maybe 80% of what I used to do before. I don't work much less, but I had a lot of clothes in stock. Currently, when I have to buy something, I ask myself whether I need it and I often answer that because what I have is enough for me I don't.</p>	<p>Adam, 34-year-old customer advisor at the bank: at the beginning we withheld from many purchases, we did not know what it would be like with work, in March I did not buy shoes - I decided that I do not need that many - I bought at a discount in a few months.</p> <p>Damian, a 35-year-old gym owner, although he had not planned it before, bought a very large TV during the pandemic, because the current 32-inch TV was too small. TV viewing, especially in winter, was one of the important accompanying entertainments every day. He spends every evening with his girlfriend in front of the TV.</p>
--	--

Source: based on (Chlipała, 2020).

4. Research limitation, discussion, and conclusion

The presented paper is methodical. Data completion and verification inquiries in the third methodological path were carried out on the plane of considering methodological assumptions and the presentation of empirical projects. The data integration review is based on the achievements of Creswell & Plano Clark (2007) and Harrison & Reilly (2011). Each type of integration has been described using the procedures of various social studies conducted around the world. It was also based on original research, where the methodological description was deepened by illustrating the methods of data integration.

Based on four basic models of research integration: concurrent, embedded, explanatory, exploratory, has some advantages and limitations. It is a comprehensive proposal in terms of methodological integration, considering the purpose and scope of integration, research synchronization over time, and the dominance of methodological approaches. However, assigning a research project to one of the models is often difficult. For example, when a research procedure is classified as exploratory, it is difficult to assign one of the types: instrument development or taxonomy, because they interpenetrate. In this article, we searched for the dominant features for a given type of integration; this determined its classification. Hanson & Grimmer (2007) drew attention to the difficulties in unambiguous classification. The empirical part presents a review of projects that illustrate all types and variants of mixed methods,

but the review of the own research projects lacked exploratory integration, as none of the authors of this article has conducted this type of research yet.

The authors' own research experience allowed outlining the ways of data integration, both in parallel procedures of data collection, where quantitative research in the positivist trend and qualitative research in the interpretative trend were conducted separately and in sequential research, where quantitative research was first carried out, then the results were interpreted and designed, and qualitative research was carried out. The embedded approach was also illustrated, where quantitative data constituted a valuable extension and confirmation of conclusions obtained in qualitative research. In two of the four analysed projects, one of the research approaches was dominant, either positivist or interpretative, and in the other two, both research approaches were given equal status.

Parallel studies show that data integration is limited, reduced not so much to combining data, but to the results obtained on their basis. Although the methodological integration is not deep, this way of combining results from different research procedures is very valuable, as knowledge from different methodological approaches complements each other. The researcher may believe that the interpretative and positivist paradigms are so different that there is no possibility of their complete integration. According to Modell (2009), the connection of these paradigms is never complete; one must always opt for a methodology, which may be the cause of problems. For example, when conducting research dominated by assumptions embedded in positivism, one must give up presenting deep and multifaceted images of reality. These paradigms are compatible but always at the cost of a compromise.

In the last of the original research projects discussed, data integration was deeper and referred to the completion and verification of data from two methodological approaches. According to the authors, this method of integration produces the best outcomes. To successfully complete and verify the data, a sequential approach should be used. The conducted considerations allow outlining further areas of research. The authors will find it valuable to try to apply the types of integration that have not been implemented so far in the research. It would be worthwhile not to narrow the problem of data integration to the question of combining quantitative and qualitative data, but to try to integrate other methodological approaches, such as critical methodology. It is also worth focusing on integration within research approaches such as action research or grounded theory, where the assumptions themselves integrate research trends and approaches.

References

1. Bauman, Z. (2000). *Liquid Modernity*. Cambridge: Polity Press.
2. Bauman, Z. (2005). *Liquid Life*. Cambridge: Polity Press.
3. Bauman, Z. (2007). *Consuming Life*. Cambridge: Polity Press.
4. Bazeley, P. (2017). *Integrating Analyses in Mixed Methods Research*. Thousand Oaks: Sage Publications.
5. Bergman, M.M. (ed.) (2008). *Advances in Mixed Methods Research*. London: Sage Publications.
6. Blaikie, N. (1991). A critique of the use of triangulation in social research. *Quality & Quantity: International Journal of Methodology*, 25(2), 115-136. <https://doi.org/10.1007/BF00145701>.
7. Burrell, G., Gareth, M. (2005). *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life*. Aldershot: Ashgate Publishing.
8. Chlipała, P. (2011). *Tworzenie wartości dla klienta na rynku usług turystycznych*. Kraków: Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie.
9. Chlipała, P. (2018). *Integracja podejść metodologicznych w badaniach marketingu*. Kraków: Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie.
10. Chlipała, P. (2020). Możliwości i ograniczenia prowadzenia wywiadów pogłębionych w przestrzeni realnej i wirtualnej. In: K. Mazurek-Łopacińska, M. Sobocińska (eds.), *Badania Marketingowe w gospodarce cyfrowej* (pp. 182-194). Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
11. Coulter, R.A., Price, L.L., Feick, L. (2003). Rethinking the Origins of Involvement and Brand Commitment: Insights from Postsocialist Central Europe. *Journal of Consumer Research*, 30(2), 151-169. <https://doi.org/10.1086/376809>.
12. Creswell, J.W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. Thousand Oaks: Sage Publication.
13. Creswell, J.W., Plano Clark, V.L. (2007). *Designing and Conducting Mixed Methods Research*. Thousand Oaks: Sage Publications.
14. Dahl, D.W., Moreau, C.P. (2007). Thinking Inside the Box: Why Consumers Enjoy Constrained Creative Experiences. *Journal of Marketing Research*, 44(3), 357-369. <https://doi.org/10.1509/jmkr.44.3.357>.
15. de Leeuw, E.D. (2005). To Mix or Not to Mix Data Collection Modes in Surveys. *Journal of Official Statistics*, 21(2), 233-255.
16. de Leeuw, E., Hox, J. (2008). Mixing Data Collection Methods. Lessons from Social Survey Research. In: M.M. Bergman (ed.), *Advances in Mixed Methods Research* (pp. 138-149). London: Sage Publications.

17. Fetters, M.M.D., Molina-Azorin, J.F. (2017). The Journal of Mixed Methods Research Starts a New Decade: The Mixed Methods Research Integration Trilogy and Its Dimensions. *Journal of Mixed Methods Research*, 11(3), 291-307. doi:10.1177/1558689817714066.
18. Flick, U. (2011). *Introducing Research Methodology. A Beginner's Guide to Doing a Research Project*. Los Angeles: Sage Publications.
19. Garczarczyk, J., Mocek, M. (2014). Cykliczność wahań koniunktury na rynku usług ubezpieczeniowych wobec zmian aktywności polskiej gospodarki. *Marketing i Rynek*, 7, 14-24.
20. Gorard, S., Taylor, C. (2004). *Combining Methods in Educational and Social Research. Conducting Educational Research*. Berkshire: Open University Press.
21. Gorbaniuk, O., Kolańska, M., Ryzak, D., Sabat, J., Nitkiewicz, H., Kędziorek, D., Kleniewska, J. (2014). Skale do pomiaru zmian w obrazie siebie pod wpływem zakupu marek produktów. *Marketing i Rynek*, 9, 23-32.
22. Greene, J.C. (2015). Preserving Distinctions Within the Multimethod and Mixed Methods Research Merg. In: S. Nagy Hesse-Biber, R. Burke Johnson (eds.), *The Oxford handbook of multimethod and mixed methods research inquiry* (pp. 606-615). New York: Oxford University Press.
23. Grimmer, M., Hanson, D. (2009). *Qualitative and quantitative research published in the International Journal of Human Resource Management, 1998-2007*. Available online: https://www.anzam.org/wp-content/uploads/pdf-manager/977_ANZAM2009-017.PDF, 20.06.2021.
24. Hammersley, M., Atkinson, P. (1995). *Ethnography. Principles in practice*. London: Routledge.
25. Hammersley, M. (2008). Troubles with Triangulation. In: M.M. Bergman (ed.), *Advances in Mixed Methods Research* (pp. 138-149). London: Sage Publications.
26. Hanson, D., Grimmer, M. (2007). The mix of qualitative and quantitative research in major marketing journals, 1993- 2002. *European Journal of Marketing*, 41(1/2), 58-70. <https://doi.org/10.1108/03090560710718111>.
27. Harrison, R.L., Reilly, T.M. (2011). Mixed methods designs in marketing research. *Qualitative Market Research: An International Journal*, 14(1), 7-26. <https://doi.org/10.1108/13522751111099300>.
28. Hewett, K.R., Money, B., Sharma, S. (2006). National Culture and Industrial Buyer-Seller Relationship in the United States and Latin America. *Journal of the Academy of Marketing Science*, 34(3), 386-402. <https://doi.org/10.1177/0092070305285370>.
29. Jaciow, M., Wolny, R. (2011). *Polski e-konsument. Typologia, zachowania*. Gliwice: Helion.
30. Jaciow, M. (2011). Polski e-konsument. Założenia metodologiczne badań. *Marketing i Rynek*, 5, 27-34.

31. Jick, T.D. (1979). Mixing Qualitative and Quantitative Methods. Triangulation in Action. *Administrative Science Quarterly*, 24(4), 602-611. <https://doi.org/10.2307/2392366>.
32. Johnson, B., Onwuegbuzie, A.J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33(7), 14-26. <https://doi.org/10.3102/0013189X033007014>.
33. Johnson, B., Gray, R. (2010). A History of Philosophical and Theoretical Issues for Mixed Methods Research. In: A. Tashakkori, C. Teddlie (eds.), *SAGE Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks: Sage Publications.
34. Leander, K.M., McKim, K.K. (2003). Tracing the Everyday ‘Sittings’ of Adolescents on the Internet: a strategic adaptation of ethnography across online and offline spaces. *Education, Communication & Information*, 3(2), 211-240. <https://doi.org/10.1080/14636310303140>.
35. Leech, N.L., Onwuegbuzie, A.J. (2009). A typology of mixed methods research designs. *Quality & Quantit*, 43(2), 265-275. <https://doi.org/10.1007/s11135-007-9105-3>.
36. Mertens, D.M. (2007). Transformative Paradigm: Mixed Methods and Social Justice. *Journal of Mixed Methods Research*, 1(3), 212-225. <https://doi.org/10.1177/1558689807302811>.
37. Modell, S. (2009). In defence of triangulation: A critical realist approach to mixed methods research in management accounting. *Management Accounting Research*, 20(3), 210-221.
38. Newman, I., Ridenour, C.S., Neuman, C., de Marco, G.M.P. Jr (2003). A Typology of Research Purposes and Its Relationship to Mixed Methods research. In: A. Tashakkori, C. Teddlie (eds.), *Handbook of Mixed Methods in Social & Behavioral Research* (pp. 167-188). Thousand Oaks: Sage Publications.
39. Perlesz, A., Lindsay, J. (2003). Methodological triangulation in researching families: Making sense of dissonant data. *International Journal of Social Research Methodology*, 6(1), 25-40. <https://doi.org/10.1080/13645570305056>.
40. Plano Clark, V.L., Creswell, J.W. (eds.) (2008). *The Mixed Methods Reader*. Thousand Oaks: Sage Publications.
41. Plowright, D. (2011). *Using Mixed Methods: Frameworks for an Integrated Methodology*. London: Sage Publications.
42. Sade-Beck, L. (2004). Internet Ethnography: Online and Offline. *International Journal of Qualitative Methods*, 3(2), 45-51. <https://doi.org/10.1177/160940690400300204>.
43. Silverman, D. (2001). *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction*. London: Sage Publications.
44. Silverman, D. (2005). *Doing Qualitative Research: A Practical Handbook*. London: Sage Publications.
45. Snelson, C.L. (2016). Qualitative and Mixed Methods Social Media Research: A Review of the Literature. *International Journal of Qualitative Methods*, 15(1), 1-14. <https://doi.org/10.1177/1609406915624574>.

46. Tashakkori, A., Teddlie, C. (eds.) (2010). *SAGE Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks: Sage Publications.
47. Teddlie, C., Tashakkori, A. (2009). *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. Thousand Oaks: Sage Publications.
48. Walsh, G., Beatty, S.E. (2007). Customer-based corporate reputation of a service firm: scale development and validation. *Journal of the Academy of Marketing Science*, 35(1), 127-143. <https://doi.org/10.1007/s11747-007-0015-7>.
49. Wiktor, J.W., Chlipała, P. (Eds.) (2012). *The Marketing Strategies of Polish Companies in International Markets*. Warsaw: Polish Economics Publishers.
50. Żbikowska, A. (2012). *Eksport jako forma internacjonalizacji polskich przedsiębiorstw. Uwarunkowania i strategie*. Kraków: Polskie Towarzystwo Ekonomiczne.

ANALYSIS OF A COMPANY'S ACTIVITY IN TERMS OF DISTRIBUTION COSTS

Monika CHŁAD

Częstochowa University of Technology, Faculty of Management, Department of Logistics;
monika.chlad@pcz.pl, ORCID: 0000-0002-9925-6000

Purpose: Running a business is correlated with incurring costs. These are related to the management of resources in enterprises, which is why they must be constantly analysed and controlled. Based on cost information, certain management decisions are made. The aim of the article is to present basic issues concerning the functioning of distribution costs in an enterprise.

Design/methodology/approach: An analysis of a company's activities in terms of distribution costs was conducted. In addition, the article defines the logistical indicators and measures of an enterprise and presents expenses incurred for training in specific years.

Determinations: The article presents the allocation of primary distribution costs, which are divided into storage costs, transport costs, inventory maintenance costs, and administrative costs through conducting an interview in the enterprise.

Originality/Value: The results of the study can be used in the company's strategic distribution decisions.

Keywords: distribution logistics, logistics costs, enterprise.

1. Introduction

Currently, distribution policy is an area within which important decisions are made in an organization. Over the years, this process has been significantly intensified, due to the fact that an enterprise's financial results and position on the market depend on the decisions made in the field of its distribution policy (Bełch, 2016a, pp. 14-16). Intense consideration of the issue of distribution has led to finding many different interpretations and the establishment of different theoretical concepts of this process (Crochet, 2014, p. 512). Distribution is a particularly complex area. The purpose of this phenomenon, which is one of the most important elements of marketing impact on the market, is to overcome various barriers separating the manufacturer from the final buyer.

Distribution logistics are activities related to the goods and services flow at a specific time and place. All tasks carried out within the distribution system and its individual subsystems generate costs. In turn, logistics costs are the basic method of quantitatively measuring the effectiveness and efficiency of all company processes. Cost management requires looking at the phenomena that cause costs, as well as focusing on increasing cost efficiency.

2. Analysis of a company's activities in terms of distribution cost factors

A manufacturing company is presented as an entity conducting business activity, the main purpose of which is to achieve profit and meet the needs of its customers. Each enterprise operating on the market has to bear certain internal and external costs. It should be noted that companies try to reduce costs, but often external costs are minimized to the detriment of other costs (Ślusarczyk, 2011, pp. 14-16). In the literature "cost is the consumption of resources expressed in money, arising from the implementation of activities related to achieving the organization's objectives, in an enterprise it is the consumption of resources during the production and sale of products" (Fertsch, 2006, p. 189). One of the main goals of logistics is to minimize the product flow cost, increase the company's profit, and create a satisfactory level of customer service (Gołębbska, 2006, pp. 36-37). Companies very often point to stocks as a cost-generating factor, but it should be noted that they are inextricably linked to the production process. The structure of logistics costs in manufacturing enterprises can be presented as follows (Fechner, Szyszka, 2006, pp. 186-189).

When analysing a production plant's value and cost structure, all the smallest details should be taken into account. Starting with revenues, number of employees, products, etc., providing information on the size of the business, through other studies facilitating the analysis of cost factors of distribution, namely the results regarding individual costs:

- transport, considering additional transport costs,
- maintaining inventories, i.e. the costs of accumulation and ageing of material inventories,
- product storage, as well as the costs of packaging, equipment, energy, computer software,
- administration, i.e. costs related to mandatory product controls, material flow, as well as computer hardware and software, and personnel involved in logistics and distribution processes,
- lost benefits, obtained through calculating costs at the specific product level.

The method of calculating costs in the discussed production plant depends on several factors. In order for accounting employees to accurately manage documents, it is necessary to know the controlling areas and products, as well as individual fractions. There are two steps to

this process. The first is the responsibility of specific substantive cells that develop contracts and orders. Their tasks include the initial documentation implementation. The following step, however, is considered to be the work of an employee from the accounting department, namely the posting of a document that was initially implemented. The work of these people gives the opportunity to control all costs incurred by the company. Thus, the figure below shows what share is occupied by the basic costs.

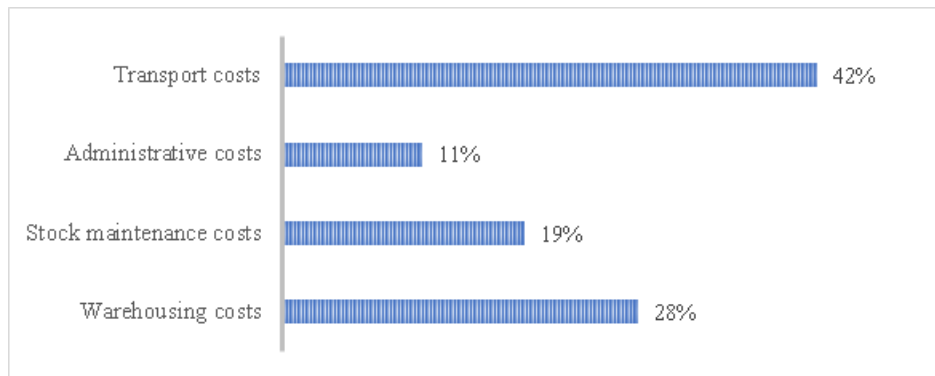


Figure 1. Allocation of basic distribution costs in the enterprise.

Source: Own study based on the company's source materials.

Based on the above chart, it is clear that the largest expenses incurred by the company are related to transport costs. Such a high percentage (42%) is mainly comprised of costs related to transport services, the costs of maintaining cars, the consumption of materials, fuels and energy related to the operation of these cars, the remuneration for drivers, as well as the repair and maintenance costs of means of transport. For the sake of comparison, Figure 2 will show the difference in incurred expenses related to the basic distribution costs by the plant over a period of 3 years.

From Figure 2 it can be concluded that, despite the passage of years, transport costs still constitute the largest sum of total distribution costs - on average they account for 40.6%. It is certainly not possible for administrative costs to exceed the cost limit of maintaining stocks, as the former represent 11% for 2019, 12% for 2020 and 8% for 2021 respectively, while the costs of maintaining stocks represent 19%, 12% and 21% respectively. Storage costs change in relation to the costs of maintaining inventories, i.e. when the costs of collecting inventories decrease, the cost of their storage also decreases. The above figure indicates an even spread of distribution costs, which is important when operating, among others, a production plant. However, if certain indicators were to change dramatically, managers would have to find the reason for this and then take steps to regulate this situation.

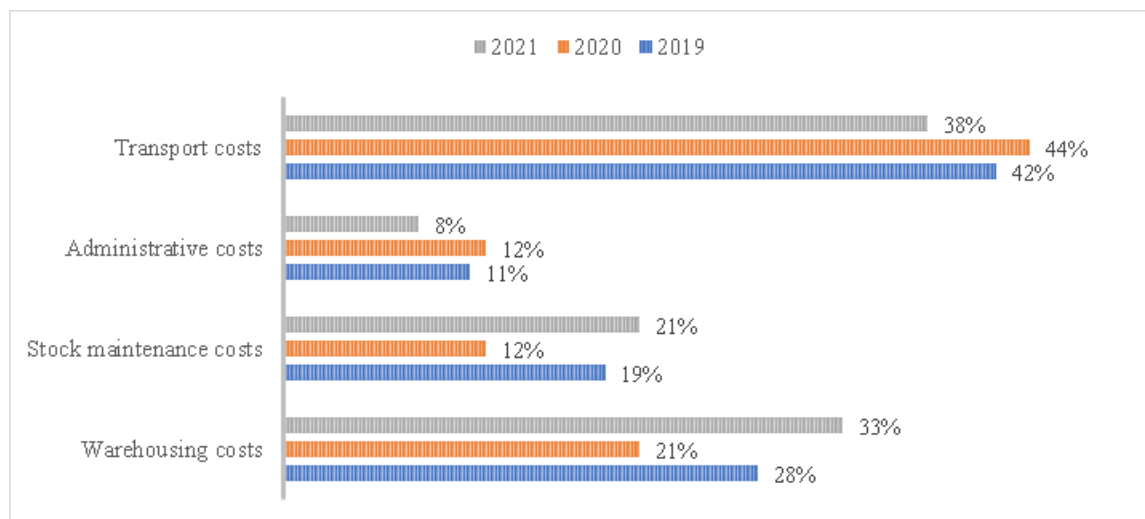


Figure 2. Distribution costs incurred by the company in 2019-2021.

Source: Own study based on the company's source materials.

Table 1 below shows a detailed breakdown of transport costs per year. Transportation costs include the operation of cars, their maintenance and repairs, fees, insurance, as well as compensation for employees, transport services, motorway tolls and parking lots. The table shows that the costs of repairing means of transport are the lowest (only 5% of the total costs), because at the turn of one year they are definitely lower than the others. The cost of car maintenance is just behind the cost of repairs. They account for 10% of transport costs and are also not among the highest, as insurance fees are paid only once a year. The above figure indicates that 15% of the total transport costs are related to transport services - these include motorway tolls, vignettes. The basic costs that overlap with transport-related costs are the 30% employee costs, and above all – costs related to fuel consumption, i.e. 40% of the total transport costs.

Table 1.

Detailed breakdown of transport costs in the enterprise

Exploitation	Wages and salaries	Transport services	Maintenance	Repairs
40%	30%	15%	10%	5%

Source: Own study based on the company's source materials.

Based on the figure presented earlier, it should be noted that the next area associated with high costs incurred by the company, are costs related to product storage. These costs include stockpiling warehousing, property taxes including rent, maintenance costs (heating and lighting), costs of repairs, maintenance of buildings and maintaining the safety of warehouse space, as well as employee remuneration. In view of this, the figure below will present, similar to transport costs, a detailed breakdown of the total storage costs incurred by the company in the years 2020-2021.

The following shows that storage costs differ little from each other over a two-year period. The highest costs are related to the storage of products, they amounted to 38% in 2020 and 32% in 2021 of all storage costs. However, they may change due to the condition of the product, as finished products are often stored in the open air, which reduces all costs. Therefore, it is concluded that storage costs are also deeply related to the stock maintenance costs. The material storage costs are directly followed by costs related to employee remuneration, which constitute 22% (2020) and 26% (2021) of all costs. The costs associated with all kinds of fees - rent, lighting, heating and other costs of maintaining the warehouse space are comparable. These constituted 15% to 20% of all costs in 2020-2021. It is clear from the above figure that the lowest costs are associated with any repairs being made. In 2020, the company spent only 5% on building repair and maintenance, while in 2021 that figure was only 2% more.

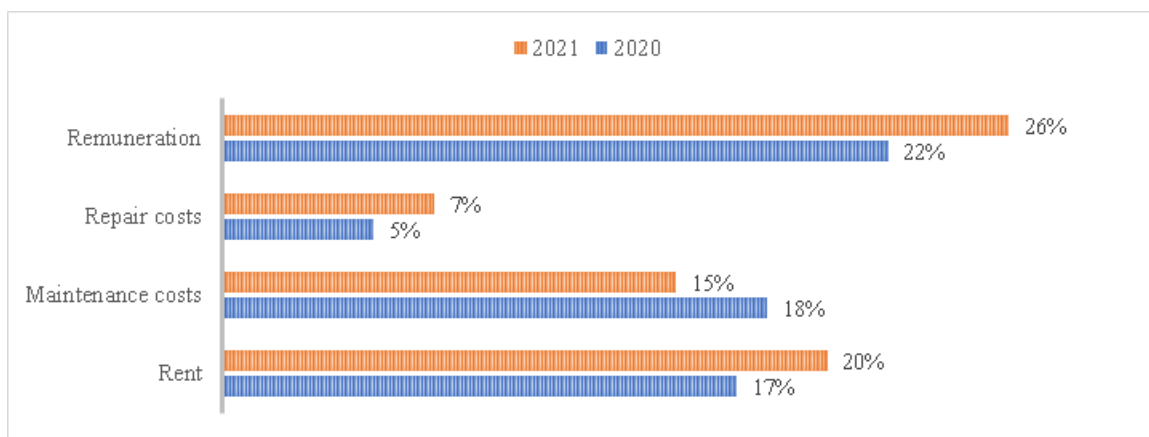


Figure 3. Breakdown of total storage costs in 2020-2021.

Source: Own study based on the company's source materials.

It is worth noting that the costs of storing finished products are much lower than the total costs. Expanded clay aggregate (LECA) in large quantities is accumulated in the open air, allowing the plant to save on the use of storage space, and thus reducing all fees.

Additional costs in the area of distribution borne by the company comprise costs related to the mandatory periodic training for employees and the so-called company-wide costs, which include protective clothing, medical care and first aid. Employees such as drivers, warehousemen, marketers, managers, or production personnel must undergo periodic training. The related expenditure is high, due to the number of company employees, as well as the frequency of training for individual departments. The figure below shows the company's expenditure on staff education and courses in 2017-2021 in PLN.

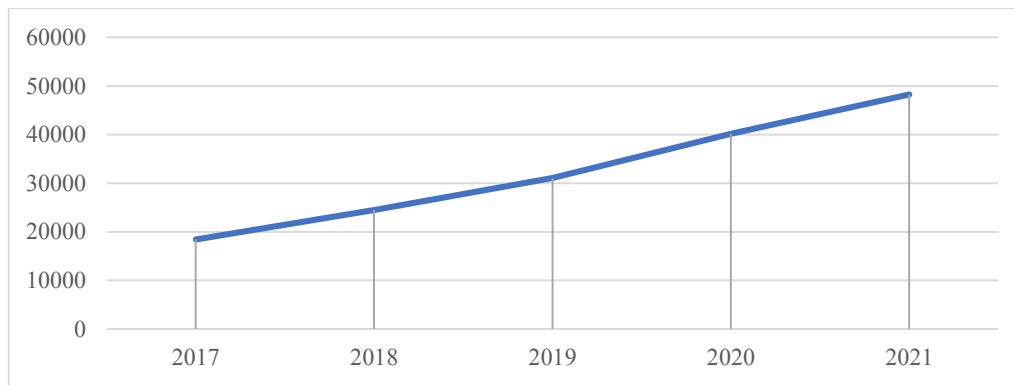


Figure 4. Company expenditure on training for distribution employees in 2017-2021.

Source: Own study based on the company's source materials.

The above chart shows the expenditures allocated to employee training. Over the five year period, these expenditures increased from year to year. Comparing 2017 to 2021, the difference is significant and amounts to almost PLN 30,000. In 2017, the company paid PLN 18,452 for training, and in 2021 it paid almost three times as much - nearly PLN 48,500. Between these years, expenditures grew by about 10 thousand over a year, namely in 2018 they amounted to almost 25 thousand PLN, in 2019 they amounted to just over 31 thousand PLN, and in 2020 nearly 42 thousand PLN. The annual increase in employee training expenditures may be caused by inflation and technological development, and thus the need to increase the knowledge and awareness of employees regarding behaviour in emergency situations.

3. The Company's logistic indicators and measures

Distribution logistics involves linking all activities related to supplying the customer with finished products. The elements of distribution include the sales method, service and sales path (Ficoń, 2019, pp. 151-153). Distribution connects the logistics market with the recipient market. As part of the measurement taking into account the economic aspect of distribution, individual measures are distinguished (Twaróg, 2006, pp. 58-60).

Assessment of the company's distribution system uses indicators that encompass warehouse management combined with transport. Another important indicator are the stock losses created during accumulation of production and its transport.

Table 2.*Measuring instruments for distribution economics*



Measures			
structural, framework	of productivity	of economy	qualitative
number of customers, deliveries per unit of time and levels, and storage locations	shipping and ordering productivity	costs of fulfilling a recipient's order and order distribution	percentage share of defective deliveries, delays, complaints
average sales per customer, distance between storage levels, and distance between warehouse and customer	order transport time	share of order performance costs in sales and shipping costs	average delivery time volume of supplementary deliveries average delivery time
order format		ratio of company transport costs to rented transport costs	
costs of shortages order and external transport performance			
distribution worker contribution			

Source: Own study based on the company's source materials.

Table 2 is designed to assess the economic aspect of distribution. The measures are divided into four main sections related to the construction of the company's distribution, productivity, economy, as well as quality.

Cost accounting in enterprises may vary. Below is a diagram that shows the methods of recording, indicating which method the company's operations are based. Table 3 shows that the company, for the purpose of recording cost, is limited to only the method of cost accounting. It omits the accounting of individual direct and indirect costs, the costs of specific products and services, as well as the ABC method.

Table 3.*Method of recording costs*

Recording method	
	Cost accounting
	Division of costs into direct and indirect
	Calculation at the product and service level
	Cost calculation using the ABC method
	

Source: Own study based on the company's source materials.

Cost-generating factors include the relationship with the customer, the method of customer communication, the service sharing the distance, as well as the frequency and size of orders placed by the customer. In order to maintain a good customer relationship and acquire regular consumers, the company strives for the highest customer service quality. All these factors indicate the amount of incurred costs.

Table 4 presents what in the process of order placement by a customer influences the amount of costs. It follows from the above that the best solution for the company would be a large, standard order, placed by a customer not too far from the production plant, using an electronic form of communication, and a short payment cycle. In cost reduction, it is important that the customer accepts the prices proposed in offers and price lists, rather than agreeing the price through the negotiation process or tenders. Placing small and frequent orders, similar to a product quality guarantee, increases transport costs.

Table 4.
Customer cost drivers

Low costs	High costs
standard orders	special orders
large orders	small, frequent deliveries
shorter distance to the customer	greater distance to the customer
classic selling procedures (offer/price list)	pre-sales services (negotiations/ advice/tender)
no pre-sales service	training, servicing, warranty
electronic communication	traditional communication
short payment chain	long payment chain

Source: Own study based on the company's source materials.

In order to calculate the logistics costs needed to assess the production process situation and the related costs, the company uses appropriate formulas.

4. Summary

Costs are one of the most important economic categories related to a company's functioning. Their appropriate division and accounting allow correct determining the company's financial result in a given period. Familiarity with the costs, knowledge about them, learning their essence and economic thread ensure effective and efficient enterprise management (Geyskens, Steenkamp, Kumar, 2006, pp. 519-543; Müller, Aust, 2011, pp. 1287-1330). Calculating distribution costs, i.e. the sum of all costs related to the physical flow of products from the manufacturer to the end customer, i.e. customer service, orders, transport, warehouse space maintenance and inventory maintenance, is a difficult process, although very important in proper company functioning. Costs are interdependent, which means that deciding to reduce costs in one particular sphere may result in increased costs in another sphere, and thus in an increase in total costs.

References

1. Belch, P. (2015). Analysis of generic costs in the fuel sector. *Scientific Papers of the Wrocław University of Economics, No. 398*.
2. Belch, P. (2016). Metrics in controlling logistics of a company from the fuel sector. *Scientific Papers of the Wrocław University of Economics, No. 440*.
3. Ciesielski, M. (2006). *Instruments of logistics management*. Warsaw: PWE.
4. Fechner, I., Szyszka, G. (2006). *Logistics in Poland*. Poznań: Logistics Library.

5. Fertsch, M. (ed.) (2006). *Basics of logistics*. Poznań: Institute of Logistics and Warehousing.
6. Ficoń, K. (2019). *Economic logistics. Logistics processes*. Warsaw: BelStudio Publishing House.
7. Geyskens, I., Steenkamp, J-B.E.M., Kumar, N. (2006). Make, Buy, or Ally: A Transaction Cost Theory Meta-analysis. *Academy of Management Journal*, vol. 49.
8. Gołębska, E. (ed.) (2006). *Basics of Logistics*. Łódź: NWSK.
9. Müller, M., Aust, H. (2011). Transaction Costs Detailed: Single-industry Studies and Operationalization. *Industrial Management & Data Systems*, vol. 111, no. 8.
10. Ślusarczyk, B. (ed.) (2011). *Basics of enterprise logistics costs*. Częstochowa: Faculty of Management of the Częstochowa University of Technology.
11. Szydzielko, Ł. (2014). Accounting policy in a process-focused company - selected issues. *Scientific Papers of the Wrocław University of Economic*, No. 344.
12. Twaróg, J. (2003). *Logistics metrics and indicators*. Poznań: Institute of Logistics and Warehousing.

ACTIVITY OF SELECTED HEALTHCARE ENTITIES IN THE LOWER SILESIA REGION THROUGH THEIR SOCIAL MEDIA ACTIVITIES IN THE CONTEXT OF IMAGE SHAPING

Iwona CZERSKA

Wroclaw University of Economics and Business; iwona.czerska@ue.wroc.pl, ORCID: 0000-0002-9680-6695

Purpose: The study's main objective was to identify the presence of selected healthcare entities from the Lower Silesian province in social media. The specific goal was to assess the status of the use of social media by selected medical entities in the context of building their image.

Design/methodology/approach: The author drew attention to the creation of the image of medical entities in the context of legal conditions and presented permissible (in light of the law) marketing activities shaping the idea of the medical entity in social media. Then the author, using the desk research method, analyzed the content of the profiles of selected medical entities from the Lower Silesian Province that have corporate accounts on Facebook, LinkedIn, Instagram, and YouTube. The author based his considerations on Polish and foreign literature on the subject, studying scientific articles and electronic sources. The author used the following professional databases to collect scientific literature: Biblioteka Nauki and Google Scholar.

Findings: Shaping the image of a healthcare entity on social media as communicative, engaged, and open to the patient's preferences and needs is a way to increase competitiveness in the region. Given the nature of the healthcare industry, healthcare entities should adopt a strategy to build an expert position in the region. An analysis of the content of the company's social media accounts showed that the selected healthcare entities run their profiles in a diversified manner, emphasizing one medium chosen, which is usually Facebook, and posting less frequently (Instagram) or incidentally (YouTube) in others. The least often used medium is LinkedIn.

Social implications: The advantage of using social media channels by healthcare entities is direct and immediate contact with stakeholders, through which it is possible to effectively target information messages to people/groups interested in the facility's offerings.

Originality/value: The author directed the article primarily to managers/directors in charge of healthcare entities and medical marketing specialists to make them aware that maintaining a medical institution's corporate social media account is necessary today. Without this, it is impossible to effectively reach a wide range of patients using social media channels daily. According to the author, it is necessary to strengthen the role of the patient in the health system as a full-fledged stakeholder and realize its actual impact on the economic situation and competitive position of medical facilities in the context of their social media marketing activities. The article's value is a comprehensive discussion of the importance of individual social media in the activities of the analyzed medical entities from the Lower Silesian Province.

Keywords: healthcare entity, image shaping, social media, Facebook, LinkedIn, Instagram, YouTube.

Category of the paper: Research paper.

1. Introduction

System changes in health care, especially market rules and competition, have forced a different approach to the management of medical entities. It involves: changing the style of management; introducing a system to support the flow of information between medical facilities and between them and the payer; standardizing the way health IT systems are accessed by providers, pharmacies and medical personnel; introducing a risk management system, including for reducing hospital-acquired infections; emphasis on skilful management of personnel resources; developing technical and technological facilities and internal transportation. However, the issue of competition in health care is more complex than in other sectors of the economy due to the specificity of health services for saving human life and health. Therefore, the health market differs from the free market (Sikora et al., 2022). Despite this difference, the competitiveness of medical entities is associated, first, with the need to build the reputation of medical institutions by gaining the recognition and trust of their patients, and second, with strengthening the negotiating position of these entities when contracting for public financing of health services (Sikora et al., 2021). Added to this is the turbulent environment in which healthcare units have come to operate, which requires a change in approach - from classical management focused on strategy, structures, and systems to management focused on goals, processes, and human capital (Zadros, 2017).

More and more companies, not only large global ones but also those in the small and medium-sized enterprise (SME) sector, are trying to build their image on social media. For medical facilities, a social media presence is an opportunity to attract new stakeholders, including patients, and retain existing ones. According to Katarzyna Zadros (2016), the modern patient is still a burdensome stakeholder or supplicant rather than a stakeholder of strategic importance. Such a statement applies primarily to public healthcare entities. The author's research also shows that medical entity managers are increasingly beginning to realize the real impact of the patient on the economic situation and competitive position of medical facilities - especially in primary care. Hence, the changes introduced in the health care system should strengthen the role of the patient in the system as a full-fledged stakeholder. Taking care of this should translate into the effective functioning of the facility in the long term (Zadros, 2016).

During the pandemic period caused by the spread of the coronavirus, most patients isolated from their doctors contacted them through remote medical services. E-visits dominated mainly in 2020 when the COVID-19 pandemic officially began in Poland in mid-March. At that time,

patients searched for information about medical services online and began to observe fan pages of specific medical entities and doctors on social media. Therefore, medical facilities started promoting their services and the medical professionals working in them on social networks: Facebook, Instagram, and LinkedIn.

Shaping the image of medical entities in the region is determined by the following activities: public relations (PR), corporate social responsibility (CSR), cause-related marketing (CRM), and social marketing (Zadros, 2017). A skillfully created image of a medical facility involving the development and implementation of an appropriate marketing strategy, the selection of distribution channels for information about the entity aligned with current communication trends, and the creation of relevant content about the facility and services make it attractive in the market for medical services. Sabina Ostrowska (2014) points out that building the image of a medical entity is primarily based on communication habits and relationships within it, and the actual image is formed in the patient only during a confrontation with the diagnosis, medical service, or medical professionals. In the case of social media, a facility's image is shaped in response to the manner and quality of presentation of information about services, medical staff, or the frequency of posts on the entity's fan page. According to Piotr Skrobich (2018), social media has become a tool of marketing policy in which the patient plays a key role. However, through marketing, it should create corporate profiles by medical entities and complete transparency in their activities.

The study's main objective is to identify the presence of selected healthcare entities from the Lower Silesia region in social media. The specific goal is to assess the status of the use of social media by selected medical entities in the context of building their image. The author paid attention to creating the image of medical entities in the context of legal conditions arising from the Act. The author studied scientific articles and electronic sources from 2012-2022.

2. Methodology

The author used the desk research method. First, the author analyzed the literature treating the creation of the image of healthcare entities on social media. Second, the author conducted a media content analysis. The subject of the content analysis was the profiles of selected medical entities on social media (Facebook, LinkedIn, Instagram, YouTube) and the posts they publish. Through the media content analysis, the author attempted to identify and evaluate the manner, frequency, and quality of the materials published by the selected entities on the respective social network.

The bibliography includes 49 scientific articles (18) and electronic sources, including social media profiles (31) - mainly from 2020-2022. In the desk research analysis, the author used the following professional scientific databases (brackets show the number of cited publications in a given database): Biblioteka Nauki (3) and Google Scholar (15). The author used these scientific databases because of the opportunity to gather literature for this article.

3. Image creation of healthcare entities and legal conditions

When creating the image of a medical entity in social media, it is necessary to consider the marketing aspects of such entities' operations and, above all, the legal aspects. This situation is about advertising one's facility. According to article 14. point 1. of the law on medical activity, an entity performing medical action may make public information about the scope and types of health services provided. Still, the content and form of this information must not bear the marks of advertising (Ustawa z dnia 15 kwietnia 2011, 2021). Persuasion, i.e., persuading patients to use the services of an establishment with simultaneous public disclosure of the size and type of health services offered, should be specified here. These three elements co-occurring: persuasion, public, and health benefits disqualify a medical entity under the law. However, it is possible to use marketing activities differently to make them legal. Table 1 presents the permissible (under the law) marketing activities shaping the image of a medical entity on social media.

Table 1.
Marketing activities of healthcare entities in social media

Marketing activities	
Form of action	Description and examples
Informing patients about the scope and type of health services, among other things	<p>It is all about the right way to convey information. The form is often more important than content on the Internet, and how information is conveyed is more important than the information itself. Examples of social media posts containing:</p> <p>Pictorial information (infographics) about preventive services/actions A video showing the treatment A photo depicting the effect of a given treatment with a redirect to a website where a before-and-after photo gallery is posted Information about the possibility of making an appointment through online registration with a link to the facility's website Presentation of the medical staff of a given facility, its experience with the scope of its activities Information/photos of the facility's daily operations Educational materials Informational content from reliable sources: health recommendations, social actions published on the Ministry of Health website, reports on the activities of the National Health Fund</p>

Cont. table 1.

Health promotion through the promotion of healthy lifestyles	<p>As part of health promotion, the healthcare entity may undertake activities that enable patients and their families to increase control over the determinants of their health, thereby improving it. Healthy lifestyles can be promoted as dedicated health/prophylaxis campaigns for specific age groups. Examples of social media posts/actions:</p> <p>Descriptions of activities related to the scope of services of the facility Facebook events bring together people interested in healthy lifestyles Webinars on healthy lifestyles Instructional videos, podcasts, and interviews about diet, physical activity/exercise Information about live meetings with doctors Information about White Saturdays, White Sundays</p>
Non-public promotional activities	<p>In non-public promotional activities, a healthcare entity targets messages to a specific group (e.g., a group centred around a particular condition, patients of a specific doctor at a healthcare facility, or patients in a clinical program). Examples:</p> <p>Closed Facebook groups Direct contact with patients via SMS, MMS, Messenger, and WhatsApp messages Setting up a chatbot to automatically answer frequently asked questions</p>

Source: own study based on: Al-Sheyab et al., 2021; Grzanek, 2020; Gurol-Urganci et al., 2012; Jędrzejewski, n.d.

The activities and marketing activities carried out by healthcare entities in social media, presented in the table above, can successfully influence the formation of a positive image of the entity in the region, thereby building its reputation. It depends on a given institution what kind of materials it will present on its profiles and the frequency and channels it will use to reach selected patients with its message.

4. Selected healthcare entities from Lower Silesia Province active in social media

One can now point to examples of medical entities doing very well on social media. Their profiles attract the attention of the customer-patient and are updated regularly. Table 2 shows selected healthcare entities from the Lower Silesian region and their social media activity statistics.

Table 2.

Examples of activities and statistics of medical entities from the Lower Silesian Province in social media

Healthcare entity	Social media profile(s)/ date of creation	Total number of observers	Frequency of publication (on average)	Published materials
Dolnośląskie Centrum Medyczne DOLMED S.A. in Wrocław	Facebook: Dolmed - w Centrum Zdrowia: https://www.facebook.com/DCMDolmed/ / July 14, 2020.	3017	Once a day	<ul style="list-style-type: none"> - contact information - specialist consultations - occupational medicine - diagnostic tests - medical procedures - presentations of the Center's medical staff - videos (e.g., recruitment, Earth Day, World Health Day, Pink October) - photos - events (e.g., Senior Week, Health Town, Movember in DOLMED, Pink October) - Ask the Dolmed website - at the Health Center: "How can I make an appointment?" "Do you provide medical services under the National Health Insurance?" "What services are provided?" "What are the prices for private medical services?" "Type a question."
	LinkedIn: DOLMED - w Centrum Zdrowia: https://www.linkedin.com/company/dolmed-w-centrum-zdrowia/?fbclid=IwAR354rktWlvrCNI7_eX9cVpr79-tZx-NTIuxZeNtWRD5yqNGjaYYh_RRRV8/ August 2, 2020.	82	Twice a month	<ul style="list-style-type: none"> - contact information - location with a route map - job offers - videos - photos - prevention programs
	Instagram: DOLMED - W centrum zdrowia: https://www.instagram.com/dcm_dolmed/ August 3, 2020.	261	Several times a month	<ul style="list-style-type: none"> - contact information - research packages - preventive programs - tests dedicated to specific age groups - Get to know our team - presentations of the Center's medical staff - information about commercial visits
	YouTube: DOLMED - w Centrum Zdrowia: https://www.youtube.com/channel/UCKjWauttNLjRcXZc49EJW-Q / Mai 28, 2021.	Four subscribers	9 and 10 months ago	<ul style="list-style-type: none"> - description of the Center - Two videos (Action Rehabilitation - Primary Health Care, DOLMED - at the Health Center (Join us!))

Cont. table 2.

Wojewódzki Szpital Specjalistyczny we Wrocławiu Ośrodek Badawczo-Rozwojowy	Facebook: Wojewódzki Szpital Specjalistyczny we Wrocławiu Ośrodek Badawczo-Rozwojowy: https://www.facebook.com/wsk.wroclaw/ March 14, 2014.	2192	Several times a month	<ul style="list-style-type: none"> - description of the Hospital - contact details - Ask the site Wojewódzki Szpital Specjalistyczny we Wrocławiu Ośrodek Badawczo-Rozwojowy: "Can I chat with someone?" "What is the location?" "Can I book an appointment?" "What services are offered?" - recommendations and ratings - photos - videos - events (e.g., Celebrating Prematurity Day, 5th Rally for Transplantation. Share yourself!, Laparoscopic Cystectomy, Living Kidney Donor- Conference).
Przychodnia Lekarska ARMED in Legnica	Facebook: Przychodnia Lekarska ARMED: https://www.facebook.com/przychodnia.lekarskaarmed/ November 20, 2017.	910	Three times a month	<ul style="list-style-type: none"> - contact information - a team of employees - services: execution time + cost - recommendations and evaluations - photos
Szpital Specjalistyczny CDT Medicus in Lubin	Facebook: Szpital Specjalistyczny CDT Medicus Lubin: https://www.facebook.com/szpitalcdtmedicus/ June 22, 2018.	Information not available	Every other day	<ul style="list-style-type: none"> - address information plus a map of how to get there - mentions of the Hospital published by other persons/institutions - photographs - films - events (e.g., Month with obesity treatment, Surgical treatment of obesity and metabolic diseases) - information about (new) treatments performed at the facility - job offers
	Instagram: Szpital CDT Medicus Lubin: https://www.instagram.com/szpital_cdtmedicus/ March 5, 2021.	220	Every two or three days	<ul style="list-style-type: none"> - contact information - posts about new treatment methods and procedures performed at the Hospital - videos - job offers
	YouTube: CDT MEDICUS LUBIN: https://www.youtube.com/user/cdtmedicus/ October 16, 2012.	321 subscribers	Several times a year	<ul style="list-style-type: none"> - comprehensive description - including addresses of clinics in other localities - playlists - videos about current services/treatments - the latest video, dated July 19, 2022, is about the free CDT MEDICUS mobile application that allows: <ol style="list-style-type: none"> a. use online registration 24/7 b. pay for appointments online c. download test results d. viewing medical recommendations e. receiving e-prescriptions

Cont. table 2.

Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży in Lubin	Facebook: Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży w Lubinie: https://www.facebook.com/DCZPDM/ / November 10, 2020.	Information not available	Two or three times a month	<ul style="list-style-type: none"> - contact information - posts about parenting, children/young people's lifestyles, school stress, learning, school violence - mentions of the Center published by other people/institutions - opinions - photos
	YouTube: dczpdm w Lubinie: https://www.youtube.com/channel/UCBQY7_671k_qM001UDIVqA/ / March 17, 2020.	No subscribers (93 views)	Exclusively two videos - on the day the profile was created	<ul style="list-style-type: none"> - first video: visualization - Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży in Lubin - second video: visualization of the Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży in Lubin
Medfemina Health Centre in Wrocław	Facebook: Medfemina - Centrum Zdrowia Kobiet: https://www.facebook.com/Medfemina/ / November 13, 2012.	12 071	Every two or three days	<ul style="list-style-type: none"> - contact information - brief description of the Centre's activities - posts about services performed within the Centre - posts about Open Days at Medfemina Hospital - reviews - photos - possibility to join a private group: Medfemina - let us talk about women's issues - videos - events (e.g., Mom, Dad, what about that cord blood..?, Myths and facts about cytology. Does cytology make sense in the 21st century?, Women's infertility in a nutshell) - Mentions of the Centre published by individuals/institutions - Ask the Medfemina - Centre for Women's Health website: "Can I ask for help?" "What services are offered?" "Can I book an appointment?" "What is the location?" "Type your question."
	Instagram: medfemina: https://www.instagram.com/medfemina/ / September 16, 2018.	1495	Every two or three days	<ul style="list-style-type: none"> - news posts - videos - posts and photos with the label Centre
	YouTube: Szpital Medfemina: https://www.youtube.com/channel/UCKiohN0PT_TrywKgBOiM-FA/ / Februar 14, 2017.	40 subscribers	Latest videos of 2019.	<ul style="list-style-type: none"> - description + detailed contact information - videos - playlist

Source: own study based on: Facebook, 2012, 2014, 2017, 2018, 2020a, 2020b; Instagram, 2018, 2020, 2021; LinkedIn, 2020; YouTube, 2012, 2017, 2020, 2021.

The author did not choose the above healthcare entities at random. First, the author chose entities he knows and whose services he uses or has used. The author chose a psychiatric care entity because of his professional connection to this area. Namely, the author is a co-owner and board member of the Psychiatric and Psychological Center "Metis" Ltd. in Legnica and serves as a medical information and communication specialist. Of the many mental health facilities

reviewed previously, the author chose one that fairly consistently maintains a profile in at least one social media outlet. Unfortunately, the healthcare entity with which the author is professionally affiliated does not hold its activity on social media.

For this reason, the author did not include this entity in Table 2. However, the Center's management plans to establish a corporate account shortly - initially on Facebook. Finally, analysis of the content of the social media profiles of several medical entities operating in the Lower Silesian Province has made it possible to identify those that resiliently, systematically, and professionally communicate their activities to stakeholders. Resiliently, with a strong commitment, often citing the latest discoveries in medicine, referring to current events and health service offerings, and meeting patients' expectations. Systematically - publishing timely posts on the profile, posting updates. Finally, professionally, that is, among other things, using cross-posting, which means publishing similar content on multiple social media channels. This marketing tactic is used to streamline the publishing strategy and the ability to repurpose content across multiple platforms, thereby continuously updating social channels. Cross-posting is also about building brand awareness due to sharing content across channels, increasing the chance of being seen by the target audience.

5. Discussion

As part of the content analysis, the author selected several areas from the treatment entity's social media profile, making the study quantitative and qualitative. The first information the author listed as the profile's name, the link to it, and the date the company created an account in the medium. This criterion is relevant to the article's primary purpose, as it allows us to verify a given entity's profile and track its activity on social media. All the entities considered have company accounts on Facebook. According to Daniel Nowocin (2017), this medium is the most suitable social media platform for medical institutions due to offering potentially the most significant reach of activities and the most intuitive focus of its users' discussions around the entity's activities. Facebook as a powerful and opinion-forming medium in the Polish healthcare market is also indicated by Magdalena Syrkiewicz-Świtała (2015). She argues that it is possible to very precisely target pro-health messages to specific groups of recipients, which of course, affects the formation of a positive image of medical entities in a given region. Piotr Kocemba et al. (2015) give reasons for patients' use of Facebook, among which are: social support, exchange of advice, gaining knowledge, self-care, and communication with the doctor. In doing so, these researchers mention good practices for publishing on social media, such as the consistency of the publicly available profile with a professional image and the support of the published content with scientific knowledge - due to the possibility of patients treating it as medical advice, or, finally, the openness, politeness, and honesty of all communication. Medical

entities should skillfully, reliably, and systematically communicate with their audiences - patients, who are increasingly aware of their expectations and needs in terms of health, education, and society, as well as the possibility of satisfying them - including by medical institutions on social media.

LinkedIn is the second medium worth attention to healthcare entities with corporate accounts. Only one analyzed entity has a company account, established relatively recently in 2020. Publication of posts is pretty regular but not very frequent - compared to Facebook, where communication takes place daily. According to Marcin Janicki (n.d.a), it is difficult for a medical institution to maintain an account on every existing and popular social network. Mostly one starts with one medium and, over time, expands to other mediums. One of the portals that are often overlooked in the choice by medical entities is precisely LinkedIn. Despite its different specifics than Facebook or Instagram - due to LinkedIn's dedication to professional-business contacts in the broadest sense, entrepreneurs, business people, and executives, it is, according to Daniel Nowocin (2020), also a valuable platform for medical entities. Among the benefits for a medical entity present on LinkedIn, he mentions: creating a profile card for a given entity (profile photo, logotype, background photo, tags, a brief description of activities, contact information: phone, email address, link to website); publishing valuable content prepared by the institution: expert articles, scientific and educational materials (e.g., on healthy lifestyle, prevention of various diseases); gaining contacts with medical industry stakeholders; recruiting a medical professional to the team; establishing beneficial business relations; shaping a positive image of the entity in the region. Even though LinkedIn has more than five times fewer users than Facebook and more than two times fewer than Instagram (Grzanek, 2021), it is a valuable place to build engagement among those focused on the institution. Publishing posts on this medium does not have to be frequent - just regular and high-quality. According to Łukasz Grzanek (2021), a medical facility should refer to current events and industry news and publish news from the company's life. It is a good idea to post information on the facility's corporate social responsibility (CSR) activities on its corporate profile. Finally, the LinkedIn platform can also successfully prove itself as a mutual referral system for healthcare entities (Janicki, n.d.b).

Summarizing the consideration of LinkedIn in shaping the image of medical entities, it is difficult to give reasons for the non-use of this medium by the analyzed medical institutions. On the one hand, it could be the lack of knowledge on how to run a profile in this service skillfully; on the other; there may be a lack of a suitable person, a manager, who would communicate with it. Often only one person employed at a given medical entity, in addition to his daily duties, is additionally engaged in running the company's account on at least one social media platform and chooses the more popular ones and the ones he knows best.

Another service used by the selected healthcare entities analyzed is Instagram. Three entities have an account on them. According to Bartosz Nassalski (n.d.), a profile on Instagram is not the basis for marketing medical services, but it can be an essential complement

to a presence on Facebook. Due to the nature of this medium, created primarily for sharing photos and videos, a medical entity should provide visually appealing content, know how to share information and any news, and be patient. Therefore, the facility must focus on sincere messages, use hashtags, target niches (concentrate on providing content built around the issues it specializes in), interact with service users, and regularly add new posts and testimonials. In addition to news posts, photos, and videos, healthcare entities can showcase their medical staff - as in the case of DOLMED, or job opportunities - in the case of CDT Medicus. Important information is also provided by posts about examination packages carried out at a given institution, preventive programs, or examinations dedicated to specific age groups. In summary, Xin L. Wong et al. (2019) indicate that Instagram has great potential to facilitate the exchange of medical information with the public and between medical professionals. From the point of view of medical entities, there is patient education, education of healthcare providers, patient support groups, and availability of active users.

The last social medium analyzed is YouTube. Entities with accounts do not regularly update, translating into very few or no subscribers. YouTube, as a still under-appreciated medium in the health sector, opens up a new space in the health field, according to Rodrigo Luiz Vancini et al. (2021). Their published content can generate engagement comparable to or surpass that of digital media specialized in health communication. YouTube is an opportunity for healthcare entities to gain subscribers, as a skillfully run channel can serve as a health education tool, both for patients and medical students, up to all those interested in issues of taking care of their health (Gimenez-Perez et al., 2020; Hasamnis, Patil, 2019). Running a company channel on YouTube is neither an easy nor a quick way to gain user attention. Published videos should engage and focus the audience's attention, making reaching their needs and expectations easier. Valuable videos help position a treatment entity's website online. According to Marcin Janicki (n.d.c), a higher ranking in Google's search engine involves several rules that a medical entity must remember. First, the audio and video quality must be good. Second, to avoid boring the viewer, published videos should be short, several minutes long. Third, relying on relevant keywords is the right way to meet the needs of information-seeking patient-clients. Finally, a fundamental principle is the right video title, which should be short, concise, and understandable to everyone. Of course, those publishing videos on behalf of a medical entity should review them on an ongoing basis and make appropriate changes to improve their craft and, more accurately, meet subscribers' expectations. In conclusion, YouTube is still a place for medical entities to shape their image in the region.

In the case of the analyzed entities, establishing a company profile on social media dates mainly to 2020. This situation may be related to the coronavirus pandemic, which is assumed to have started on March 11, 2020, and significantly reduced people's mobility and direct social contact, making long-distance communication much more frequent and willingly used than before (Paszek, Sitko, 2021). Adrian Wong et al. (2021) believe that during the COVID-19 pandemic, social media has become a ubiquitous part of modern healthcare systems. Social

media has added a new dimension to health care by providing treatment providers, patients, and the public with a common communication channel on health issues, which can translate into improved health outcomes. In general, social media is becoming a tool to support the health system and foster patient empowerment by increasing patient knowledge and putting patients at the Center of managing their own treatment needs (Farsi, 2021).

It can be noted that entities with accounts after 2017 mainly function resiliently, systematically communicating their activities to their surroundings. According to Daniel Nowocin (2016), this primarily depends on the managers of medical institutions, who use patient engagement on social networks to shape a positive image of the medical entity in the region. This situation is done by drawing patient attention to the engaging and relevant message content and events encouraging patients to engage in various physical activities and care for their health. This situation results in building long-term relationships with patients in the context of the ongoing development of the medical entity in the region. Magdalena Syrkiewicz-Światała (2015) pointed out that managers of medical entities responsible for communication policy must be aware of the requirement to be constantly active and systematically publish up-to-date and engaging content to keep sustaining the interest of the audience.

Subsequently, the author included the total number of followers for a given profile, but not every entity provided this information. In the case of YouTube, the author considered the number of subscribers. At the same time, the author mentioned that observers/subscribers do not include all visitors to a profile but only those who have chosen this option. The author pointed out the modification of Facebook's settings for corporate accounts; specifically, some profiles' likes are no longer visible - the number of observers is given instead (Żyłowska, 2021). Hence, as a profile statistic, the author chose only the total number of observers for all media. The following statistic was the average frequency of publishing in a given medium. Based on an analysis of the frequency of the posts published by a given entity, the author independently determined its intermediate frequency. According to a study by Juan Manuel Rojas Salazar (2017), the optimal frequency of publishing content on social media is 6-7 posts per week. Broken down by specific medium, it is assumed: Facebook: 1-2 posts per day, Instagram: 1-2 posts per day, and LinkedIn: 1 post per day (Kot, 2017). Posting more frequently reduces engagement among users and positive mentions of an entity. DOLMED follows these recommendations best, posting on average once a day on Facebook, followed by CDT Medicus and Medfemina Health Centre with an average of every second/third day on Facebook and Instagram. It is noteworthy that Medfemina has had its corporate Facebook account since 2012. - the longest of all the analyzed entities, having the most, with more than 12,000 followers. However, it is difficult to find a correlation between the frequency of posting and the number of observers for the analyzed entities. According to David Hartshorne (2022), a more critical issue than frequency is the consistency of posts, i.e., the quality of content, not the quantity. Besides, according to Jeff Quipp (2015), a digital marketing expert, what matters in social media is not the number of followers but their quality.

The last information in the tabulation is the material published by a given medical entity in a given medium. Medical establishments post the most information on Facebook while the least on YouTube. Medical entities often publish on their company profiles: address information with a map of how to get to the facility, a description of activities, and posts with news, photos, videos, and events. Increasingly, the presentation of medical personnel on social media is taking place, which affects the entity's image in the local environment (CAMP7 Digital, 2020). In the case of selected commodities, this is only the case at DOLMED.

To summarize the discussion, according to Dorota Pindel (2014), marketing manager at Blink Interactive, healthcare entities with social media profiles can be divided into three groups. The first comprises entities with company accounts but does not publish any information. These profiles are neglected, and the information posted about the facilities is incomplete. This group includes DOLMED and Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży in Lubin - which have YouTube accounts. The second group consists of entities on the profiles in which the flow of information occurs irregularly and only when the institution has something important to communicate. This group includes DOLMED on Instagram and LinkedIn, Wojewódzki Szpital Specjalistyczny we Wrocławiu Ośrodek Badawczo-Rozwojowy on Facebook, ARMED, CDT Medicus on YouTube, Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży in Lubin on Facebook, and Medfemina on YouTube. The last group comprises medical entities that share daily or several times a week on social media about their surroundings, with topics that cover medical or cosmetic aspects in addition to organizational issues. Among the messages in the latter group, one can find tips on healthy living, preventive measures, presentations from medical staff, promotions, news, trivia, funny photos, and memes. The latter group includes the other entities in Table 2: DOLMED on Facebook, CDT Medicus, and Medfemina - on Facebook and Instagram.

6. Limitations

The author knows the limitations of taking only a few selected healthcare entities for analysis. First, the nature of such a media content analysis is unsystematic in terms of a possible comparison of its results. Second, the piecemeal analysis resulting from the subjective selection of survey subjects limits the value of the survey results. Third, the author omitted other social media (e.g., Twitter) on which healthcare entities could communicate with the public. The lack of inclusion of other social networks in the analysis is primarily due to the author's failure to have an account of them. Finally, limiting only to entities operating in the Lower Silesian Province does not allow us to obtain a broader context for the study.

Despite the identified limitations of the study, this article could form the basis for a more extensive study in the future. A new study could include more healthcare entities from the Lower Silesian region and several or all provinces in Poland. Other researchers could also include other social networks in the analysis, such as Twitter, Pinterest, or, last but not least, TikTok, which is increasingly the place where medical facilities interact with patients.

7. Conclusions and recommendations

Promoting a medical entity on social media is a very effective way to increase regional competitiveness. The advantage of medical facilities' use of social media channels is direct contact with stakeholders and, undoubtedly, with the most critical group - patients. Thanks to these channels, it can effectively target information messages to those interested in the facility's offerings. Among the benefits of this type of communication between the treatment entity and the patient are:

- focusing and developing the community around the health services offered,
- creating the image of an entity that is communicative, committed, and open to the needs and preferences of patients,
- building and strengthening trust in the facility by emphasizing its identity,
- expanding outreach to reach more stakeholders.

According to Łukasz Grzanek (2020), Online Digital Marketing Specialist at Medidesk, "The keys to success in managing the medical business on social media are reliability, credibility, and cyclicity." The medical entities analyzed develop their social media activities diversified, emphasizing one selected medium, usually Facebook, and posting less frequently (Instagram) or incidentally (YouTube) on others. The least used medium is LinkedIn, which only supports the shaping of DOLMED's image - and only since 2020.

Due to the nature of the healthcare industry, the image formation of healthcare entities should adopt a strategy of building a position as an expert in the region. To this end, running an establishment's profile on social media must be very serious and responsible, as it is a kind of business card of the entity. The most important features of a professional profile of a medical entity in social media are:

- a refined logo,
- the full address of the facility with a map of how to get there,
- up-to-date photos of the building,
- mission, vision, and values,
- bookmarks with up-to-date information,
- transparency of message,

- relevancy of content,
- regularity and timeliness of published content,
- feedback/reviews about the facility, staff, and services.

References

1. Al-Sheyab, N.A., Alyahya, M.S., Alqudah, J.A. (2021). Effectiveness of theory-based Multimedia Messaging Service (MMS) on exercise benefits and barriers among patients with type 2 diabetes. *Health Education Research, Vol. 36, No. 6*, pp. 646-656, doi: 10.1093/her/cyab038.
2. CAMP7 Digital (2020). *Przedstawienie zespołu w mediach społecznościowych – czy to konieczne?* Retrieved from <https://www.camp7.pl/przedstawienie-zespołu-w-mediach-społecznościowych-czy-to-konieczne/>, 26.08.2022.
3. Facebook (2012). *Medfemina - Centrum Zdrowia Kobiety*. Retrieved from <https://www.facebook.com/Medfemina/>, 29.07.2022.
4. Facebook (2014). *Wojewódzki Szpital Specjalistyczny we Wrocławiu Ośrodek Badawczo-Rozwojowy*. Retrieved from <https://www.facebook.com/wssk.wroclaw/>, 21.07.2022.
5. Facebook (2017). *Przychodnia Lekarska ARMED*. Retrieved from <https://www.facebook.com/przychodnialekarskaarmed/>, 25.07.2022.
6. Facebook (2018). *Szpital Specjalistyczny CDT Medicus Lubin*. Retrieved from <https://www.facebook.com/szpitalcdtmedicus/>, 25.07.2022.
7. Facebook (2020a). *Dolmed - w Centrum Zdrowia*. Retrieved from <https://www.facebook.com/DCMDolmed/>, 20.07.2022.
8. Facebook (2020b). *Dolnośląskie Centrum Zdrowia Psychicznego dla Dzieci i Młodzieży w Lubinie*. Retrieved from <https://www.facebook.com/DCZPDM/>, 29.07.2022.
9. Farsi, D. (2021). Social media and health care, part I: literature review of social media use by health care providers. *Journal of Medical Internet Research, Vol. 23, No. 4*, e23205, doi: 10.2196/23205.
10. Gimenez-Perez, G., Robert-Vila, N., Tomé-Guerreiro, M., Castells, I., Mauricio, D. (2020). Are YouTube videos useful for patient self-education in type 2 diabetes? *Health Informatics Journal, Vol. 26, No. 1*, pp. 45-55, doi: 10.1177/1460458218813632.
11. Grzanek, Ł. (2020). *Jak wykorzystać social media do promowania placówki medycznej, cz. 2*. Retrieved from https://medidesk.pl/jak-zarzadzac-biznesem-medycznym-w-mediach-społecznościowych/?fbclid=IwAR1_isQSTvB2Oc_wZU8Juft3dkJDvzaykWiRIGGkQUIQPq7u0Ugm6U6H0vU&doing_wp_cron=1657447246.0386359691619873046875, 10.07.2022.

12. Grzanek, Ł. (2021). *Nowoczesna placówka medyczna na LinkedIn, cz. 1*. Retrieved from https://medidesk.pl/linkedin-a-nowoczesna-placowka-medyczna-jak-stworzyc-profil-firmowy/?fbclid=IwAR2icHfmkHtK9zt3iPwFLKVLpr4ZMDd87GPIE71VwNnwspONGA1Wk_IOF9E, 4.08.2022.
13. Gurol- Urganci, I., de Jongh, T., Vodopivec- Jamsek, V., Car, J., Atun, R. (2012). Mobile phone messaging for communicating results of medical investigations. *Cochrane Database of Systematic Reviews, Vol. 6, No. CD007456*, doi: 10.1002/14651858.CD007456.pub2.
14. Hartshorne, D. (2022). *How often should you post on social media in 2022?* Retrieved from <https://www.sendible.com/insights/how-often-to-post-on-social-media>, 23.08.2022.
15. Hasamnis, A.A., Patil, S.S. (2019). YouTube as a tool for health education. *Journal of Education and Health Promotion, Vol. 8, No. 241*, doi: 10.4103/jehp.jehp_150_19.
16. Instagram (2018). *Medfemina*. Retrieved from <https://www.instagram.com/medfemina/>, 29.07.2022.
17. Instagram (2020). *DOLMED - W centrum zdrowia*. Retrieved from https://www.instagram.com/dcm_dolmed/, 20.07.2022.
18. Instagram (2021). *Szpital CDT Medicus Lubin*. Retrieved from https://www.instagram.com/szpital_cdtmedicus/, 25.07.2022.
19. Janicki, M. (n.d.a). *Doktorze, nie ma Cię na LinkedIn? Czas to naprawić*. Retrieved from https://medyczny-marketing.pl/tools/profil-lekarza-na-linkedin/?fbclid=IwAR1To3icMtdTSNK6TCNkTLPpTNRqg4CmjKIJ2kog8V9q_At4kRZt6rUoKVA, 5.08.2022.
20. Janicki, M. (n.d.b). *LinkedIn jako narzędzie do promocji marki medycznej*. Retrieved from <https://medyczny-marketing.pl/business/linkedin-dla-branzy-medycznej/?fbclid=IwAR1HKhqm5jnlqy5uxobObQ9ipKqnOp5bL6QKYQDUxX0T4MsJIZb-uKXSg6g>, 6.08.2022.
21. Janicki, M. (n.d.c). *5 reguł publikowania filmów wideo dla placówki medycznej*. Retrieved from <https://medyczny-marketing.pl/tools/5-regul-publikowania-filmow/?fbclid=IwAR3ry0NR4bCIedq1GtM8VIOHaHjAm49r4tnMMeJSFleJqZuqKqxTHFvTs5A>, 13.08.2022.
22. Jędrzejewski, P. (n.d.). *Jak stworzyć reklamę (podmiotu leczniczego), aby nie była (zakazaną) reklamą?* Retrieved from <https://imagedmed.pl/jak-stworzyc-reklame-podmiotu-leczniczego-aby-nie-byla-zakazana-reklama/>, 8.07.2022.
23. Kocemba, P., Lasota, M., Sroka, N.H., Feleszko, W. (2015). Facebook-based medicine, or the doctor's professional image on the Internet. *Pediatrics i Medycyna Rodzinna, Vol. 11, No. 3*, pp. 328-338, doi: 10.15557/PiMR.2015.0032.
24. Kot, J. (2017). *Jak często publikować w mediach społecznościowych?* Retrieved from <https://geekcat.pl/jak-czesto-publikowac-w-mediach-spolesznosciowych/>, 24.08.2022.
25. LinkedIn (2020). *DOLMED - w Centrum Zdrowia*. Retrieved from https://www.linkedin.com/company/dolmed-w-centrum-zdrowia/?fbclid=IwAR354rktWlvrCNI7_eX9cVpr79-tZx-NTIuxZeNtWRD5yqNGjaYYh_RRRV8/, 20.07.2022.

26. Nassalski, B. (n.d.). *Instagram w branży medycznej – jak zacząć i zaistnieć?* Retrieved from <https://simpliteca.com/medycyna/instagram-w-branzy-medycznej-jak-zaczac-i-zaistniec/>, 6.08.2022.
27. Nowocin, D. (2016). *Jak skutecznie wykorzystywać social media w marketingu medycznym. Część I.* Retrieved from <http://mediahealth.pl/skutecznie-wykorzystywac-social-media-marketingu-medycznym-czesc/>, 26.07.2022.
28. Nowocin, D. (2017). *Social media w marketingu medycznym.* Retrieved from <https://mediahealth.pl/social-media-w-marketingu-medycznym/>, 1.08.2022.
29. Nowocin, D. (2020). *LinkedIn – czy placówki medyczne powinny z niego korzystać?* Retrieved from https://mediahealth.pl/linkedin-czy-placowki-medyczne-powinny-z-niego-korzystac/?fbclid=IwAR0QPg7tkSHPS9vy1ZF9WjYYJR8rcUue38oRJ0VHDg_OahWHJJrHNXvnrc, 4.08.2022.
30. Ostrowska, S. (2014). Kształtowanie wizerunku podmiotu działalności leczniczej. *Studia Ekonomiczne, No. 185*, pp. 142-150.
31. Paszek, A., Sitko, B. (2021). The media in the face of the coronavirus pandemic – new trends and challenges. Outline of the issues. *Com.Press, Vol. 4, No. 2*, pp. 36-51, doi: 10.51480/compress.2021.4-2.323.
32. Pindel, D. (2014). *Analiza branży medycznej na Facebooku.* Retrieved from <https://marketerplus.pl/analiza-branzy-medycznej-na-facebooku/>, 26.08.2022.
33. Quipp, J. (2015). *In social media it's not the number of followers you have but the quality that counts.* Retrieved from <https://financialpost.com/entrepreneur/in-social-media-its-not-the-number-of-followers-you-have-but-the-quality-that-counts>, 23.08.2022.
34. Salazar, J.M.R. (2017). Inverted u-shaped impact of social media posting frequency on engagement and sentiment ratio. *Empirical Quests for Management Essences, Vol. 1, No. 3*, pp. 1-15.
35. Sikora, T., Kanecki, K., Sikora, A., Bogdan, M. (2021). Key factors of the competitiveness of healthcare entities. *Journal of Education, Health and Sport, Vol. 11, No. 11*, pp. 73-83, doi: 10.12775/JEHS.2021.11.11.00.
36. Sikora, T., Sikora, A., Bogdan, M. (2022). Management of a medical entity based on models of competitiveness of enterprises on the example of Corten Medic Medical Center. *Journal of Education, Health and Sport, Vol. 12, No. 1*, pp. 216-224, doi: 10.12775/JEHS.2022.12.01.018.
37. Skrobich, P. (2018). Konceptualizacja postrzegania jakości udzielanych świadczeń zdrowotnych w dobie społeczeństwa informacyjnego. *Medyczna Wokanda, Vol. 11, No. 11*, pp. 57-66, doi: 10.32055/mw.2018.11.4.
38. Syrkiewicz-Światała, M. (2015). Facebook – medium komunikacji marketingowej w ochronie zdrowia. *Zarządzanie Mediami, Vol. 3, No. 3*, pp. 197-205, doi: 10.4467/23540214ZM.15.010.4870.

39. Ustawa z dnia 15 kwietnia 2011 r. o działalności leczniczej. (2021). Dz.U. z 2021 r., poz. 711, 1773, 2120. Retrieved from <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20210000711/U/D20210711Lj.pdf>, 8.07.2022.
40. Vancini, R.L., Viana, R.B., Andrade, M.S., Barbosa de Lira, C.A., Nikolaidis, P.T., de Almeida, A.A., Knechtle, B. (2021). YouTube as a source of information about physical exercise during COVID-19 outbreak. *International Journal of Sport Studies for Health*, Vol. 4, No. 2: e123312, doi: 10.5812/intjssh.123312.
41. Wong, A., Ho, S., Olusanya, O., Antonini, M.V., Lyness, D. (2021). The use of social media and online communications in times of pandemic COVID-19. *Journal of the Intensive Care Society*, Vol. 22, No. 3, pp. 255-260, doi: 10.1177/1751143720966280.
42. Wong, X.L., Liu, R.C., Sebaratnam, D.F. (2019). Evolving role of Instagram in #medicine. *Internal Medicine Journal*, Vol. 49, No. 10, pp. 1329-1332, doi: 10.1111/imj.14448.
43. YouTube (2012). *CDT MEDICUS LUBIN*. Retrieved from <https://www.youtube.com/user/cdtmedicus>, 25.07.2022.
44. YouTube (2017). *Szpital Medfemina*. Retrieved from https://www.youtube.com/channel/UCKiohN0PT_TrywKgBOiM-FA, 29.07.2022.
45. YouTube (2020). *dczpdm w Lubinie*. Retrieved from https://www.youtube.com/channel/UCBQY7_671k_qM0OIUDIIVqA, 29.07.2022.
46. YouTube (2021). *DOLMED - w Centrum Zdrowia*. Retrieved from <https://www.youtube.com/channel/UCKjWauttNLjRcXZc49EJW-Q>, 20.07.2022.
47. Zadros, K. (2016). Pacjent w podmiocie leczniczym – interesariusz, interesant czy petent. *Zeszyty Naukowe. Organizacja i Zarządzanie*, No. 93. Politechnika Śląska, pp. 525-534.
48. Zadros, K. (2017). Kształtowanie wizerunku i pozycji rynkowej podmiotów leczniczych – CSR czy PR? *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, No. 313, pp. 198-210.
49. Żyłowska, K. (2021). *Facebook dąży do zlikwidowania liczby polubień na stronach profesjonalnych*. Retrieved from <https://socialpress.pl/2021/01/facebook-dazy-do-zlikwidowania-liczby-polubien-na-stronach-profesjonalnych>, 21.08.2022.

DEVELOPMENT DIRECTIONS OF THE GAMING INDUSTRY AS OPPORTUNITIES FOR PEOPLE WITH DISABILITIES

Iwona CZERSKA

Wroclaw University of Economics and Business, Wroclaw; iwona.czerska@ue.wroc.pl,
ORCID: 0000-0002-9680-6695

Purpose: The study's main objective was to identify potential directions for developing gaming and virtual reality that can contribute to bridging the exclusion of people with disabilities. The specific objectives were to isolate functioning facilities for people with disabilities in the gaming market and to identify prospects for further development of technology-affecting facilities for gamers with disabilities.

Design/methodology/approach: The author discussed existing gaming solutions as facilities for people with disabilities and then presented directions for further industry development about players with various disabilities and disorders. Subsequently, the author pointed out several benefits of gaming for people with disabilities. The paper also includes the author's identified limitations of the analysis made. In the desk research method, the author used the following scientific databases: PubMed, ResearchGate, Taylor and Francis Online. The author based his considerations primarily on foreign literature on the subject.

Findings: Video games can benefit people with various disabilities and disorders - improving their physical fitness, sensorimotor coordination, spatial orientation, motivation and self-confidence. Players with disabilities can experience improvements in mental health, well-being, and behavioural change. Games focused on disability as a starting point stand out enormously. Identifying barriers among players with disabilities presents an opportunity to improve game design and development practices.

Social implications: Inclusivity and diversity in games mean opening up to an increasingly wide range of players - without dividing them by gender, ethnicity, cultural background or type of disability. A socially desirable approach in this regard should result in the ability to personalize characters in games with different skin colours, body sizes, and stories related to culturally diverse characters. In doing so, game designers should focus on friendly and healthy communication during gameplay.

Originality/value: The author directed the article to all interested in the gaming industry, including gamers with various disabilities and disorders, to make them aware that more and more improvements are for excluded groups. The numerous benefits for gamers with disabilities speak for the right direction of the industry. In the author's opinion, it is necessary to systematically check reports from the gaming world in the context of innovative facilities that contribute to bridging the exclusion of people with disabilities.

Keywords: gaming, people with disabilities, virtual reality, accessibility, inclusivity in gaming.

Category of the paper: General review.

1. Introduction

Information and communication technologies are now integral tools of the educational process. These technologies help students with various needs and disabilities, including those with special educational needs, change their attitude from passive to active, forming independence and autonomy in various activities. The importance of games, including digital games, as tools for the learning process, has grown tremendously in recent years, highlighting their numerous benefits (Chaidi, Drigas, 2022). ICTs are tools that enable people with disabilities to escape isolation and stigma. In addition, access to the Internet improves how people with disabilities assess their level and quality of communication with others, their sense of independence and self-determination (Dobransky, Hargittai, 2006).

Researchers also highlight the Internet's significant impact on sex education for excluded groups. They point to this medium as a potentially valuable source of comprehensive, interactive and youth-friendly sex education in reaching marginalized groups, including but not limited to people with disabilities (Franco Vega et al., 2022). However, according to the authors, it is unclear which elements of digital games facilitate positive outcomes to improve the sexual health of adolescents with disabilities. Further research is needed in this area, as relatively few studies were to date, with inconclusive results. There is, therefore, a good direction for the development of virtual reality as an opportunity for people with disabilities (Pereira et al., 2021).

People with intellectual and developmental disabilities (IDD) have less access to and participation in digital citizenship activities, putting them at greater risk of digital social isolation and lack of community involvement (Fisher et al., 2021).

A tremendous opportunity for a better understanding the needs and peculiarities of gamers with disabilities seems to be the fuller and more widespread presence of characters with disabilities in games. It could also contribute to eliminating mental limitations in a large community of gamers who often perceive disability in a stereotypical way and as a source of fear (Stasieńko et al., 2021).

The article's main objective is to identify potential directions for developing the gaming industry in the context of people with disabilities. The specific objectives are: to discuss the existing gaming solutions as facilities for people with disabilities and to present the directions of further development of the industry in this regard. The author studied the literature on the subject mainly from 2020-2022.

2. Methodology

The author used the desk research method. He analyzed the literature treating the development of gaming and virtual reality in bridging the exclusion of people with disabilities from the digital world. The bibliography includes 23 items, including scientific articles, reports and electronic sources - mainly from 2020-2022. In the desk research analysis, the author used the following scientific databases: PubMed, ResearchGate, Taylor and Francis Online. The author used mentioned scientific databases because of the collecting literature for this article about the purpose of the work.

3. Existing gaming solutions as facilities for people with disabilities and directions for further development of the industry

The field of adaptive video games has been proliferating in recent years. Many adaptive video game controllers are now accessible to people with disabilities who can access a standard controller. Facilities range from head-controlled pneumatic joysticks to customizable gaming platforms, allowing users to connect external joysticks and accessibility switches (Redepenning et al., 2022). Other conveniences for players with disabilities include the option to hold the button instead of button mashing, the option to auto-target opponents, and the option to change graphics, i.e. to distinguish the colour of opponents from each other and the environment (Malinowski, 2019). Assistive mode, on the other hand, is an option for players with visual, hearing and mobility impairments that allows them to customize gameplay more suitably. For example, one can turn on invincibility or disable automatic aiming (Harris, 2021).

Other gaming facilities for players with various disabilities include (Cieślak, 2022): the ability to change the size of the font according to one's preferences; the ability to distinguish critical elements of the game not only through colours but also through symbols; the ability to change the size of subtitles, as well as to increase the contrast of visual elements; the ability to change the mapping of keys according to one's preferences; the ability to change the required reaction time, the dead zone of analogues or slowing down the control; the ability to change the difficulty level of different elements of the game, independently of each other; the display of a maximum of two lines of subtitles containing 37 to 42 characters at any given time so as not to lead to cognitive overload; visual signals in the form of sound waves propagating from the direction of noise investigation. Other dedicated gaming solutions for people with dyslexia and epilepsy include the ability to scroll the subtitles further by pressing the appropriate button, use a particular font to make reading more accessible, and disable sequences with fast flashes (Cieślak, 2022).

Within the development of the gaming industry in the context of people with disabilities, several directions should be pointed out. Eye Gaze Gaming technology has excellent potential as a functional computer interface for children with severe dyskinetic cerebral palsy (DCP) (Bekteshi et al., 2020). The authors, based on the results of a pilot study to examine the ability of participants to acquire specific skills related to visual control in games, i.e. operational competence (screen navigation and dwell function), point to the possibility of improving communication skills and levels of participation and quality of life among players with DCP.

Promising potential for learning and competence acquisition by children and adolescents with cognitive or physical disabilities shows Serious Games (Keller et al., 2021). The results show that these games can effectively support subject-specific learning, acquiring learning-related skills, and improving behaviours necessary for this process. At the same time, Christopher Keller et al. (2021) indicate that the effectiveness of Serious Games, as well as approaches to their meaningful methodological and didactic integration into school lessons, have not yet been sufficiently studied, and further in-depth research in this area is needed.

Xiaoyi Hu et al. (2020) indicate the effectiveness and efficiency of computer-assisted visual association instruction for children with autism spectrum disorder (ASD) and other developmental disabilities. In their study, the authors compared the effectiveness and efficiency of using computer-assisted instruction (CAI) and teacher-implemented instruction (TII) to teach visual association skills to students with ASD or other developmental disorders. CAI included discrete trial instruction with a gesture-tracking application, while TII included traditional one-on-one instruction using cards. The results showed that both CAI and TII were effective. However, CAI was more effective than TII regarding the prompts and instructional session duration. CAI also resulted in greater student engagement in self-directed learning (Hu et al., 2020).

The potential for engagement, access and conceptual development of students with disabilities is Dream 2B, a universal online game about fractions. By helping students understand fractions, the game introduces them to the world of science, technology, engineering and mathematics, as well as information and communication technology (ICT). Complex mathematical content, such as fractions, is challenging for all students, especially those with mental retardation. The Dream 2B game provides students with multiple ways to access the material and demonstrate conceptual understanding of complex school material in an enjoyable way (Hunt et al., 2022).

The directions for further development of the gaming industry include combining video games with physical exercise, increasing players' motivation and shaping their physiological well-being. This solution can improve health and physical fitness and rehabilitate people with various disabilities and disorders. Active video games are a way to reduce sedentary behaviour and increase physical activity among people with physical disabilities and limitations in lower limb function (Rowland et al., 2016). Using an adapted controller provides a convenient way for people with mobility impairments to engage in active video games of light to moderate

intensity, reducing sedentary leisure lifestyles (Malone et al., 2021). According to a game design study focused on improving the lives of gamers, including those with disabilities and limitations, players show greater comfort when they realize that a motion-based form is in an environment familiar to them. However, at the same time, they are intrigued by the possibility of rediscovering the game through a new way of interaction (Kabir et al., 2020). Sofia Balula Dias et al. (2022) suggest more targeted activities and different game difficulty levels - consistent with the age and abilities of students with disabilities. Such adaptive game-based learning design with attention to the characteristics of students' disabilities is likely to increase their attention spans. Also important is the aspect of technology integration (Dias et al., 2022).

Another direction in developing the gaming industry is introducing an enhanced design and evaluation framework of eudaimonia (personal growth, expression) and hedonic (pleasure, comfort) into cooperative games for older adults using an electric wheelchair. The purpose of such a treatment is to satisfy two psychosocial well-being needs - perceived task mastery and empathy enhancement - through a game with an interactive format that enhances the experience of using an electric wheelchair. A mixed reality with interaction and mobility-based movement is occurring here. Compared to the game without it, the mixed reality version elicited eudaimonic experiences in adult participants, which included their perception of a positive change in the mastery of wheelchair-use skills (Seaborn et al., 2020).

Promising study results (Szczepańska-Gieracha et al., 2020) confirm the effectiveness of various forms of virtual reality (VR) therapy in alleviating psychological and behavioural problems and mental disorders among post-stroke patients. However, there is a lack of VR-based technological solutions that, in addition to physical rehabilitation, offer such patients therapeutic tools to alleviate psychological disorders and improve the patient's moods and motivation. According to the study's authors, such solutions have the potential for intensive research in the coming years.

Finally, games focused on disability or diseases that can lead to it stand out enormously. Disability is the starting point in these games, both in the narrative and mechanics. This situation shows that consistently appealing to the deep level of experiences, feelings and forms of perception of reality by people with disabilities makes it possible to create unique games. These types of games show high social impact. Sometimes, however, the game mechanics, narrative, or interface solutions are clunky, cumbersome and discouraging, so not all attempts are always successful. In doing so, the author would like to mention that independent developers create most such games, which come with various inconveniences and barriers - if only financially (Stasieńko et al., 2021).

4. Benefits of gaming for people with disabilities

For people with disabilities, technology plays a unique role in facilitating social interaction and interaction among people with disabilities. Technicization and advances in computer and communications technology allow these people equal access to many activities. The benefits of gaming for people with disabilities are enormous. Among them are (Chaidi, Drigas, 2022): gaining experience in everyday situations, developing problem-solving skills, preparing for social integration, increasing concentration, increasing satisfaction, perseverance, personal commitment to tasks, reducing anxiety, increasing initiative and the value of participation, feeling included in society, developing socialization. Irene Chaidi and Athanasios Drigas (2022) stress that integrating digital technologies into education is very productive in the context of special education by transforming learning into play. Using digital games is a valuable tool to support the development and social competence of people with various disabilities, including hearing or vision problems, mental retardation, learning disabilities, and pervasive developmental disorders. Virtual reality provides enjoyable entertainment and opportunity to develop motor, cognitive and social skills for people with disabilities (Dias et al., 2022).

Computer games can improve language, math and social skills and general knowledge for children with special educational needs. Such games can improve facial recognition skills, especially for children with autism. Through gaming, children with this type of disability can learn new skills and become less timid and confident. Computer games can also help children with developmental disabilities participate in job training and prepare for employment. For children with ADHD, on the other hand, gamified learning increases motivation and concentration and addresses their behavioural problems. Individualized and well-chosen games also improve visual perception and reasoning skills in children with learning disabilities (Stankova et al., 2021).

People with disabilities can temporarily disconnect from their "diagnosis-based" identities, physical and social limitations and stigmas by playing games. Playing provides them with a refuge for their identities, creates community and provides enjoyment. In addition, gamers with disabilities have significantly more positive perceptions of the impact of games on employment than their non-disabled counterparts (Weston et al., 2020).

In conclusion, video games can benefit people with disabilities by improving their physical fitness and sensorimotor coordination. They also prevent diseases such as asthma and diabetes. Players with disabilities improve body movements, spatial orientation, motivation and self-confidence. Mental health, well-being and behavioural change in people with disabilities are strengthened or improved through play (Weston et al., 2020). An essential piece of information in doing so is that, from the perspective of parents and professionals, investing in gaming equipment (PCs, game consoles, motion-controlled applications) is seen as a very effective

strategy to facilitate the participation of children with disabilities in society with their non-disabled peers (Steinhardt et al., 2021).

5. Limitations

This paper contains several limitations. First, the desk research analysis (excluding electronic sources) was based only on three scientific databases: PubMed, ResearchGate and Taylor and Francis Online. The failure to include other bibliographic databases in the analysis prevented the acquisition of other scientific publications potentially valuable to the analysis. However, this procedure was intentional, as the author cared about the same databases used in the first place. In continuing the thread of gaming in the context of people with disabilities, the author plans another publication soon - this time using other scientific databases. Secondly, the author is aware of the lack of inclusion of references to all types of disabilities in work. Such a step leaves room for analysis in subsequent studies. Finally, the identified gaming and virtual reality developments certainly do not exhaust the topic and contribute to further in-depth research in this area.

Despite the identified limitations of the paper, this article could form the basis for further complementary research in the future. Besides, a new survey could include the opinions of players with disabilities on accessible facilities - based on the author's CAWI survey.

6. Conclusions and recommendations

Despite the many benefits of gaming for people with disabilities, there are still not enough improvements for such players. The existing facilities for gamers with disabilities are insufficient for all types of disabilities and disorders. Therefore, access to many games for such groups is still a roadblock.

Besides, the topic of disability in games is still not enough. In their report, this situation is pointed out (Stasieńko et al., 2021). Despite showing characters with disabilities in games, they are "fixed" by futuristic implants, prostheses and exoskeletons. According to the authors above, characters with disabilities rarely appear in sports games, and there are practically no games with sports dedicated to people with disabilities. Finally, game designers often avoid the topic of disabilities in games. They do this to avoid offending the disability community by introducing unacceptable, schematic characters into games. On the other hand, designing elaborate disability mechanics requires more work, financial investment, and a non-standard approach to its creation.

Identifying barriers among players with disabilities can significantly contribute to improving practices in designing and developing educational games and can support the learning process. According to the study (Stankova et al., 2021), the three most severe barriers to accessing games among children with learning disabilities are the cost of the game, the lack of games that have severe educational and therapeutic effects, and the lack of information about access to quality games. Game designers should bridge the barriers above to increase the accessibility of games to excluded social groups.

As part of the recommendations, the author points to the phenomena of inclusivity and diversity in games, i.e. opening up to an increasingly wide range of players - without dividing them by gender, ethnicity, cultural background or type of disability. In the context of this approach, game designers should increasingly include the possibility of personalizing characters with different skin colours or body sizes, narratives related to culturally diverse characters, support for players with various disabilities and disorders, and healthy communication during gameplay.

References

1. Bekteshi, S., Konings, M., Vanmechelen, I., Deklerck, J., Ortibus, E., Aerts, J.-M., Hallez, H., Karlsson, P., Dan, B., Monbaliu, E. (2020). Eye Gaze Gaming Intervention in Children with Dyskinetic Cerebral Palsy: A Pilot Study of Task Performance and Its Relation with Dystonia and Choreoathetosis. *Developmental Neurorehabilitation*, 23(8), 548-556. <https://doi.org/10.1080/17518423.2020.1770890>.
2. Chaidi, I., Drigas, A. (2022). Digital games & special education. *Technium Social Sciences Journal*, 34, 214-236.
3. Cieślak, K. (2022). *Projektowanie gier dla osób z niepełnosprawnościami*. <https://tryevidence.com/pl/blog/projektowanie-gier-dla-osob-z-niepelnosprawnosciami/>.
4. Dias, S.B., Cano, S., Stasolla, F., Tlili, A., Burgos, D., Denden, M., Duan, A., Padilla-Zea, N., Huang, R., Sun, T. (2022). Game-Based Learning for Learners With Disabilities-What Is Next? A Systematic Literature Review From the Activity Theory Perspective. *Frontiers in Psychology*, 12, 814691. <https://doi.org/10.3389/fpsyg.2021.814691>.
5. Dobransky, K., Hargittai, E. (2006). The disability divide in internet access and use. *Information, Communication & Society*, 9(3), 313-334. <https://doi.org/10.1080/13691180600751298>.
6. Fisher, K.W., Williamson, H.J., Guerra, N., Kupferman, S. (2021). Digital Citizenship: Technology Access and Use for Youth With and Without Intellectual and Developmental Disabilities. *Inclusion*, 9(4), 263-275. <https://doi.org/10.1352/2326-6988-9.4.263>.

7. Franco Vega, I., Eleftheriou, A., Graham, C. (2022). Using Video Games to Improve the Sexual Health of Young People Aged 15 to 25 Years: Rapid Review. *JMIR Serious Games*, 10(2):e33207. <https://doi.org/10.2196/33207>.
8. Harris, B. (2021). *Why Assist Modes Should Feature in More Games*. <https://www.keengamer.com/articles/features/opinion-pieces/why-assist-modes-should-feature-in-more-games/>.
9. Hu, X., Lee, G.T., Tsai, Y.-T., Yang, Y., Cai, S. (2020). Comparing Computer-Assisted and Teacher-Implemented Visual Matching Instruction for Children with ASD and/or Other DD. *Journal of Autism and Developmental Disorders*, 50, 2540-2555. <https://doi.org/10.1007/s10803-019-03978-2>.
10. Hunt, J., Taub, M., Marino, M., Duarte, A., Bentley, B., Holman, K., Banzon, A. (2022). Enhancing Engagement and Fraction Concept Knowledge With a Universally Designed Game-Based Curriculum. *Learning Disabilities: A Contemporary Journal*, 20(1), 77-95. <https://files.eric.ed.gov/fulltext/EJ1339498.pdf>.
11. Kabir, M., Fahim Faisal Dhruba, Q., Mahmud, H., Kamrul Hasan, M., Rejwan Zaman, A. (2020). Gaming Insight: Conversion of Popular Sedentary Games into Motion-Based Form. *International Journal of Human-Computer Interaction*, 36(13), 1205-1215. <https://doi.org/10.1080/10447318.2020.1726597>.
12. Keller, C., Döring, A.K., Makarova, E. (2021). The Potential of Serious Games to Foster Learning among Children and Adolescents with Disabilities: A Systematic Review. *Digital Culture & Education*, 13(2), 6-36.
13. Malinowski, B.F. (2019). *Dostępność gier, czyli jak i po co projektować gry bez barier?* <https://antyweb.pl/dostepnosc-gier-czyli-jak-i-po-co-projektowac-gry-bez-barier>.
14. Malone, L.A., Davlyatov, G.K., Padalabalanarayanan, S., Thirumalai, M. (2021). Active Video Gaming Using an Adapted Gaming Mat in Youth and Adults With Physical Disabilities: Observational Study. *JMIR Serious Games*, 9(3). <https://doi.org/10.2196/30672>.
15. Pereira, F., Bermúdez Badia, S., Jorge, C., Cameirão, M.S. (2021). The use of game modes to promote engagement and social involvement in multi-user serious games: a within-person randomized trial with stroke survivors. *Journal of NeuroEngineering and Rehabilitation*, 18(62). <https://doi.org/10.1186/s12984-021-00853-z>.
16. Redepenning, D.H., Huss, S.A., Maddali, S. (2022). Influence of adaptive video gaming on quality of life and social relationships. *Assistive Technology*, 1-8. <https://doi.org/10.1080/10400435.2022.2067913>.
17. Rowland, J.L., Malone, L.A., Fidopiastis, C.M., Padalabalanarayanan, S., Thirumalai, M., Rimmer, J.H. (2016). Perspectives on Active Video Gaming as a New Frontier in Accessible Physical Activity for Youth With Physical Disabilities. *Physical Therapy*, 96(4), 521-532. <https://doi.org/10.2522/PTJ.20140258>.

18. Seaborn, K., Pennefather, P., Fels, D.I. (2020). Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being. *Human-Computer Interaction*, 35(4), 289-337. <https://doi.org/10.1080/07370024.2018.1555481>.
19. Stankova, M., Tuparova, D., Tuparov, G., Mihova, P. (2021). Barriers to the Use of Serious Computer Games in the Practical Work with Children with Educational Difficulties. *TEM Journal*, 10(3), 1175-1183. <https://doi.org/10.18421/TEM103-22>.
20. Stasieńko, J., Dytman-Stasieńko, A., Madej, K., Flamma, A., Śledź, M. (2021). Fragile Avatars? Representations of Disability in Video Games. In: *FRAGILE AVATARS? Representations of Disability in Video Games*. Wydawnictwo Naukowe Dolnośląskiej Szkoły Wyższej.
21. Steinhardt, F., Ullenhag, A., Jahnsen, R., Dolva, A.-S. (2021). Perceived facilitators and barriers for participation in leisure activities in children with disabilities: Perspectives of children, parents and professionals. *Scandinavian Journal of Occupational Therapy*, 28(2), 121-135. <https://doi.org/10.1080/11038128.2019.1703037>.
22. Szczepańska-Gieracha, J., Cieślik, B., Rutkowski, S., Kiper, P., Turolla, A. (2020). What can virtual reality offer to stroke patients? A narrative review of the literature. *NeuroRehabilitation*, 47(2), 109-120. <https://doi.org/10.3233/NRE-203209>.
23. Weston, A., Smith, T., Lu, Y. (2020). Perceived Impact of Video Gaming on Employment: Implications for Vocational Rehabilitation Counseling. *Journal of Rehabilitation*, 86(3), 33-41.

ANALYSIS OF THE FOURTH INDUSTRIAL REVOLUTION IN THE CONTEXT OF INNOVATION AND THE IDEA OF TECHNOLOGY DEVELOPMENT

Karolina CZERWIŃSKA¹, Andrzej PACANA^{2*}, Michalene Eva GREBSKI³

¹ Rzeszow University of Technology, Faculty of Mechanical Engineering and Aeronautics;
k.czerwinska@prz.edu.pl, ORCID: 000-0003-2150-0963

² Rzeszow University of Technology, Faculty of Mechanical Engineering and Aeronautics; app@prz.edu.pl,
ORCID: 0000-0003-1121-6352

³ Colorado Mesa University, 1100 North Avenue, Grand Junction, CO 81504 USA;
mgrebski@coloradomesa.edu, ORCID: 0000-0002-3487-4473

* Correspondence author

Purpose: The purpose of the study was to analyze the phenomena occurring in the industrial area as a result of the penetration and spread of new technologies and innovations within the framework of Industry 4.0, taking into account the possible forms and areas of their application in practice.

Design/methodology/approach: The research method was an analysis of the literature on the Fourth Industrial Revolution and our own observation of the changes occurring in the industrial area in the context of new technologies.

Findings: Currently, the industrial area and its innovative potential is conditioned by new technologies, which are increasingly (directly and indirectly) influencing production processes and manufactured products, while implying their continuous evolution. The study reveals a research gap regarding the lack of systematic research - analysis in the field of the degree and depth of the changes that have occurred, in which the products of the fourth industrial revolution affect the achievement of the adopted goals within the industrial sector and sustainable development.

Research limitations/implications: Future research directions will concern the scope of implications of Industry 4.0 creations in the industrial and service sectors and their impact on the operation of business entities. Another direction of research will be the question of the validity of the division of economic sectors in view of the significant interpenetration of the material, product and service spheres.

Practical implications: The results of the research indicate the possibilities of implication of Industry 4.0 creations (such as, but not limited to: advanced human-machine interfaces, Internet of Things platforms, intelligent sensors, cloud computing, 3D printing, mobile devices, data analytics and advanced algorithms, multifaceted customer interactions and their profiling) in order to increase the efficiency of processes implemented in manufacturing companies and increase their level of competitiveness.

Originality/value: Filling the research gap in the analysis of creations and improvements in the industrial area resulting from the diffusion of new technologies and innovations under Industry 4.0 and the possibilities of their implications. The research is addressed to the management of business entities.

Keywords: Industry 4.0, industrial revolutions, new technologies, management and quality.

Category of the paper: Research paper.

1. Introduction

Advances in the visualization of business models, advanced information and communication technologies, as well as information technology are the result of changes in existing customer expectations and preferences (Bembenek, 2017). These types of activities indicate the level of competitiveness of business entities, for this reason, it is noticeable that companies are striving to increase the area of investment projects. These activities determine the implementation of changes within the organizational structure, development strategy or introduction of changes within the implemented production processes. The aim of the undertaken improvements is to maintain a stable market position by maintaining the current number of customers and acquiring new ones, and ultimately to achieve an increase in profits from the sale of products and services provided (Kraszewska, Pujer, 2017; Pacana, Czerwińska, 2020).

The literature on the subject presents numerous studies relating to modern, process-based enterprise models. These models are distinguished by greater or lesser detail. It can be noted, however, that all models are based on the definition of the process, which is defined as a set of activities processing products of a similar nature and at the same time referring to a clearly defined range of knowledge. The enterprise model according to Deming is based on the pursuit of a high level of quality, whereas the prior model operating in the Taylor era was oriented towards ensuring productivity. Silvestro's model, on the other hand, is mainly oriented toward a quality management system (Silvestro, 1998). Zaskórski and Warszawski, on the other hand, proposed a process management model using modern tools currently implied in the solutions used in the fourth industrial revolution. In the framework of activities related to Industry 4.0, in which the integration of process activities within the information and decision-making plane and the dynamic cooperation of business entities focused on shared value, guided by decision-makers of decision-making processes, is crucial (Zaskórski, Warszawski, 2015).

A key component of the competitiveness of business entities is also the effective acquisition, collection of information resources and then their interpretation and processing into useful knowledge, which can increase the quality of the implemented processes, ensure their stability and reduce their execution time (Sobinska, 2016; Czerwinska et al., 2020). This creates the possibility of producing products adequate to individual customer demand and means optimizing the level of reputational risk. The risk refers to the possibility of dissatisfaction with the operation of products, the production of products that have non-conformities and, ultimately, their withdrawal from the sale or the obligation to cover repair costs (Szwajca et al., 2014; Szwajca, 2017; Pacana et al., 2020). Therefore, in the context of the development of manufacturing enterprises, it is important to expand the analytical and IT infrastructure, including from the implementation of such tools as cloud computing, Big Data, Internet of Things, as well as highly developed information systems (Smart Industry Poland Report, 2018). Efficient acquisition, processing and transfer of information in real-time make it possible to integrate the various planes operating within the company and adjust the company's offerings to the prevailing needs in the market while taking into account the predispositions and production capabilities of the organization (Kieltyka, 2017; Olender-Skorek, 2017; Czerwińska, Pacana, 2020).

The article is devoted to the fourth industrial revolution and innovation in the industrial sector. The purpose of the study was to analyze the phenomena occurring in the industrial field as a result of the penetration and spread of new technologies and innovations within the framework of Industry 4.0, taking into account the possible forms and areas of their application in practice.

2. Industrial revolutions

Over the past several hundred years, the development of civilization (and especially the economy) has proceeded in stages. The beginning of each stage was characterized by transformations resulting in significant changes in three main areas: economic, cultural and social life. Within the economic domain, the transformations were called industrial revolutions. So far, four such transformations have been identified. So far, the industrial revolutions have brought breakthroughs in production processes, mainly enabling the growth of efficient yet mass production of goods and provision of services. We are currently in the midst of the fourth industrial revolution (Gracel et al., 2017; Michalski, 2017). The main features of the four industrial revolutions are shown in Table 1.

Table 1.*Key features of industrial revolutions and technological breakthroughs*

Key features			
Industry 1.0	Industry 2.0	Industry 3.0	Industry 4.0
<ul style="list-style-type: none"> - Mechanization - invention of the steam engine, - The introduction of production into the era of industrialization - the transition from manufactures and craftsmen to mechanized production 	<ul style="list-style-type: none"> - Era of mass production - manufacturing identical products on production lines in large batches, - Electrification - replacement of steam engines, - Application of the concept of division of labor, - Specialized machinery and moving assembly lines, - Manufacturer develops product and produces it, assuming existing demand, - Reduction of the unit cost of the product, lowering prices, making the market offer more attractive and increasing demand for the product 	<ul style="list-style-type: none"> - Digitization - made it possible to control machines with software, - Automation of machines - greater efficiency and flexibility, - Mass customization, i.e. meeting the needs of more customers, - Variation of products based on their modularity 	<ul style="list-style-type: none"> - New information technologies - systems integration and networking, - Integration of man with machine, with the process, - Increased product traceability, - Smart products or services, - Value paradigm shift, - Transfer of decision-making processes to the virtual world, - Personalizing production - the customer becomes an active participant in the design of the product or service

Source: own compilation based on: (Wodnicka, 2021).

The beginning of first industrial revolution took place at the end of the 18th century. The main changes were identified within three levels. The first was a technical breakthrough within industrial production. This breakthrough was based on mechanization, i.e., a shift away from manual labor toward work done through a machine. The key invention in this period turned out to be the steam engine, which began the era of industrialization. At that time, water pores and water began to be used as the driving force for machinery. The steam engine found a wide range of applications, and was used in steam stagecoaches, steam locomotive structures, steam hammers for forging metals, tractors and printing machines, among others. The second was related to the economic breakthrough based on changes in production organization and economic calculation. The third, on the other hand, was related to social structure - lifestyle changes. Urban society began to change into an industrial one, and there was intellectual development of society (Michalski, 2017; Janikowski, 2017).

The start of the second industrial revolution is indicated in the second half of the 19th century and the beginning of the 19th century. This revolution was associated with the popularization of electricity and the final development of electrification, lighting and the emergence of a significant number of technical solutions, such as the method of oil ratification (1852), the kerosene lamp (1853), the light bulb (1879), the telephone (1879), the internal combustion engine (1897), dynamite (1867) (Michalski, 2017).

The beginning of the third industrial revolution took place in the 1960s/70s. This revolution mainly concerned the scientific and technical areas. The third revolution is identified with computerization, the implementation of new IT solutions, the digitization of production and the use of new sources of energy generation. The development of high technology, automation of work, as well as the development of telecommunications and transportation are also features of this revolution. The third revolution saw the widespread use of IT systems for production planning and control, as well as robots cooperating with humans. The result of this revolution was also a boom in online services, the possibility of e-purchasing and other online activities was created (Rifkin, 2012; Michalski, 2017).

Industry 4.0 is a concept based on technologies enabling the integration of people, machines and processes. It refers to the exchange of information between systems, equipment and management, providing convenient access to processed information at any time and from anywhere. The Fourth Industrial Revolution points to the process of integrating smart solutions that relate to new roles taken by available human resources, new ways of working, and IT systems and devices (Schwaba, 2016; Pietraszek et al., 2020). It focuses attention on a relational approach concerning human-machine interfaces, i.e. both horizontal and vertical integration of production systems, which is determined by the exchange of user data in real-time, and a flexible production system adequate to customer needs and prevailing market conditions. A number of solutions used within the framework of Industry 4.0 are presented in the literature (Poplawski, Bajczuk, 2019; Li et al., 2017; Ustundag, Cevikcan, 2017).

3. The fourth industrial evolution in the context of the development of technology

Technology has accompanied humans since they consciously began using tools to achieve their goals. It is worth considering more broadly the human labor view. Human labor should be understood as socially realized labor, assuming that the birth of the individual is at the same time the birth of human society, since the two variables cannot be separated. Referring to human labor, technology can be understood as a tool for shaping reality. Taking the presented view of the essence of technology for human development and labor, the necessity of a rational effort to look at the entire development of technology based on the plane of true value becomes important. As part of this, it is important to pay attention to the changes bearing the name of revolutionary within the framework of industrial development (Peterson, Schaefer, 2014; Quina et al. 2016).

Figure 1 captures the most significant inventions whose emergence revolutionized industry from a historical perspective. After the stage of mechanical production (Industry 1.0 - mechanization), through mass production (Industry 2.0 - electrification) and computer-controlled production (Industry 3.0 - digitization), there was a period of a homogeneous cyber-physical system, which means the unification of the real functioning of machines with the virtual world of the Internet and information technology and people. The factors starting each industrial revolution and at the same time triggering changes in production and management processes and the products and services themselves are disruptive technological innovations.





INDUSTRY 1.0	<p>The first industrial revolution Mechanization</p> <ul style="list-style-type: none"> • Mechanical control (cams) • Steam engines 
INDUSTRY 2.0	<p>The second industrial revolution Electrification</p> <ul style="list-style-type: none"> • Punched cards for recording information • First production lines 
INDUSTRY 3.0	<p>The third industrial revolution Digitization</p> <ul style="list-style-type: none"> • Microcontrollers for machine control • Increase in automation • IT systems for production planning and control 
INDUSTRY 4.0	<p>The fourth industrial revolution Networking/Internet</p> <ul style="list-style-type: none"> • Vertical and horizontal networking of computers and machines using Internet standards • Identifiable and communicable objects • Self-improving objects 

Figure 1. Summary of the most important achievements of the industrial revolutions. Source: own compilation based on: (Strcuła et al., 2018).

So far, industrial revolutions, that is, up to and including the Third Revolution, have been exhaustively described in the literature in the context of the changes and consequences that were associated with their emergence of changes and consequences that were associated with their occurrence (Melnik et al., 2019; Pozdnyakova et al., 2019; Ratajczak, Wozniak-Jêchorek, 2020; Zamorska, 2020). For this reason, the changes conditioned by the current revolution - Industry 4.0 - deserve special attention.

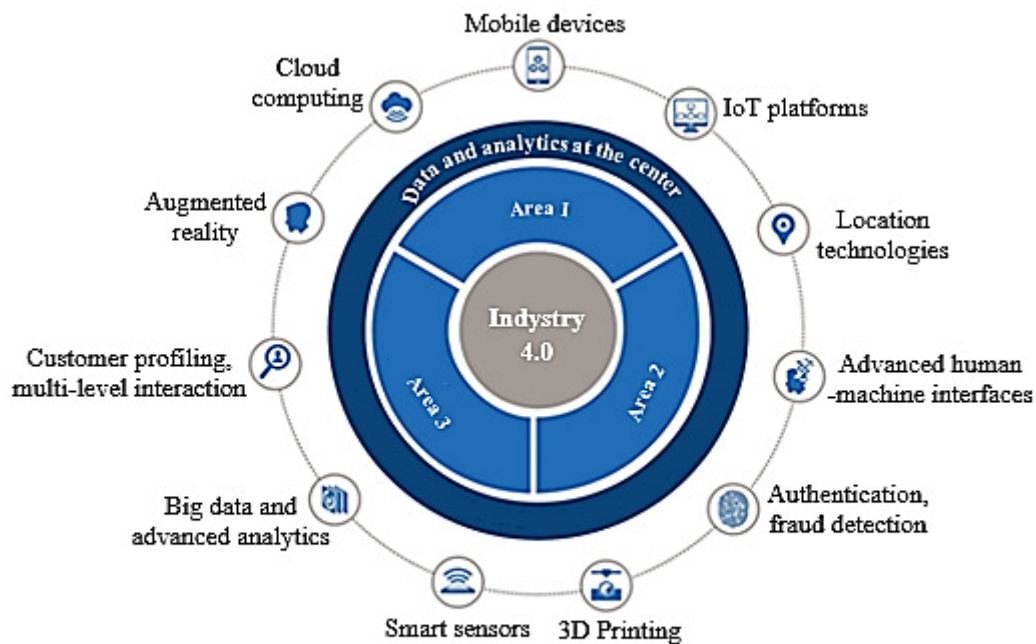
About technology, the fourth revolution is associated with the creation of (Mączyńska, 2011; Hahn, 2020; Xu et al., 2018):

- a new method of communication that does not only involve people, but also devices and machines,
- highly developed interfaces that function between man and machine and machine and man,
- internet cloud computing, whose reaction dynamics siege milliseconds,
- techniques for simulating the operation of real objects in a virtual mapping environment, thus making it possible to verify and optimize manufacturing processes before implementing real adjustments.

The technical advances of Industry 4.0 outlined have contributed to (Götz, Gracel, 2017; Furmanek, 2018; Skilton, Hovsepian, 2018), among other things:

- integrating available digital and physical resources,
- changes in the area of communication and the work of individuals,
- the emergence of new philosophies and business models in the management of contemporary economic entities,
- implementation of innovations contributing to efficiency leaps in specific manufacturing areas,
- 24/7 access of societies to products, goods, services, and thus to consumption,
- personalization of production through increased individualization and expansion of the importance of consumers,
- changes in transportation, education, health systems and other areas of the economy,
- visualizing changes in the global labor market - the impact of the processes of platformization and digitization of work, especially in terms of: labor demand and new hiring patterns, increased labor mobility of workers.

In the context of the indicated effects of the Fourth Industrial Revolution, the term Industry 4.0 can be defined as a highly developed digital transformation of chains with vertical and horizontal linkages in terms of units, combined equipment and machines, manufactured products, provided services and business models, whose main links are the Internet of things, Internet of services, cyber-physical systems and so-called smart factories (Figure 2) (Furmanek, 2018).



Legend:

- Area 1. Digitization and integration of value chains horizontally and vertically
- Area 2. Digitization of products and service offerings
- Area 3. Digitization of business models and access to customers

Figure 1. Industry 4.0 basics Source: *Przemysł 4.0, czyli wyzwania współczesnej produkcji* (2017). Warszawa: PWC.

Figure 2 provides a graphic depiction of the essence of Industry 4.0 in the context of the development of technology, as a combination of digitization processes and 21st-century human activity products, such as advanced human-machine interfaces, Internet of Things platforms, smart sensors, cloud computing, 3D printing, mobile devices, data analytics and advanced algorithms, multi-faceted customer interactions and their profiling. The products of Industry 4.0 promote cost reduction for manufacturing companies and improve their efficiency. They contribute to shortening production processes and testing phases. They make it possible to extend the life and usefulness of products, while ensuring flexible response and supplier substitutability thanks to a cohesive network. In addition, it enables the production of individual pieces of products without limiting profitability to mass production (Miśkiewicz and Wolniak, 2020). Industry 4.0 is expected to be a guarantee of maintaining competitiveness by enabling business entities to adapt their offerings to the ever-changing needs of customers and the market, as well as expectations of high quality. However, before manufacturing companies can take full advantage of the application opportunities created by Industry 4.0, which will begin to have positive effects on the economy, it becomes important to both adequately ensure network security and data transmission quality. It is likely that the efficiency of Internet connections will determine the success of the idea of smart factories (Wolniak, Skotnicka-Zasadzień, 2014; Ingaldi, Ulewicz, 2019).

When considering the results of the Fourth Industrial Revolution in terms of the development of technology, including the inventions and discoveries that took place as part of Industry 4.0, it is also worth noting a particular challenge from the area of the modern knowledge economy - artificial intelligence. Many scientists are seeking answers to questions such as how human knowledge is built and how it can be applied to action and problem-solving. The research conducted on the mechanisms of human intelligence has contributed to the emergence of a field of science called "artificial intelligence." Within the framework of this science, there are activities related to the construction and modeling of systems that provide support and even replace creative and rational human actions (King et al., 2017). In its experimental stream, artificial intelligence (applied artificial intelligence) is treated as a branch of computer science (including divisions: expert systems, systems with a knowledge base, natural language processing, theorem proving and inference, games, simulation, robotics and others), while in its theoretical stream, artificial intelligence integrates relevant issues from electronics, computer science, neurophysiology, mathematics, as well as psychology, anthropology and philosophy (Tegmark, 2017; Denning, Denning 2020; Homes et al., 2021).

In the future, industrial production will be performed by integrally connected technological systems. The Fourth Industrial Revolution is a step in the context of the development of the economy, while for manufacturing companies it means the emergence of a new business model. It implies the need to engage new technologies and innovations for the provision of public goods (Götz, 2018).

4. Conclusions

Currently, one of the criteria for increasing the level of innovation within the industrial sector and the processes implemented in manufacturing companies is both the development of new technologies and the rate of their absorption by organizations. Industry 4.0 makes it possible to create new innovative technologies, as well as to improve and modify existing ones.

The purpose of the study was to analyze the phenomena occurring in the industrial area as a result of the penetration and spread of new technologies and innovations within Industry 4.0, taking into account the possible forms and areas of their application in practice.

As a result of the analysis of available scientific studies, it was found that currently the industrial area and its innovative potential are conditioned by new technologies, which increasingly (directly and indirectly) affect production processes and manufactured products, at the same time implying their continuous evolution. It is worth noting that most of the literature is focused on the general discussion of the concepts and theories of Industry 4.0. There is a noticeable lack of systematic research on the industrial sector, specifically, established information on possible applications in this sector, the actual use of Industry 4.0

creations and their benefits. This will require systematic and in-depth research. The study also reveals a research gap relating to the lack of analysis on the extent and depth of the changes that have occurred, to which the creations of Industry 4.0 affect the achievement of the adopted goals within the industrial sector and sustainable development.

Analysis of the most relevant phenomena describing Industry 4.0 facilitates the direction of further development of production systems. For this reason, future research directions will concern the extent of the implications of Industry 4.0 creations in the industrial and service sectors and their impact on the functioning of business entities. Another direction of research will be the question of the validity of the division of economic sectors given the significant interpenetration of the material, product and service spheres. The research is addressed to the management of manufacturing business entities.

References

1. Bembenek, R. (2017). Klastry przemysłu 4.0 w zrównoważonej gospodarce opartej na wiedzy. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Nr 491*.
2. Czerwińska, K., Pacana, A. (2020). Analiza zarządzania ciągłością wiedzy w nowoczesnym przedsiębiorstwie. *Problemy Jakości, 52*.
3. Czerwińska, K., Pacana, A., Dwornicka, R. (2020). Improvement of the production process with the use of selected KPIs. *System Safety: Human-Technical Facility-Environment, 2(1)*.
4. Denning, P.J., Denning, D.E. (2020). Dilemmas of Artificial Intelligence. *CACM, No. 3, 63*.
5. Furmanek, W. (2018). Najważniejsze idee czwartej rewolucji przemysłowej. *Dydaktyka Informatyki, 13*.
6. Götz, M. (2018). Przemysł czwartej generacji (przemysł 4.0) a międzynarodowa współpraca gospodarcza. *Ekonomista, 4*.
7. Götz, M., Gracel, J. (2017). Przemysł czwartej generacji (Industry 4.0) – wyzwania dla badań w kontekście międzynarodowym. *Kwartalnik Naukowy Uczelni Vistula, 1(51)*.
8. Gracel, J., Stoch M., Bieguńska, A. (2017). *Inżynierowie Przemysłu 4.0 (Nie)gotowi do zmian?* Kraków: Astor Publishing.
9. Hahn, B. (2020). *Technology in the industrial revolution*. Cambridge: Cambridge University Press.
10. Homles, W., Bialik, M., Hadel, C. (2021). *Artificial Intelligence in Education. Promises and Implications for Teaching and Learning*. Boston: Center for Curriculum redesign.
11. Ingaldi, M., Ulewicz, R. (2019). *Problems with the Implementation of Industry 4.0 in Enterprises from the SME Sector. Sustainability, 12(1)*.

12. Janikowski, R. (2017). Środowiskowe aspekty czwartej rewolucji przemysłowej. *Studia i Prace WNEiZ US, Problemy współczesnej ekonomii, Nr 47, T. 22.*
13. Kiełtyka, L. (2017). Inspiracje i innowacyjność w zarządzaniu współczesnymi organizacjami. Wykorzystanie nowoczesnych technologii w tworzeniu innowacyjnych strategii organizacji. *Przegląd Organizacji, Nr 7.*
14. King, B.A., Hammond, T., Harrington, J. (2017). Disruptive Technology: Economic consequences of artificial intelligence and the robotics revolution. *J. Strategy. Innov. Sustain, 12.*
15. Kraszewska, M., Pujer, K. (2017). *Konkurencyjność przedsiębiorstw. Sposoby budowania przewagi konkurencyjnej.* Wrocław: Wydawnictwo Exante.
16. Li, G., Hou, Y., Wu, A. (2017). Fourth industrial revolution: technological drivers, impacts and coping methods. *Chinese Geographical Science, vol. 27.*
17. Mączyńska, E. (2011). Dysfunkcje gospodarki w kontekście ekonomii kryzysu. *Zeszyty Naukowe PTE, 9.*
18. Melnyk, L., Kubatko, O., Dehtyarova, I., Matsenko, O., Rozhko, A., Rozhko, O. (2019). The effect of industrial revolutions on the transformation of social and economic systems. *Problems and Perspectives in Management, 17(4).*
19. Michalski, M. (2017). Od I do IV Rewolucji Przeysłowej. *Człowiek w Cyberprzestrzeni, 1.* Warszawa.
20. Miśkiewicz, R., Wolniak, R. (2020). *Practical application of the Industry 4.0 concept in a steel company. Sustainability, 12(14).*
21. Olender-Skorek, M. (2017). *Czwarta rewolucja przemysłowa a wybrane aspekty teorii ekonomii. Nierówności Społeczne a Wzrost Gospodarczy, Nr 51.*
22. Pacana, A., Czerwińska, K. (2020). *Improving the quality level in the automotive industry. Production Engineering Archives, 26.*
23. Pacana, A., Czerwińska, K., Bednářová, L., Džuková, J. (2020). *Analysis of a practical approach to the concept of sustainable development in a manufacturing company in the automotive sector. Waste Forum, 3.*
24. Peterson, A., Schaefer, D. (2014). Social Product Development: Introduction, Overview, and Current Status. In: D. Schaefer (Ed.), *Product Development in the Socio-sphere: Game Changing Paradigms for 21st Century Breakthrough Product Development and Innovation, Springer International Publishing, 16.*
25. Pietraszek, J., Radek, N., Goroshko, A.V. (2020). Challenges for the DOE methodology related to the introduction of Industry 4.0. *Production Engineering Archives, 26.*
26. Popławski, K., Bajczuk, R. (2019). *Przemysł 4.0. Nowa polityka przemysłowa Niemiec.* Warszawa: Ośrodek Studiów Wschodnich.
27. Pozdnyakova, U.A., Golikov, V.V., Peters, I.A., Morozova, I.A. (2019). Genesis of the Revolutionary Transition to Industry 4.0 in the 21st Century and Overview of Previous Industrial Revolutions. In: E. Popkova, Y. Ragulina, A. Bogoviz (eds.), *Industry 4.0:*

- Industrial Revolution of the 21st Century. Studies in Systems, Decision and Control, vol. 169.*
28. Qina, J., Liua, Y., Grosvenora, R. (2016). A Categorical Framework of Manufacturing for Industry 4.0 and Beyond. *Procedia CIRP*, 52.
 29. Raport Smart Industry Polska (2018). *Innowacyjność w sektorze mikro oraz małych i średnich przedsiębiorstw produkcyjnych w Polsce*. Warszawa.
 30. Ratajczak, M., Woźniak-Jęchorek, B. (2020). Rewolucje przemysłowe i ich wpływ na rozwój ekonomii. *Studia BAS. Gospodarka, rynek i państwo wobec rewolucji technologicznej*, 3.
 31. Rifkin, J. (2012). *Trzecia rewolucja Przemysłowa. Jak lateralny model władzy inspirowane całe pokolenie i zmienia oblicze świata*. Katowice: Wydawnictwo Sonia Draga.
 32. Schwab, K. (2016). *The fourth industrial revolution*. Geneva, Switzerland: World Economic Forum.
 33. Silvestro, R. (1998). The Manufacturing TQM and Service Quality Literatures: Synergistic or Conflicting Paradigms? *International Journal of Quality & Reliability Management*, No. 3.
 34. Skilton, M., Hovsepian, F. (2018). *The 4-th Industrial Revolution. Responding to the Impact of Artificial Intelligence on Business*. Cham: Palgrave Macmillan.
 35. Sobińska, M. (2016). Rola IT we współczesnych modelach biznesu. *Informatyka Ekonomiczna, Nr 3(41)*.
 36. Stecuła, K., Brodny, J., Puzik, K. (2018). Stan i perspektywy zastosowania osiągnięć idei czwartej rewolucji przemysłowej w branży górniczej. *Innowacje w zarządzaniu i inżynierii produkcji, T. 1*. Opole: Oficyna Wyd. Polskiego Towarzystwa Zarządzania Produkcją.
 37. Sz wajca, D. (2017). Media społecznościowe jako źródło ryzyka reputacyjnego przedsiębiorstwa. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, Nr 322*.
 38. Sz wajca, D., Rydzewska, A., Nawrocki, T. (2014). Identyfikacja kosztów pogorszenia reputacji przedsiębiorstwa z perspektywy interesariuszy. *Przegląd Organizacji, Nr 4*.
 39. Tegmark, M. (2017). *Life 3.0: Being Human in the Age of Artificial Intelligence*. Knopf Doubleday Publishing Group.
 40. Ustundag, A., Cevikcan, E. (2017). *Industry 4.0. managing the digital transformation*. Switzerland: Springer International Publishing.
 41. Wodnicka, M. (2021). Wpływ czwartej rewolucji przemysłowej na innowacyjność usług. Wydawnictwo Uniwersytetu w Białymstoku Optimum. *Economic Studies, Nr 3(105)*.
 42. Wolniak, R., Saniuk, S., Grabowska, S., Gajdzik, B. (2020). *Identification of energy efficiency trends in the context of the development of industry 4.0 using the Polish steel sector as an example*. *Energies*, 13(11).
 43. Xu, M., David, J.M., Kim, S.H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, 9(2).

44. Zamorska, K. (2020). Pięć rewolucji przemysłowych – przyczyny, przebieg i skutki (ujęcie historyczno-analityczne). *Studia BAS. Gospodarka, rynek i państwo wobec rewolucji technologicznej*, 3.
45. Zaskórski, P., Warszawski, P. (2015). Model zarządzania procesowego w doskonaleniu systemów logistycznych. *Gospodarka Materialowa i Logistyka*, Nr 5.

TALENT MANAGEMENT IN POLISH COMPANIES IN THE LIGHT OF EMPIRICAL STUDIES

Irena DUDZIK-LEWICKA

University of Bielsko-Biala, Department of Marketing and Entrepreneurship; idudzik@ath.bielsko.pl,
ORCID: 0000-0002-3497-8934

Purpose: The aim of the paper is the introduction of talent management practices that are applied in Polish companies in the context of effectively identifying, developing and retaining talent within the company.

Design/methodology/approach: The approach applied in the paper is of descriptive-empirical nature. The research methods involved in this paper are: induction, deduction, literature studies, as well survey and data analysis.

Findings: On the basis of the analysis of the research material - in the conclusion - recommendations are presented for Polish companies to implement the practices of talent management programs talents.

Research implications: Future research directions should focus on further extended research exploration in this area, taking into account various companies, both small, medium and large.

Practical implications: The presented research results (from 2006 to 2018) make an important contribution to the existing knowledge on building and implementing talent management programs in a company and have a number of practical implications mainly for HR professionals.

Social implications: Building awareness of talent management issues in the company.

Originality/value: The research findings and opinions have both theoretical and practical implications, which can be used to shape and optimize management practices with regard to talent employees. The work has cognitive value for managers, HR departments, people managing human resources, as well as for people interested in the topic of talent management and employee development. It may also be of interest to academics, providing them with a source of inspiration for research work.

Keywords: talent, talent management, human capital, Polish companies.

Category of the paper: research paper.

1. Introduction

Talent management (TM), both in terms of individuals and the entire process of developing and achieving an organization's goals, is currently one of the biggest global trends. The success of a company¹ nowadays is based not only on the struggle of competing companies, but also on the ability to attract the best talented individuals. Undeniably, talent management has become one of the main strategic elements of the functioning of a modern organization and is gaining in importance every year. Confirmation of this thesis is provided by numerous scientific studies available in the literature. This claim is also substantiated by the results of studies conducted in Poland by actively operating training and consulting companies. This study includes considerations of the talent management process. The purpose of the essay is to introduce the talent management practices used in Polish companies in terms of their effective operating strategy for the various phases of the process. The essay reveals the concept and essence of talent, as well as the complexity and definitional diversity of the talent management process, presents synthetically collected research results from House of Skills and HRM partners S.A. on talent management in Polish companies, as well as presents selected results of our own research of the issue. The purpose of this interpretation is to better understand the present issue, as well as its dynamics, and to present in conclusion areas for further improvement in the talent management process in Polish companies. The analysis of gathered material and literature studies devoted to talent management has made it possible to carry out the task, at the same time shaping the layout and scope of the present article.

2. "Talent" and "talent management" in literature

A highly dynamic nature of changes in business environment has facilitated transition from the industrial era to the world ruled by knowledge and information. Progress has put more focus on human resources which started to be perceived as crucial determinants of enterprise development. Together with advancing globalization, social-and-demographic changes and turbulent environment, the concept of human capital has gained the status of a strategic factor in business organizations. Thus, the run for best employees, i.e. talents, has started.

Both in practical management and management theory, there is no unique definition of talent to be found. The experience of organizations described in thematic literature teaches us that the definition of talent is made up to a great extent by companies themselves,

¹ The author uses the following terms: enterprise, company and organization inter-changeably with reference to micro-economic business entities. Such an approach is resultant from stylistic purposes and goes in tandem with a common understanding of these terms, which are frequently used interchangeably in thematic literature.

as by implementing new solutions or introducing novel concepts it is always necessary to adjust them to already existing standards according to which the organizations function (Cannon, McGee, 2007, pp. 4-6). Thus, talent can mean whatever a business owner or organizational manager wants it to mean, as each has its own view of what should be understood by its term and meaning (Ulrich, 2011, pp. 189-211). Such dissonance is also characteristic of academic publications devoted to organizational aspects of human resource management (Janowski, 2017, pp. 29-31). It seems, therefore, that the development of a consensus when defining this concept is an extremely important step on the way to introducing effective talent management.

An attempt to define talent has been made by T. Ingram and team. Having analyzed the concept, they identified three main categories of a talent-based idea: the characteristics of talent as a person, the activities characteristic of talent, and the object of talent's influence (Ingram, 2011, pp. 17-18). Exemplary definitions according to every category have been provided in Table 1.

Table 1.
Definitions of talent

Definition by	Definition
First category	
S. Borkowska	Talent is a creative, resourceful person with a high potential for development that can trigger and foster a company's value.
L. Barlow	Talent is a person inclined to face challenges, who cares about personal growth, with a company's adequate support.
Second category	
T. Listwan	Talent is made by: extraordinary abilities, specific skills, creativity and deep involvement in tasks.
D. Ulrich	Talent = competence x involvement x contribution
Third category	
V. Garrow, W. Hirsch	Talents are people with a great potential, who are of special value to an organization.
C. Zheng, C. Soosay, P. Hayland	Talents are people capable of creating organizational effectiveness, who help to maintain a competitive advantage.

Source: own analysis based on: (Borkowska, 2005; Barlow, 2006; Listwan, 2022; Ulrich, 2008; Ulrich, Smallwood, 2012; Zheng, Soosay, Hayland, 2008, Ingram, 2011; Juchnowicz, 2014).

Talent management is a relatively new concept of action. The growing popularity of the concept in this case obliges a precise definition of the essence of talent management. However, in the literature, just like the concept of talent, the concept of talent management is not clearly defined. There are many interesting concepts on the essence of talent management. In M. Armstrong's work, the term talent management can be attributed to succession planning and to activities aimed at employee development (Armstrong, 2011). The author believes that this concept brings nothing new to known human resource management processes, apart from an eloquent name. Talent management should be treated as a universal set of activities. It aims to secure the flow of talents in the organization, treating it as one of the company's key resources (Balcerzyk, Matera, 2019, p. 11). Based on the achievements of R.E. Lewis and R.J. Hackman, talent management should be considered in three basic trends:

- in the first perspective, talent management is perceived as a set of standard practices, activities and functions of human capital management. These include, for example, recruitment, selection and development,
- the second approach concerns activities within the talent pools. The inflow of employees is subject to analysis and control. The employed are assigned to the appropriate job positions,
- the third view, whose center is talent itself, distinguishes two different tendencies (Lewis, Hackman, 2006). The first one assumes that talents are people with high potential. They should be sought, recruited and rewarded for the results achieved. The second approach considers talent as undifferentiated good. The role of the executive personnel is to manage the overall talent to achieve the best possible results (Balcerzyk, Matera, 2019, p. 11).

According to a pragmatic approach, represented by E. Maliszewska, talent management consists in searching for talented individuals within or outside company structures, and once found, taking special care of them by facilitating their self-development, offering business trainings and helping them with adequate career planning. It is also important to make sure that the payment offered is accurate and satisfactory so that the talents could stay resistant to enticement from other employers and stick to their current business engagement (Maliszewska, 2005, p. 79). On the other hand, Ł. Sienkiewicz defines talent management as identification, development, preservation, involvement and proper use of talents under specific organization conditions (Sienkiewicz, 2007, p. 32). T. Listwan describes talent management as a group of actions that are directed towards outstandingly skilled individuals and which are taken with the aim to facilitate talent growth and effectiveness to benefit fulfilment of an organization's goals (Listwan, 2010, p. 21). Thus, despite the discrepancies in the way the concept is interpreted, many researchers show a consensus on the main feature of this issue. Talent management undeniably refers to talented individuals who are of great importance to their company.

The activities undertaken within the framework of the talent management concept are a certain complex process of a holistic nature, the purpose of which is to make the best use of talent in the organization. The multifaceted nature of the issue forces the existence of many models and research approaches describing the phenomenon in question. The basis of the model developed by T. Listwan (2022) is the separation of three main phases of the talent management process in an organization: entry (acquisition of talent through recruitment and selection, as well as their identification from among existing employees), transformation (motivation, training, development, assessments) and exit (includes activities aimed at retaining talent in the organization and dealing with the situation of their departure). The approach emphasizes linking talent management to company goals, strategy (including HR strategy), values and organizational conditions. A more detailed approach talks about identifying, developing, retaining, engaging and properly utilizing talent in specific organizational conditions (Pocztowski, 2008, pp. 61-62). In this author's model, the talent management strategy details

the human resources strategy, which in turn is derived from the organization's business strategy. An important aspect influencing all processes here is the labor market, particularly supply, demand and compensation issues (Mróz, 2015, pp. 98-99).

The connection of the concept of talent management with the company's business strategy is the dominant theme of many interesting research proposals, all of which, due to the volume limitations of this paper, it is impossible to cite here. Models that emphasize the importance of considering talent management in relation to organizational strategy are described in the Polish-language literature by, among others, H. Bieniok (2010, p. 23), T. Ingram (2011, p. 49), or A. Miś and A. Pochtowski (2016, p. 65), and in the English-language literature by M. Armstrong (2011, pp. 504-506), R. Silzer, B. Dowell (2010, pp. 21-22), or J. Cannon and R. Mc Gee (2015, pp. 28-39).

3. Talent management – practices in Polish companies

Every organization, in order to stay in the market, must try to improve its competitiveness. Perhaps the term competitiveness was used in Polish literature for the first time by S. Flejterski, who described it as “the ability to design, create and sell goods whose prices, quality and other added values are more attractive than those of comparable products offered by competitors” (Flejterski, 1984, p. 391). M.J. Stankiewicz defines competitiveness as a feature characterizing the members of competition (Stankiewicz, 2002, p. 30). On the other hand, M. Gorynia assumes that “competitiveness means the ability to compete, i.e. to act and survive in competitive surroundings” (Gorynia, 2009, p. 51). Many factors influence the competitiveness of an organization. One of the important ones is the quality of human capital. The strategies of today's organizations are making increasing demands. Wanting to respond to the ambitious plans of business, the HR function strives to provide the best possible employees, capable of achieving more and more, faster and in new ways. Companies are faced with the challenge of dynamically developing the business and, through it, the employees. Key employees are of particular importance in this. Therefore, leading consulting and training companies decided to look at the talent management practices of companies in the Polish market. How do companies think about key employees and how do they manage them? Synthesized selected results of the companies' research: House of Skills and HRM partners S.A. are presented in tables 2 and 3.

Table 2.
Selected results – a dynamic approach

Author's own research	
Research method	<p>Since 2006 House of Skills has been conducting studies devoted to talent management in Polish companies. Until now, they have realized two research campaigns: in 2006 and in 2015. The first edition was organized together with The Conference Board association, while the partner of the second event was SAP Polska. The study was based on two primary methods: on-line questionnaire and individual interviews, which made it possible to gather both quantitative and qualitative data. In 2006, the quantitative data consisted in personal application forms distributed to HR managers of 300 biggest enterprises in Poland (according to the ranking of 500 top companies published by Rzeczpospolita newspaper). The data obtained from 34 correctly filled-in forms was supplemented with remarks provided by HR managers of key branches of Polish enterprises. The study lasted between July and September 2006. On the other hand, the report from 2015 was based on data collected via personal surveys distributed to a group of big companies operating on the Polish market and hiring above 250 employees each. On-line version of the questionnaire was filled in by 22 firms. 15 companies took part in a personal interview. The study was carried out between June and August 2015.</p> <p>The limitations of the research study - relatively small research sample.</p>
Definition of talent	<p>Almost all companies that took part in 2006 study considered talent as a person with a higher, outstanding potential. However, throughout the current decade and since the first research edition we have witnessed a certain transformation of this approach. Nowadays, organizations take a broader look and tend to believe that a talent is a person capable of rapid learning, adjustment to changes and role-swapping, determined by specific business needs.</p>
The importance and scope of talent programs in Polish companies	<p>In 2006, 94% of HR Managers were convinced that the process of talent management would gain on popularity and importance in the future. This belief must have been reflected in the fact that as many as 73% of the surveyed companies were running a program devoted to talent management. In 2015, already 85% had it applied. What is more, the majority of respondents declared the intention to continue talent programs and re-launch them in the future. This may point to a gradually increasing effectiveness of these processes, and to numerous benefits they bring to business organizations. Personal opinions seem only to corroborate this statement: in 2006 people saw both advantages and consequences of introduced talent programs, whereas now they derive pure benefits out of programs run in their companies.</p>
Aims of talent programs	<p>According to respondents of 2015 survey, talent fostering programs are primarily aimed at developing a company's key competences (68%) to secure succession (68%) and output of future managers (51%). This conclusion seems to confirm the one drawn in 2006. However, it is to be noticed that nowadays talent programs tend to be more specified and focused on the development of selected qualifications, the implementation of specific changes or realization of strategic projects, as well as making employees ready to take up new business roles.</p>
How long do the talent programs last ?	<p>Programs tend to become shorter: nowadays, companies go for programs that last up to one year - 36% (vs earlier practices that lasted from one up to three years - 39%). This tendency must come from the requirement to react rapidly to fluctuating business needs.</p>
Talent management process - tools and methods used to identify talents	<p>According to respondents, the most effective sources of finding talents are:</p> <ul style="list-style-type: none"> - indication of the supervisor (73% - 2006; 95% - 2015), - results of periodic evaluation (55% - 2006; 73% - 2015), - assessment center (0% - 2006; 59% - 2015)).
Talent management process - tools of keeping and developing talents	<p>Activities and methods used during realization of Talent Management programs are highly diversified. According to respondents, the most often used tools are:</p> <ul style="list-style-type: none"> - training programs (76% - 2006; 82% - 2015), - internal projects(0% - 2006; 77% - 2015), - team/individual tasks (0% - 2006; 73% - 2015).

Source: own analysis based on: (House of Skills, 2022; The Conference Board, 2022).

Table 3.
Selected results – a dynamic approach

Author's own research	
Research method	Since 2010 HRM partners S.A. has led studies devoted to practical aspects of talent management in Polish companies. Until now, three research editions have been conducted: in 2010, 2013 and 2016 with the application of a questionnaire method. 2010 study was done with the involvement of 53 companies, in 2013 it embraced 101 entities, whereas in 2016 as many as 130 firms. In each case, respondents were constituted by local and international businesses of various fields, all running their activity in Poland. The first edition took place throughout October and November 2010, the second in May-June 2013, and the third one in July and August 2016.
Definition of talent	The results obtained through HRM partners' research demonstrate that the definition of a talent evolved in the span of six years. It is still understood as a person achieving targets and possessing outstanding competences and erudition, but above all, this is an individual focused on self-development (85% in 2016 vs 60% in 2013). One of talent-defining criteria that has gained on popularity is business thinking (46% in 2016 vs 28% in 2013).
The importance and scope of talent programs in Polish companies	Talent management programs are directed to a greater range of employees. In 2010 and 2013 all organizations tried to maintain an exclusive character of the programs which were reserved for only 1-5% of employees (78% and 65% respectively). On the contrary, now they are offered to 5-10% (a shift from 11% in 2010 to 47% in 2016) and to 11-15% of employees (shift from 7% in 2010 to 16% in 2016). Where do companies seek for talents? The answer is simple and short: everywhere. Not so long ago, the target group involved only managers. Nowadays, talent programs are directed to specialists rather than managers (51% and 44% respectively in 2016 vs 44% and 67% in 2010). Moreover, it is worth noticing that the share of organizations offering talent programs to all employees has grown from 22% in 2010 to 36% in 2016.
Aims of talent programs	An increased priority of programs for talented individuals is supported by a significant change of goals they are faced with. While the initiatives were once meant to merely boost engagement or limit headcount fluctuation (52% - 2010; 23% - 2013; 42% - 2016), now they constitute a tool that facilitates talent keeping inside company structures and makes it possible to take advantage of their potential through a greater involvement in diversified projects (89% - 2010; 37% - 2013; 66% - 2016).
How long do the talent programs last ?	It is essential to realize that nowadays talent programs tend to be shorter and last from one to two years
Talent management process - tools and methods used to identify talents	The results show that companies do not find it problematic to pick up talents and they use a variety of methods to achieve this goal. Most of the practices are focused on qualifications (assessment center – 41% - 2010; 30% - 2013; 54% - 2016, qualifications-based interview – 33% - 2010; 16% - 2013; 46% - 2016). It is also worth noticing that co-workers' recommendations (0% - 2010; 0% - 2013; 13% - 2016) and talent matrices (0% - 2010; 0% - 2013; 26% - 2016) have recently emerged as a new popular source of valuable information about potentially talented employees.
Talent management process - tools of keeping and developing talents	Furthermore, the last decade has brought a change in a program structure itself. Although training sessions still constitute its crucial element (81% - 2010; 49% - 2013; 69% - 2016), it is practice and action that keep gaining interest as new forms of development. When it comes to motivating talent programs, the results demonstrate that Polish companies lack a coherent, clearly defined policy. The majority of business entities do not make use of any additional motivating systems. However, it should be acknowledged that the number of companies that use financial methods has relatively grown, which may point to the fact that Polish enterprises have started to recognize the value of talented individuals.

Source: own analysis based on: (HMR partners S.A., 2022).

Results presented in the reports show clearly that talent concepts over the last decade have evolved intensively. It's their philosophy that has mainly been changing. Talent management concept is not considered as a separate process any more. Instead, it has become an integral part of the company's strategy, thus being closer to the business and its needs. The scope of changes that has been observed is significant:

- firstly, what undergoes a change is the way one thinks about a talent - it is still a person who achieves high results and possesses unique competences and knowledge, but most importantly, it is someone who is noticeably focused on development. Among the criteria defining talent, business thinking is becoming more and more important;
- the second change is the mentality and attitude of entrepreneurs towards talent programs - more and more surveyed firms have talent programs and want to continue them. Their intention is to realize succeeding editions, which is a proof of growing effectiveness of these processes and benefits they bring for the organization. In addition, talent management programs are addressed to the growing number of employees, which means that they lose their exclusive character;
- thirdly, talent programs tend to concentrate on particular targets and business needs - predominantly, they used to be a tool to decrease the employees' fluctuation but now the programs are used to keep talented employees in a firm because it gives the opportunity to use their potential and engage them in the realization of various projects;
- fourthly, entrepreneurs shorten the period of talent programs from three years to one year only. It is connected with the necessity of a quick response to the changing needs of the business;
- finally, the research shows that within the first area of talent management, firms do not have problems with hunting talents. To do it they use different methods, especially those focused on competences, like assessment center or competency interview. It is worth mentioning that there have appeared new sources of information about a talented employee in an organization, such as a recommendation of co-workers or a talent matrix.

As far as the development activities are concerned, the construction of talent programs undergoes changes. The programs' concepts are clearly evolving, becoming more versatile, practical and demanding. All kinds of practical actions for business play a more and more important role here. However, the results show that when motivation is taken into account, the companies in Poland do not have a clear strategy on how to keep talented employees. Most of them do not use any additional motivation systems (Dudzik, 2019, pp. 13-14).

Studies on practical talent management in Polish companies, published between 2006 to 2016, encouraged the author of the present article to take a closer look on the topic from the angle of precise identification, development and bolstering of talents in a business entity. In 2018, pilot studies were conducted that approximated talent management practices that were applied in Polish companies. Selected results of this research are presented in table 4.

The available scientific studies present diverse approaches to the essence of talent and talent management, but are based mainly on research conducted in large organizations. The author's research reveals the peculiarities of talent management both in large companies and in the SME sector. This approach is intended to indicate possible differences in the areas of talent management occurring between these entities. However, due to the fact that the research sample is not large, which is certainly an important limitation of the study conducted, the results of the study should be treated as preliminary, aimed at identifying areas for further research.

Table 4.

Presentation of selected results of the pilotage study

Author's own research	
Research method	The research, whose aim was to get familiar with talent management practices, was carried out with the use of the quantitative method and auditorium technique. It was conducted among 16 entrepreneurs who took part in the workshop organised by the author of this work. They were asked to fill in the questionnaire that had been prepared together with Marek Fulara. The questionnaire included 17 closed questions. The analysis was based on 16 correctly filled in questionnaires. The research was conducted in large, medium-sized and small companies. The structure of the research sample: large companies - 25%, medium-sized - 25%, small - 25%, micro - 25%. The limitations of the research study - relatively small research sample.
Definition of talent	Talent is a person with a high development potential (63,64%) who achieves above-average results (83,33%) and possesses high intellectual skills at the same time (62,5%). Equally important seem to be unique competences and knowledge (57,14%). Among the criteria defining the concept of talent, motivation is also gaining importance (45,45%).
The importance and scope of talent programs in Polish companies	The results of the research show that respondents treat the subject of talent management more and more seriously. However, their attitude is not always mature enough to rise to this difficult challenge. Many of the respondents have not implemented talent programs yet - merely 43,75% of study participants declared that talented employees are subject to these programs in their organisations. Talent programs are dedicated to a rather small group of employees - 42,86% of companies which implemented such programs admit that they offer them to 10-25% of the total number of employees. The above was a dominant reply among companies which operate on international markets. It is worth mentioning that 28,57% of the companies confirmed that over 50% of their employees are included in total management programmes. 14,29% of organisations apply talent programmes to 25-50% of their employees.
Aims of talent programs	The following factors have a decisive influence on the fact that talent management programs are implemented in organisations: <ul style="list-style-type: none"> - the will to employ the best specialists (5 answers - 3 of them as "the most important", 1 "very important" and 1 "important"), - the need to prevent the best employees from leaving work (5 answers - 2 of them as "the most important", 2 "very important" and 1 "important"), - elimination of competence gaps among employees (4 answers - 2 of them as "the most important", 2 "very important" and 1 "important"), - The need to improve employer's image on the labour market (4 answers, 2 of them as "very important" and 2 "important"). Two first factors seem to be particularly interesting - the first one enables talents to enter an organisation, while the second factor tries to keep them in it.

Cont. table 4.

How long do the talent programs last?	Talent programs are realised cyclically and usually last from 1 to 2 years (42,86%). However, there are employers who still prefer longer-lasting programs - from 2 to 4 years (28,57%) and over 4 years (28,57%).
Talent management process - tools and methods used to identify talents	According to respondents, the most effective sources of finding talents are: <ul style="list-style-type: none"> - internship programs addressed to students and graduates of universities (33,33%), - recommendation of a talented employee (30%), - head-hunters (23,33%).
Talent management process - tools of keeping and developing talents	Activities and methods used during realisation of talent management programs are highly diversified. According to respondents, the most often used tools are: <ul style="list-style-type: none"> - workshops (68,75%), - specialised development programs for future leaders (45,45%), - participating in the company's projects (36,36%). And what motivates the employee the most effectively? In view of respondents, the most important elements are: supporting development of employees (57,14%), remuneration (53,33%) and ambitious tasks (42,86%).

Source: author's own analysis.

4. Summary

The results of the research presented in this work point explicitly that companies take the issue of talent management more and more seriously. Moreover, they are becoming more and more aware of how complex this challenge is. Modern concepts of talent management evolve clearly. The observed changes in concepts and construction of talent programs indicate that they (programs) are more and more often regarded as elements of business programs and are the answer to business needs and demands.

The range of these changes is significant. The most important ones are: the way of perceiving the talented person, the change in mentality and attitude of entrepreneurs to the very talent programs (noticing the effectiveness and benefits of these processes, extension of the target group of potential talents), concentration of talent programs on realization of particular targets of the business company, cutting down the lasting period of these programs, the use of a wide variety of recruitment and talent selection tools and a change in the talent programs' construction.

Polish companies will certainly face plenty of challenges connected with effective talent management. Among the recommendations for the future the crucial ones seem to be:

- introduction of more intensive actions to build mature concepts, in which talent management strategy is integrated with the main strategy of the company. The very strategy should be focused on realization of particular business aims that are able to meet the business needs,
- the use of a wide range of tools and methods of talent recruitment to ensure better choice of people for the program, greater emphasis on verification and motivation diagnosis of the talent to take part in the program,

- further intensive development focused on actions, which enable acquisition of particular knowledge and skills necessary to function in a changing, unstable and more and more demanding environment,
- expansion of the financial system to keep the talents,
- emphasis on the individualisation of talent programs by creating dedicated career paths for talented employees.

“The war about talents” continues and will probably be constantly continued. As for now, talent management activities have been the domain mainly of large companies. However, the results of the research obtained by the author indicate that talents are pursued not only by large firms, but also by medium-sized and small ones. It means that modern companies, regardless of their size, notice the necessity of possessing dedicated talent programs. No relevant differences in the concept of talent management have been found among these entities. Nevertheless, one should bear in mind that the research group was relatively small, which was a significant limitation for the research as a whole. Therefore, the research is to be considered only as a pilotage study and it remains open for further research in the future.

References

1. Armstrong, M. (2011). *Zarządzanie zasobami ludzkimi*. Warszawa: Wolters Kluwer.
2. Balcerzyk, R., Matera, J. (2019). Talent management as a concept of human capital management. *Scientific Papers of Silesian University of Technology – Organization and Management Series, No. 133*, pp. 7-18, doi: 10.29119/1641-3466.2019.133.1.
3. Barlow, L. (2006). Talent development: the new imperative? *Development and Learning in Organizations, Vol. 20, No. 3*, pp. 6-9, doi: 10.1108/14777280610656325.
4. Bieniok, H. (2010). Rola zarządzania talentami w procesie budowy potencjału innowacyjnego organizacji. In: H. Jagoda, J. Lichtarski (eds.), *Kierunki i dylematy rozwoju nauki i praktyki zarządzania* (pp. 17-25). Wrocław: Uniwersytet Ekonomiczny we Wrocławiu.
5. Borkowska, S. (2005). *Zarządzanie talentami*. Warszawa: Instytut Pracy i Spraw Socjalnych.
6. Cannon, J.A., McGee, R. (2007). *Talent Management and succession planning*. London: CIPD.
7. Cannon, J.A., McGee, R. (2015). *Zarządzanie talentami i planowanie ścieżek kariery*. Warszawa: Wolters Kluwer.
8. Dudzik-Lewicka, I. (2019). Zarządzanie utalentowanymi pracownikami we współczesnym przedsiębiorstwie. *Przedsiębiorczość i Zarządzanie, Vol. XX, Iss. 6, No. 3*, pp. 9-22.

9. Flejterski, S. (1984). Istota i mierzenie konkurencyjności międzynarodowej. *Gospodarka Planowa, Vol. 39, No 9*, p. 390-394.
10. Garrow, V., Hirsch, W. (2008). Talent management: Issues of focus and fit. *Public Personnel Management, No. 37(4)*, pp. 389-402, doi: 10.1177/009102600803700402.
11. Gorynia, M. (2009). Teoretyczne aspekty konkurencyjności. In: M. Gorynia, E. Łązniewska (eds.), *Kompendium wiedzy o konkurencyjności* (pp. 50-51). Warszawa: PWN.
12. HMR partners S.A. *Praktyki zarządzania talentami w Polsce – czyli jak efektywnie identyfikować, rozwijać i utrzymywać talenty w firmie. Raport z trzeciej edycji badania HMR partners S.A.*. Retrieved from: http://www.hrmpartners.pl/docs/raporty/raport-z-badania-praktyki-zarzadzania-talentami-w-polsce-2016_hrm-partners-sa.pdf, 3.10.2022.
13. House of Skills. *Praktyki w zarządzaniu talentami w Polsce*. Raport z badania House of Skills. Retrieved from: http://www.houseofskills.pl/wp-content/uploads/2016/02/Raport-Praktyki-w-zarzadzaniu-talentami-w-Polsce_final_01.02.2016.pdf, 22.09.2022.
14. Ingram, T. (2011). *Zarządzanie talentami. Teoria dla praktyki zarządzania zasobami ludzkimi*. Warszawa: PWE.
15. Janowski, A. (2017). *Zarządzanie talentami w kontekście efektywności organizacji*. Warszawa: Difin.
16. Juchnowicz, M. (2014). *Zarządzanie kapitałem ludzkim. Procesy – narzędzia – aplikacje*. Warszawa: PWE.
17. Lewis, R.E., Heckman, R.J. (2006). Talent management: A critical review. *Human Resource Management Review, No. 16(2)*, pp. 139-154, doi: 10.1016/j.hrmr.2006.03.001.
18. Listwan, T. (2010). Zarządzanie talentami – nowy nurt zarządzania kadrami w organizacji. In: H. Jagoda, J. Lichtarski (eds.), *Kierunki i dylematy rozwoju nauki i praktyki zarządzania* (pp. 189-197). Wrocław: Uniwersytet Ekonomiczny we Wrocławiu.
19. Listwan, T. *Zarządzanie talentami – wyzwanie współczesnych organizacji*. Wiedza.info.pl. Otwarty Uniwersytet Ekonomiczny. Retrieved from: http://wiedzainfo.ue.wroc.pl/wyklady/105/zarzadzanie_talentami_wyzwanie_wspolczesnych_organizacji.html, 30.10.2022.
20. Maliszewska, E. (2005). Zarządzanie talentami – rozważania praktyka. In: S. Borkowska (ed.), *Zarządzanie talentami*. Warszawa: Instytut Pracy i Spraw Socjalnych.
21. Miś, A., Poczowski, A. (2016). Istota talentu i zarządzania talentami. In: A. Poczowski (ed.), *Zarządzanie talentami w organizacji* (pp. 38-67). Warszawa: Wolter Kluwer.
22. Mróz, J. (2015). Zarządzanie talentami – modele i podejścia badawcze. *Nauki o Zarządzaniu, No. 2(23)*. Uniwersytet Ekonomiczny we Wrocławiu, pp. 93-107.
23. Poczowski, A. (2008). *Zarządzanie talentami w organizacji*. Warszawa: Wolters Kluwer.
24. Sienkiewicz, Ł. (2007). Praktyczne rozwiązania w dziedzinie zarządzania talentami. *Edukacja ekonomistów i menedżerów, No. 1(5)*, pp. 31-45.
25. Silzer, R., Dowell, B.E. (2010). *Strategy-driven Talent Management. A Leadership Imperative*. San Francisco: Jossey-Bass.

26. Stankiewicz, M.J. (2002). *Konkurencyjność przedsiębiorstw: Budowanie konkurencyjności przedsiębiorstwa w warunkach globalizacji*. Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa "Dom Organizatora".
27. *The Conference Board. Zarządzanie talentami. Wyzwania, trendy, przykłady rozwiązań*. Raport badawczy The Conference Board. Retrieved from: https://www.conference-board.org/pdf_free/report_zarządzanieTalentami.pdf, 22.09.2022.
28. Ulrich, D. (2008). Call for talent: What is the best solutions? *Leadership Excellence*, No. 25. Retrieved from: https://www.researchgate.net/publication/291178268_Call_for_talent_What_is_the_best_solutions, 22.03.2018.
29. Ulrich, D., Smallwood, N. (2012). What is talent? *Leader to Leader*, Vol. 63, pp. 55-61, doi: 10.1002/ltl.20011.
30. Ulrich, D. (2011). Integrated talent management. In: K. Oakes, P. Galagan (eds.), *The executive guide to integrated talent management* (pp. 189-211). Virginia: ASTD Press.
31. Zheng, C., Soosay, C., Hyland, P. (2008). Manufacturing to Asia: who will win the emerging battle for talent between Dragons and Tigers? *Journal of Manufacturing Technology Management*, Vol. 19, No. 1, pp. 52-72, doi:10.1108/17410380810843453.

DYNAMICS OF NETWORK RELATIONS: HOW ORGANIZATIONS EXPLOIT INTER-ORGANIZATIONAL NETWORKS TO GAIN SET BENEFITS

Marcin FLIEGER

General Tadeusz Kościuszko Military University of Land Forces; marcin.flieger@awl.edu.pl,
ORCID: 0000-0002-6810-7141

Purpose: The main scientific purpose of this article is to identify the way organizations exploit network relations' features in order to gain set benefits, from the dynamic perspective of achieving another levels of network collaboration maturity.

Design/methodology/approach: Conceptual development and positioning of the research aim at providing a generalizable contribution to management science, at the same time being accessible to practitioners. The research was carried out using the interpretive method of a multiple case study, following its methodological rigor. It was divided into two stages: within-case analysis and cross-case analysis. According to the replication logic, case studies constitute series of independent research which provide data corresponding with set research questions.

Findings: The conducted research shows that as a part of a network organizations gain various types of benefit and its character evolves as the collaboration achieves another levels of maturity. At the same time, along with the evolution of the reasons for developing network collaboration, organizations exploit different features of network relations, in order to maximize the benefit.

Practical implications: The research leads to presenting a pattern of exploiting network relations' features in order to gain set benefits. The identified template serves as a tool for practitioners and allows more conscious planning and developing the interactions with business partners. Consequently, it supports maximizing benefits from the network collaboration as it achieves another levels of maturity.

Originality/value: The author adopts a dynamic perspective to the problem of intentional creation of network relations in order to gain set benefits. In the literature still very little attention is put on understanding the reasons for network development and the evolution of network relations' features as organizations achieve another levels of network maturity. Therefore, the author focuses on filling this gap by deepening the analysis of the network trend and increasing efficiency of realized tasks from the egocentric perspective of a network member.

Keywords: network, network collaboration, network relations' features, dynamics of network.

Category of the paper: Research paper.

1. Introduction

Nowadays organizations operate in the environment which is characterised by multi-directional co-dependence of business partners. These interactions constitute a network of relations (Kim et al., 2016; Mayne, Wileman, Leeuw, 2003). The theory of a network abandoned an atomic approach to explain reality in favour of a holistic perspective of a network collaboration (Bryson, Crosby, Stone, 2015; Sakai, Kang, 2000; Gebo, Bond, 2019). The network itself is understood as a collection of long-term, formal and informal, direct or indirect relations between two or more units (Håkansson, Snehota, 1989; Camagni, 1995; Kilduff, Tsai, 2003; Edelenbos, Klijn, 2007). Regarding the inter-organizational network collaboration, it is characterized by free-will access, awareness of common objectives, partnership and trust (Newman et al., 2004; Goerdel, 2006). Such networks allow achieving objectives which are not attainable either by individual units or through traditional administrative hierarchies (Hu, Khosa, Kapucu, 2016). In today's turbulent, highly unpredictable environment (lately with the substantial impact of the pandemic and the conflict in Ukraine) possibilities of securing market position by exploitation of network relations become a great value.

Scrutinizing an inter-organizational network from the *structural* perspective (Tatarynowicz, Sytch, Gulati, 2016), however, does not allow reaching in-depth conclusions regarding the efficiency of networks (Czakov, 2012; Lucidarme, Cardon, Willem, 2015) and benefits achieved by collaborating partners. Thus, the analysis should focus on the essence of *relations* between units (Pedersen, Clausen, Jørgensen, 2022; Choi, Lee, 2022). Consequently, organizations ought to treat relations in an instrumental way by conscious exploitation of different kinds of relations as the network collaboration develops, in order to achieve set objectives (Saz-Carranza, Iborra, Albareda, 2016; Kilduff, Tsai, 2003; Zaheer, Gozubuyuk, Milanov, 2010). Therefore, presented analysis concentrates on a dynamic perspective of inter-organizational network relations.

The paper provides both theoretical and practical contribution. The author concentrates on depicting a concise theoretical construct which allows more in-depth understanding of the network collaboration dynamics from the relational perspective. Such an approach leads to the conceptualization of a pattern showing the reasons for network development and the evolution of network relations' features as organizations achieve another levels of network maturity. This theoretical background serves as a template for practical use by managers; it allows more conscious planning and developing network relations with business partners, in order to maximize benefits from the collaboration.

The author answered the research questions:

1. What are and how to classify the features of network relations?
2. What is the nature of the process of achieving another levels of network collaboration maturity?
3. How do the network relations' features evolve as an organization achieves another levels of network collaboration maturity?
4. What are the reasons (driving forces) for network relations development (getting to another levels of maturity)?

Identifying the way organizations exploit network relations' features in order to gain set benefits (as the network collaboration develops) constitutes the main objective of the paper. Understanding the dynamics of the relations allows more concise development of interactions between partners (Srivastava, 2015; Sharkey et al., 2021) and the increase in efficiency of the process of creating value by each member of a network.

2. Dimensions of network relations

Identification and final operationalization of three dimensions of network relations and classification of the network relations' features were done after a semantic and comparative analysis of features presented in the literature. The author adopted the classification presented by Czakon. He proposed three following attributes of network relations: exchange, involvement and reciprocation (Czakon, 2005; 2007). Additionally, in order to ensure the full scope of possible interactions, the author included the views and divisions presented by Anderson, Hakansson and Johanson (1994) and Easton (1992). It also corresponds with the network relations typology proposed by Ford, Gadde, Hakansson and Snehota (2003). Each dimension includes a set of relations' features which correspond with the idea of the dimension:

Dimension I. Exchange:

features:

- information exchange,
- material exchange,
- energy exchange.

Dimension II. Involvement:

features:

- expectation of continuing and deepening relations,
- investing in co-specialized resources,
- developing informal relations,
- developing formal relations,

- embeddedness,
- building mutual trust,
- building loyalty,
- building shared values,
- avoiding/de-escalation of conflicts.

Dimension III. Reciprocation:

features:

- expectation of equal efforts,
- identifying common objectives,
- common planning and making decisions,
- common solving problems,
- adapting to partners' needs.

Three forms of exchange (Dimension I) should be perceived as an element of interactions between an organization and its environment. They constitute a sort of exchange which is characterized by repetitiveness, organizational autonomy and lack of hierarchy. It appears together with market transactions and allocation of resources within an organization (Czakon, 2005). What is important, this exchange is mutual – it is realized in both directions between collaborating units.

Dimension II (Involvement) is oriented on deepening and widening relations of exchange (Anderson, Hakansson, Johanson, 1994). Within inter-organizational networks, involvement has a multi-level character and it constitutes a vital factor which allows avoiding opportunistic behaviour. The above-presented classification of the network relations features in the involvement dimension was operationalized basing on the typology of involvement proposed by Dyer (1997). He set a list of four basic types of involvement: operational, informational, invest and social. As a result, the attention was put on the expectation of continuing relations, increasing their frequency and investing in co-specialized resources. The dilemma whether an organization ought to develop formal or informal bonds constitutes another key issue. The social aspect of network relations was related to embeddedness. Further, that led to the question of building trust, loyalty and shared values. Finally, the list includes avoiding or de-escalating conflicts between members of a network.

Reciprocation constitutes a natural completion of the involvement dimension; it regards expectation of symmetry (balance) between collaborating units. Each member of a network assesses their own effort put into cooperation and they expect that the other organizations will make similar effort (reciprocation). This mutuality regards both symmetry in exchange as well as coordinated planning, making decisions, solving problems and adapting to partners' needs. All these elements constitute features in the third dimension.

It is vital to recognize that these three dimensions of network relations correspond with the idea of bonds dynamics (Srivastava, 2015; Kickert, Klijn, Koppenjan, 1997). As the network relations develop (in the process of achieving another levels of maturity), all the features evolve. Each member of a network assesses them, which constitutes a natural process of learning, adapting or withdrawing from collaboration within a network.

3. Levels of network collaboration maturity

Researchers stress that creating an optimal, cohesive structure of a network requires time (Cavalcanti, Giannitsarou, Johnson, 2017) and this evolution constitutes a natural process of achieving network collaboration maturity (Siciliano, Wang, Medina, 2020). Most often, it begins with information exchange, which has multi-directional and mostly informal character. At this stage organizations make an attempt to understand mutual needs, expectations and competences of other network participants. Sometimes information exchange may have a form of consultations.

If such informal information exchange and consultations lead to identification of common objectives and benefits, partners will get to another level of collaboration maturity by initiating first formal ventures. Mostly they are operational projects, which are characterized by limited capital engagement and generally low risk. Partners get involved in planning and coordinating tasks which are aimed at achieving consistency and synergy. Members of a network search for fields of cooperation which would allow gaining benefits for all. At this stage of collaboration it is still important to signal good will and strengthen trust. If operational projects bring expected benefits, a network will achieve the ultimate level of maturity – a formal partnership. At this phase relations are based on a formal agreement, in which the fields of collaboration and responsibilities of all partners are clarified. Such a strategic partnership allows achieving long-term objectives common for all members of a network.

Those collaboration forms reflect the process of achieving another levels of network collaboration maturity. At the initial stage bonds are loose, mostly informal, and common actions do not generate considerable risk. Organizations can get to know one another better and understand partners' needs, their expectations and possibilities of gaining mutual benefits. As the units realize another common tasks and projects, relations evolve and ultimately they may achieve the stage of partnership. Ties become more tight, realized tasks generate more risk and they are more complex. In the literature researchers present different classifications (stages) of the process of achieving network collaboration maturity, stressing its different aspects and conditions. However, the essence of the process is always very similar. Therefore, it allows a synthetic generalization of three levels of the process:

Level I. Informing (consulting)**Level II. Common operational projects****Level III. Strategic partnership**

Thus, becoming conscious of the fact that competing or being in a conflict may decrease chances to achieve own objectives by a potential network partner constitutes a crucial moment which may become a starting point of network relations. All parties of a network can gain more benefits if they join forces and resources. Such a synergy effect allows creating unique value for both the whole network and individual participants (Lo, Chiao, Yu, 2016).

4. Research approach and methods

The research follows the interpretive research paradigm. It entails the epistemological position of the researcher; reality ought to be analysed contextually by acknowledging interviewees' subjective opinions and interpretations. Such an approach allows in-depth comprehending of the phenomenon in some particular context (Eisenhardt, Graebner, 2007). This situational context determines research results in each case study, but at the same time it constitutes a fundament for presenting characteristics of the whole class of researched objects (Yin, 2014).

Therefore, the author used the qualitative research method of a multiple case study, , adopting its methodological rigor presented by Yin (2014), Miles, Huberman, Saldana (2014), Eisenhardt (1991) and Hu, Khosa, Kapucu (2016). The qualitative research lets identifying and describing new concepts, categories or relations. It is useful especially when there is no theory or the existing one is not sufficient to explain a particular issue (Graebner, Martin, Roundy, 2012). Thus, the choice of the method resulted from the set research objectives and the phase of knowledge development in the analysed research area. Operating of inter-organizational networks is still a relatively new phenomenon, which develops in a very dynamic way and is conditioned by numerous variables. Hence, there is a need for a thorough examination which would lead to formulating propositions of features and dynamics of the phenomenon in question.

The analysis within a multiple case study was carried out in two stages: within-case analysis and cross-case analysis. According to the replication logic, case studies constituted a series of independent research which provided data corresponding with set research questions. The results of each individual case study served as a base for cross-case comparisons. It allowed theoretical generalizations of the pattern of exploiting network relations' features in order to

gain set benefits (in a dynamic perspective of achieving another levels of network collaboration maturity).

The author used the statistical method of clustering, in order to operationalize dimensions of network relations developed by organizations. Hence, all network relations' features were clustered according to three dimensions: exchange, involvement, reciprocation.

The paper presents results of 22 case studies. Basing on the criteria of choice proposed by Flyvbjerg (2012), the author's key criterion was the clarity of case – the final selection of the cases was done after a series of pilot interviews which aimed at diagnosing which organizations have rich experience in initiating and developing network collaboration with various partners. The access to crucial data (the will to share data, experience and opinions) constituted additional criterion.

What is important, the organizations are very diverse, which results in different conditions of operating. Characteristics of the cases was presented in table 1. They represent different types and scale of business. Moreover, they are located in different parts of Poland. Regarding the type of partners with which they develop network collaboration, apart from dominating business units, some companies collaborate with public organizations and NGOs. Such a diversity of cases allowed complex and consistent analysis of the evolution of network relations' features and identification of the main driving forces of network collaboration development.

Table 1.
Characteristics of researched cases

Criterion	Variant	Number of cases
Location	Great Poland	9
	Lower Silesia	7
	Silesia	6
Type of business	production	6
	trade	4
	services	12
Size	1-9 employees	3
	10-49 employees	13
	50-99 employees	6
Type of partners	business	22
	NGO	7
	public	11

Source: own study.

Considering complexity of the phenomenon and variety of information characteristic for the multiple case study method, the author implemented the strategy of triangulation of gathering data methods, which included an expert interview and a documents' analysis. In-depth group interviews were carried out between October 2021 and February 2022. In order to minimize subjective assessment, the author interviewed from 2 to 3 representatives of each organization (triangulation of informants). Depending on the case, they were: a managing director, a vice-managing director, a manager of department (or other organizational unit),

a spokesperson. The interviewees filled in a relational matrix which allowed identifying the evolution of network relations' features, according to the levels of network collaboration maturity (which corresponds with the results presented in table 2). Moreover, semi-structured forms were used, which included questions regarding the reasons (driving forces) for network relations development (which corresponds with the results presented in table 3). The analysis of documents (development strategies, operational and statistical reports) allowed confronting gathered data with the opinions and information provided by interviewees.

The interviews were transcribed and analysed (Miles, Huberman, 2000). The qualitative data was:

- reduced – all interviews were transcribed and the whole material was coded according to adopted conceptual frames (*a priori* codes),
- displayed – the codes (network relations' features - table 2) and driving forces of network relations development (table 3) were particularized and ordered,
- verified – the empirical data was interpreted with reference to the concepts and theories presented in the literature.

Finally, following the methodological rigor of qualitative research evaluation (Mason, 2018), correctness and trustworthiness of the research was ensured by fulfilling three evaluation criteria: credibility, transferability and confirmability.

Credibility (presenting a real picture of the investigated phenomenon) was ensured by:

- interviewing people who possess in-depth knowledge, since they are the ones who actively participate in initiating and developing network relations with partners,
- conducting interviews in time and places convenient for interviewees, in this way providing conditions to speak freely,
- iterative collection of data and detailed analysis of the material.

Transferability, understood as a possibility of formulating some recommendations for other organizations, was achieved by presenting the contextual aspect of the research and indicating in what way the research results may be useful for other units developing network collaboration.

The last criterion (confirmability) means demonstrating and ensuring that the findings are strictly correlated with the collected data and that the risk of potential subjective assessment of the researcher is minimized. It was ensured by using triangulation of methods (interviews, a documents' analysis) and triangulation of informants. Additionally, this criterion was met by detailed description of methodological perspective in relation to the research results.

5. Discussion and results

5.1. Dynamics of network relations' features

Features in dimension I (exchange) generally were assessed high or medium at all maturity levels, but the highest degree was identified at the levels of common operational projects and strategic partnership (table 2). The results show that the flow of information between partners constitutes the key element of relations. At all levels it is absolutely crucial to build and develop effective communication channels; they constitute some sort of a 'blood system' which ought to provide right information at the right moment for all participants. Also, it supports both material and energy exchange, which are most important when realizing operational projects. The reason for the highest ranks at the second maturity level is that being involved in operational collaboration requires most efforts, it is most time and energy consuming. At the same time majority of researched organizations stressed that within their network activity mostly they concentrate on an operational perspective; they realize numerous short-term common projects, whereas long-term (strategic ones) are in minority.

In case of dimension II (involvement), there are three network relations' features which stand out and received the highest ranks: expectation of continuing and deepening relations, building mutual trust and avoiding/de-escalation of conflicts. These results seem very interesting because all these features have a substantial impact on developing and strengthening bonds in a long term. Thus, for organizations it is crucial to eliminate potential barriers of collaboration and to make sure that relations are getting tighter. At the same time embeddedness plays a significantly less important role. Having social relations with potential business partners does not influence development of network relations much. Organizations present a strong business-like orientation and are eager to join and develop network relationships if only they recognize some economic potential. Finally, it is worth to mention that as network relations develop according to another levels of maturity, shared values become a more important aspect of strengthening bonds. Thus, when organizations achieve a strategic partnership, they explore deeper levels of cooperation and make an attempt to unite people by building a community which altogether focuses on some higher goals (apart from business, economic ones).

Regarding an expectation of symmetry (balance) between collaborating units (dimension III), most features were ranked very high, with the exception of adapting to partners' needs. The moment organizations get involved in network relations, there appears a strong expectation that potential partners will participate actively in identifying common objectives, making decisions and solving problems. The research results show that problems are solved mainly in the form of informal meetings. Organizations also stressed a great importance of identifying common objectives, since such consultations constitute the key element of avoiding misunderstandings and, as a consequence, allowing effective development of relations. The reason for giving lower ranks for adapting to partners' needs is that network members

expect other partners to provide resources which can increase a synergy effect. It means that effective collaboration depends less on adapting to needs of individual members, more on identifying resources which individuals have and which can be exploited within a network. It reflects a strategy of looking for (concentrating on) similarities and avoiding differences (perceived as potential barriers of collaboration).

The dynamics of network relations' features' change, with the division into three levels of collaboration maturity, was presented in table 2. In addition, it is possible to diagnose which dimension dominated at each maturity level (a dimension was ranked as dominating when it achieved the highest average rank of its features at a given level). It appeared that dominating dimensions were as follows:

Level I – Reciprocation.

Level II – Exchange.

Level III – Exchange/Reciprocation (equal average ranks).

Table 2.

Evolution of network relations' features

Dimension	Network relations' features	Level I	Level II	Level III
Exchange	information exchange	***	***	***
	material exchange	**	***	**
	energy exchange	*	***	***
Involvement	expectation of continuing and deepening relations	***	***	***
	investing in co-specialized resources	*	***	**
	developing informal relations	***	**	**
	developing formal relations	**	***	**
	embeddedness	*	*	*
	building mutual trust	***	***	***
	building loyalty	*	**	**
	building shared values	**	**	***
	avoiding/de-escalation of conflicts	**	***	***
Reciprocation	expectation of equal efforts	***	***	***
	identifying common objectives	***	**	***
	common planning and making decisions	**	***	***
	common solving problems	***	***	***
	adapting to partners' needs	*	*	*

Degree of appearance: *low; **medium; ***high.

Source: own study.

5.2. Dynamics of network relations' benefits

As many researchers indicate, organizations gain various types of benefit as a member of a network (Hopkins et al., 2019; Horn, 2018) However, its character evolves as network collaboration achieves another levels of maturity. Searching for another benefits (and maximizing existing ones) constitutes main reasons for development of network collaboration (Klaster, Wilderom, Muntslag, 2017; Silvia, 2017; Mu et al., 2018). Thus, it is crucial to identify these driving forces. The reasons for network relations development, understood as the reasons for getting to another levels of network maturity, were

identified and presented in table 3. At the same time it allowed diagnosing the dynamics of network relations' benefits.

The results show that organizations present two key reasons for developing network relations, which are important at each level of network maturity: 1) expanding access to partners' knowledge resources and a multi-directional flow of knowledge, 2) participating in a network of value (a synergy effect). These two types of benefit were also presented as main reasons for initiating collaboration within a network by Vangen and Huxham (2010) and Peteraf (1993), which supports value of the findings. Gaining and diffusing knowledge (organizations have a possibility to learn from others, but also to share (diffuse) knowledge) can be supported by both formal hierarchies and informal networks (Whetsell, Kroll, DeHart Davis, 2020; Paruchuri, Awate, 2017; Peterman, Kourula, Levitt, 2020). In case of the researched organizations, at the initial stage of network collaboration the diffusion process is hierarchical. However, there is an expectation to expand and to make the knowledge flow easier, so partners tend to exploit a *holistic* approach to multi-directional flows. That constitutes the main driving force to develop relations into taking up common operational measures and ultimately strategic projects (accordingly level II and III). Then relations are tighter, partners build trust and loyalty, which support sharing knowledge substantially.

For individual participants of a network, collaboration most of all allows creating value through a synergy effect. It results from summing partners' key resources and actions. Making an attempt to increase synergetic value constitutes the main force which stimulates development of a network. At the first level (informing/consulting) the synergy refers to non-material resources (knowledge, competences, experience of persons representing different sectors). However, organizations also look for possibilities to create value using *material* resources and at the same time to expand a potential for re-configuring all resources available within a network. Therefore, they initiate common ventures and get engaged in operational projects (level II). Later, the will to strengthen a synergy effect leads to developing a long-term partnership (level III). It ought to be stressed that integrating, building and re-configuring resources constitute one of the key elements of creating dynamic abilities. Also, apart from the value created for an organization (network's knot) itself, the importance of participating in the process of co-creating value for the *whole* network is underlined. The value appears as a result of both planning future projects and their realization.

Reducing transactional and hierarchical costs becomes one of the main reasons for development of a network mainly when partners initiate operational projects (level II). The key benefit stems from integrating common resources and limiting hierarchical relations with partners in favour of network coordination. In this way network members are able to reduce costs of tasks and projects. Therefore, after getting to know one another (at level I, which still does not allow minimizing costs *ex post*), the need arises to start gaining this kind of benefit by taking up common ventures (getting to level II). However, as network collaboration develops into the third level of maturity, this sort of advantage becomes a less important incentive.

At the level of a strategic partnership, this type of benefit is dominated by others, such as: a synergy effect, knowledge diffusion and a network effect.

As network collaboration develops, there appears a very interesting phenomenon of appropriating value created by other participants of a network. Although theoretically network collaboration ought to be based on partnership, equality and striving to achieve common goals, the research shows that distributing value between network members is not equal and with time organizations develop mechanisms which allow appropriating value from other units (this mechanism was explained thoroughly by Najda-Janoszka (2016)). As a result, they are able to achieve benefits bigger than gained by other partners. Appropriating value becomes an important reason for developing relations especially when partners start realizing operational projects (level II). However, the phenomenon in question is less important at the highest level of network maturity. In this case, an interesting paradox appears – on one hand as the collaboration develops an organization has a bigger possibility to master appropriating mechanisms, on the other - network members strengthen partnership relations, trust and sense of community. In a long term, such a dualism can lead to conflicts.

The moment network members start building a strategic partnership (which means they are heading for the highest level of maturity), they are able to achieve two another benefits: 1) rent from a network effect and 2) rent from convergence processes. However, the first one is perceived as the main reason for developing collaboration, and the latter one as an additional benefit.

The network effect refers directly to the size of a network; the value from being a part of a network grows as the number of its participants increases (Church, Gandal, Krause, 2008). That is why this effect is correlated with a structural dimension of network development. Thus, network participants search for gaining advantage from additional value stemming from the bigger size of a network. The value refers to having better access to partners' resources, mostly knowledge and experience, but also material assets. Another vital advantage of a network effect, stressed by researched organizations, is that the bigger number of network members, the bigger possibilities to choose an optimal partner to realize business projects. Consequently, it leads to the increase in scale of operations and quality of business activity outcome.

The convergence effect appears together with the mechanisms and features of a network which are characteristic for a strategic partnership. Thus, at the highest level of network collaboration maturity it is possible to spot a phenomenon which shows that the network member who has a weaker position on a market will be able to develop relatively faster and ultimately catch up with more developed partners (Cavalcanti, Giannitsarou, Johnson, 2017). It happens mostly by exploiting a benchmark concept. What is important, these convergence processes have a multi-directional character.

Table 3.*Reasons (driving forces) for network relations development*

Level I. Informing (consulting)	Reasons for network relations development (to level II)	Level II. Common operational projects	Reasons for network relations development (to level III)	Level III. Strategic partnership
<i>Dominating dimension:</i> Reciprocation	Main reasons: <ul style="list-style-type: none"> - Expanding multi-directional flow of knowledge - Building synergy of experience, competencies and material resources - Expanding possibility to re-configure resources - Reducing transactional costs <i>ex post</i> (by integrating resources) - Lowering hierarchical costs (thanks to network coordination) - Appropriating value from partners - Increasing scale and quality of fulfilling clients' needs Additional reasons: <ul style="list-style-type: none"> - Developing competences of managers (including entrepreneurial skills) - Better organization of internal operations (implementing new methods and concepts of management using benchmarking) 	<i>Dominating dimension:</i> Exchange	Main reasons: <ul style="list-style-type: none"> - Expanding multi-directional flow of knowledge - Strengthening synergy of various resources (increasing efficiency of gaining, integrating and re-configuring resources) - Achieving network effect (increase in value from being part of local network as number of participants grows) - Increasing efficiency in fulfilling clients' needs Additional reasons: <ul style="list-style-type: none"> - Catching up other organizations (convergence effect) - Reducing transactional costs <i>ex post</i> - Lowering hierarchical cost - Appropriating value from partners - Increasing efficiency in creating organization's image 	<i>Dominating dimension:</i> Exchange/ Reciprocation

Source: own study.

6. Conclusions

The research results presented in the paper allowed identifying the way organizations exploit features of network relations in order to gain set benefits from the collaboration. Thanks to adopting a dynamic perspective, it was possible to present the problem through the process of achieving another levels of network collaboration maturity. As a result, the author identified a pattern which explains the dynamics of the phenomenon in question. The general conclusion is that along with the evolution of the reasons for developing network collaboration (gaining various types of network benefit), organizations exploit different features of network relations, in order to maximize the benefit. It appeared that there are a very few main reasons for getting into another levels of network collaboration. The crucial ones seem to be the benefit from

a multi-directional flow of knowledge and from a synergy effect. Depending on the level of network relations' development, organizations also look for re-configuring resources, reducing transactional and hierarchical costs, appropriating value and achieving a network effect. What is important, in order to gain the benefit, organizations modify the features of network relations as the collaboration develops. The research showed a following pattern of the evolution of dominating dimensions: Reciprocation > Exchange > Exchange/Reciprocation. Consequently, these results show the dynamics of network relations' development, and they provide an insight into the mechanisms which allow managers to increase efficiency of collaboration. The template may serve as a tool for practitioners; it supports more conscious planning and developing interactions with network members and, ultimately, optimizing network rent.

These considerations lead to another vital conclusion – when deciding to initiate and develop network collaboration, managers ought to analyse the process from a *holistic* perspective, taking into account how different features of network collaboration influence possibilities of gaining set benefits. Thus, managers face the dilemma what strategy of developing network collaboration features to implement as network relations reach another levels of maturity. They should decide which features are to dominate, which are to be explored (strengthened as the collaboration develops), exploited (not changed), limited or not used at all. The pattern identified in the paper clearly shows that indeed this evolution takes place.

Concerning the limitations of the study, it ought to be stated that although implemented research methods provided all expected data which allowed achieving research objectives, natural character of case studies requires cautiousness regarding the scale of generalizing the results. The author's intention was to provide data and information which lead to understanding of some phenomenon which has not yet been fully identified and explored. Therefore, the limitations ought to be treated as a starting point for further scientific explorations. In the author's opinion the research should concentrate on creating hypotheses which would be verified with quantitative methods ensuring statistical representativeness. Ultimately, this direction would lead to more generalizable results regarding the dynamics of network collaboration.

Acknowledgements

The research was carried out within the confines of a research project financed by Polish Ministry of National Defence (15/WZ/9/SMON).

References

1. Anderson, J. C., Håkansson, H., Johanson, J. (1994). Dyadic business relationships within a business network context. *Journal of Marketing*, 58(4), pp. 1-15.
2. Bryson, J.M., Crosby, B.C., Stone, M.M. (2015). Designing and implementing cross-sector collaborations: Needed and challenging. *Public Administration Review*, 75(5), pp. 647-663.
3. Camagni, R. (1995). Global network and local milieu: towards a theory of economic space. In: S. Conti, E.J. Malecki, P. Oinas (Eds.), *The industrial enterprise and its environment: spatial perspectives*. Avebury: Aldershot.
4. Cavalcanti, T.V.V., Giannitsarou, Ch., Johnson, Ch.R. (2017). Network cohesion. *Economic Theory*, 64(1), pp. 1-21.
5. Choi, K., Lee, D. (2022). Network externalities and endogenous timing in managerial firms. *Managerial and Decision Economics*, 5, pp. 1462-1475. <https://doi.org/10.1002/mde.3467>.
6. Church, J., Gandal, N., Krause, D. (2008). Indirect network effects and adoption externalities. *Review of Network Economics*, 7(3), pp. 337-358. <https://doi.org/10.2139/ssrn.369120>.
7. Czakon, W. (2005). Istota relacji sieciowych przedsiębiorstwa. *Przegląd Organizacji*, 9, pp. 10-13.
8. Czakon, W. (2007). *Dynamika więzi międzyorganizacyjnych przedsiębiorstwa*. Katowice: Wydawnictwo Akademii Ekonomicznej im. Karola Adamieckiego.
9. Czakon, W. (2012). *Sieci w zarządzaniu strategicznym*. Warszawa: Oficyna Wolters Kluwer Business.
10. Dyer, J. (1997). Effective interfirm cooperation: How firms minimize transaction costs and maximize transaction value. *Strategic Management Journal*, 18(7), pp. 535-556.
11. Easton, G. (1992). Industrial networks: A review. In: B. Axelsson, G. Easton (Eds.), *Industrial networks. A new view of reality*. London: Routledge.
12. Edelenbos, J., Klijn, E.H. (2007). Trust in complex decision-making networks: a theoretical and empirical exploration. *Administration and Society*, 39(1), pp. 25-50. <https://doi.org/10.1177/0095399706294460>.
13. Eisenhardt, K.M. (1991). Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review*, 16(3), pp. 620-627. <https://doi.org/10.2307/258921>.
14. Eisenhardt, K.M., Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), pp. 25-32. <https://doi.org/10.5465/amj.2007.24160888>.
15. Flyvbjerg, B. (2012). Five misunderstandings about case study research. In: M. Savin-Baden, C. Howell Major (Eds.), *Qualitative research: The essential guide to theory and practice*. London: Routledge.

16. Ford, D., Gadde, L.E., Håkansson, H., Snehota, I. (2003). *Managing business relationships*. London: Wiley.
17. Gebo, E., Bond, B.J. (2019). Improving inter-organizational collaborations: An application in a violence reduction context. *The Social Science Journal*, pp. 1-9. <https://doi.org/10.1016/j.sosci.2019.09.008>.
18. Goerdel, H.T. (2006). Taking initiative: Proactive management and organizational performance in networked environments. *Journal of Public Administration Research and Theory*, 16(3), pp. 351-363. <https://doi.org/10.1093/jopart/mui051>.
19. Graebner, M.E., Martin, J.A., Roundy, P.T. (2012). Qualitative data: Cooking without a recipe. *Strategic Organization*, 10(3), pp. 276-284.
20. Håkansson, H., Snehota, I. (1989). No business in an island: The network concept of business strategy. *Scandinavian Journal of Management*, 5(3), pp. 187-200. [https://doi.org/10.1016/0956-5221\(89\)90026-2](https://doi.org/10.1016/0956-5221(89)90026-2).
21. Hopkins, L., Chamberlain, D., Held, F., Riley, T., Zhou Jing Wang, J., Conte, K. (2019). Collaborative networks in chronic disease prevention: what factors inhibit partnering for funding? *International Journal of Public Administration*, 4(1), pp. 1-9. <https://doi.org/10.1080/01900692.2019.1669177>.
22. Horn, J. (2018). Economic rent. In: M. Augier, D.J. Teece, (Eds.), *The Palgrave encyclopedia of strategic management*. Palgrave Macmillan.
23. Hu, Q., Khosa, S., Kapucu, N. (2016). The intellectual structure of empirical network research in public administration. *Journal of Public Administration Research and Theory*, 26(4), pp. 593-612. <https://doi.org/10.1093/jopart/muv032>.
24. Kickert, W.J., Klijn, E.H., Koppenjan, J. (Eds.) (1997). *Managing complex networks: strategies for the public sector*. London: Sage Publications.
25. Kilduff, M., Tsai, W. (2003). *Social networks and organizations*. Thousand Oaks: Sage Publications.
26. Kim, J.Y. (Rose), Howard, M., Pahnke, E.C., Boeker, W. (2016). Understanding network formation in strategy research: exponential random graph models. *Strategic Management Journal*, 37(1), pp. 22-44.
27. Klaster, E., Wilderom, C., Muntslag, D. (2017). Balancing relations and results in regional networks of public-policy implementation. *Journal of Public Administration Research and Theory*, 27(4), pp. 676-691. <https://doi.org/10.1093/jopart/mux015>.
28. Lo, F.Y., Chiao, Y.C., Yu, C.M.J. (2016). Network and institutional effects on SMEs' entry strategies. *MIR: Management International Review*, 56(4), pp. 531-563.
29. Lucidarme, S., Cardon, G., Willem, A. (2015). A comparative study of health promotion networks: Configurations of determinants for network effectiveness. *Public Management Review*, 18, pp. 1163-1217.
30. Mason, J. (2018). *Qualitative researching*. Sage.

31. Mayne, J., Wileman, T., Leeuw, F. (2003). Networks and partnering arrangements: New challenges for evaluation and auditing. In: A. Gray, B. Jenkins, F. Leeuw, J. Mayne (Eds.), *Collaboration in public services: The challenge for evaluation*. New Brunswick: Transaction Publishers.
32. Miles, M.B., Huberman, A.M., Saldana, J. (2014). *Qualitative data analysis. A methods sourcebook*. London: Sage Publications.
33. Mu, R., Jia, J., Leng, W., Haershan M., Jin, J. (2018). What conditions, in combination, drive inter-organizational activities? Evidence from cooperation on environmental governance in nine urban agglomerations in china. *Sustainability*, 10, 2387, pp. 1-16. <https://doi.org/10.3390/su10072387>.
34. Najda-Janoszka, M. (2016). *Dynamic capability-based approach to value appropriation*. Cracow: Jagiellonian University Press.
35. Newman, J., Barnes, M., Sullivan, H., Knops, A. (2004). Public participation and collaborative governance. *Journal of Social Policy*, 33(2), pp. 203-223. <https://doi.org/10.1017/S0047279403007499>.
36. Paruchuri, S., Awate, S. (2017). Organizational knowledge networks and local search: The role of intra- organizational inventor networks. *Strategic Management Journal*, 38(3), pp. 657-675.
37. Pedersen, S., Clausen, Ch., Jørgensen, M.S. (2022). Navigating value networks to co-create sustainable business models: An actionable staging approach. *Business Strategy and the Environment* (Early view). <https://doi.org/10.1002/bse.3127>
38. Peteraf, M.A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), pp. 179-191.
39. Peterman, A., Kourula, A., Levitt, R. (2020). Organizational roles in a sustainability alliance network. *Business Strategy and the Environment*, 29(8), pp. 3314-3330. <https://doi.org/10.1002/bse.2574>.
40. Sakai, K., Kang, N.H. (2000). *International strategic alliances: Their role in industrial globalization*. OECD, DSTI Working Paper/DOC 5.
41. Saz-Carranza, A., Iborra, S.S., Albareda, A. (2016). The power dynamics of mandated network administrative organizations. *Public Administration Review*, 76(3), pp. 449-462.
42. Sharkey, T.C., Nurre Pinkley, S.G., Eisenberg, D.A., Alderson, D.L. (2021). In search of network resilience: An optimization-based view. *Networks*, 2, pp. 225-254. <https://doi.org/10.1002/net.21996>.
43. Siciliano, M.D., Wang, W., Medina, A. (2020). Mechanisms of network formation in the public sector: A systematic review of the literature. *Perspectives on Public Management and Governance*, gvaa017. <https://doi.org/10.1093/ppmgov/gvaa017>.
44. Silvia, Ch. (2017). Evaluating collaboration: The solution to one problem often causes another. *Public Administration Review*, 78(3), pp. 472-478. <https://doi.org/10.1111/puar.12888>.

45. Srivastava, S.B. (2015). Intraorganizational network dynamics in times of ambiguity. *Organization Science*, 26(5), pp. 1365-1380.
46. Tatarynowicz, A., Sytch, M., Gulati, R. (2016). Environmental demands and the emergence of social structure: technological dynamism and interorganizational network forms. *Administrative Science Quarterly*, 61(1), pp. 52-86.
47. Vangen, S., Huxham, C. (2010). Introducing the theory of collaborative advantage. In: S.P. Osborne (Ed.), *The new public governance? Emerging perspectives on the theory and practice of public governance*. London: Routledge.
48. Whetsell, T.A., Kroll, A., DeHart Davis, L. (2020). *Formal hierarchies and informal networks: How organizational structure shapes information search in local government*. Retrieved from <https://arxiv.org/abs/2006.08019>. 12.02.2021.
49. Yin, R.K. (2014). *Case study research: Design and methods*. Thousand Oaks: Sage Publications.
50. Zaheer, A., Gozubuyuk, R., Milanov, H. (2010). It's the connections: The network perspective in interorganizational research. *Academy of Management Perspectives*, 24(1), pp. 62-77.

IMPACT OF THE COVID-19 PANDEMIC ON MANAGEMENT. REMOTE WORK – NEW CHALLENGES FOR EMPLOYEES AND COMPANIES

Anna GEMBALSKA-KWIECIEN^{1*}, Elżbieta MILEWSKA²

¹ Silesian University of Technology, Faculty of Organization and Management;
Anna.Gembalska-Kwiecien@polsl.pl, ORCID: 0000-0001-9275-0447

² Silesian University of Technology, Faculty of Organization and Management; Elzbieta.Milewska@polsl.pl,
ORCID: 0000-0001-8053-4333

* Correspondence author

Purpose: The purpose of the article is to discuss issues related to remote work. The article is addressed to all persons who recently had to switch to remote work. Remote work is a novelty for many people. Just like every change, it often triggers adverse reactions, including fear, anxiety and reluctance. The article explores this type of work, presenting both its advantages and disadvantages. It summarises drawbacks and merits of remote work for both companies and individual employees. Moreover, it outlines challenges faced by companies and associated with the remote work system.

Design/methodology/approach: Literature research of the subject was carried out.

Findings: According to the data of OECD, we are currently one of the hardest working nations of Europe. However, this makes apparent the adverse trend related to remote work – a lot of overtime. This is a proof that many employees are unable to draw the line between their professional life and private life, with a significant harm to the latter. Therefore, the problem must be explored further. However, with a high degree of probability, where remote work proves to be effective, companies will combine remote and office work by deploying a hybrid work model. Such a solution is advantageous from both social – it is important for employees to experience team work and feel that they belong to a group – and well-being – isolation is often harmful for mental health – point of view.

Practical implications: A modern organisation, corporation or company is an entity that quickly and decidedly responds to changing market needs. Every employee must be able to use modern technologies. Such skills turned out to be a necessity to perform tasks and professional duties, since use of cutting-edge technologies is a foundation of remote work.

Originality/value: A holistic view on the issue of remote work from the perspective of employees for whom it is a novelty. Presentation of certain hazards associated with remote work along with its undeniable advantages for employees and employers.

Keywords: company management, remote work, pandemics, human factor.

Category of the paper: General review.

1. Introduction

Recently, many white-collar employees who previously worked in offices, schools, institutions or corporations had to face a radical change of conditions of performance of their professional work. In the face of pandemics, they had to stay home to limit spreading of the coronavirus. Therefore, many employees had to leave a common office or school space and create their own workplaces at home. Of course, such a workplace had to be equipped with appropriate office devices, in particular a PC with Internet access, phone, fax, photocopier, as well as many other devices necessary to perform remote work.

When executing work in a traditional, on-site form, employees up to this point tried to draw the line between professional work and private space, to “not bring their work home”, according to the rule “my home is my castle”.

Is it possible in case of remote work? How employees and employers dealt with this new situation? What consequences and challenges remote work brings about for both?

Searching for answers to the above questions, the authors of this article conducted research aimed at familiarizing themselves with the conditions of remote work. Attempting to present the discussed issue in a holistic perspective, they analyzed and described the perspective of both the employer and the employee. The article presents various definitions of the return: remote work. Its advantages and disadvantages are described, which reflect the sociological, organizational, technical and financial aspects. In the summary, the authors drew attention to the new challenges faced by employees. They are related both to the adaptation of the home environment to the performance of professional work, to the change in the manner of performing the entrusted professional duties in changing environmental conditions, and to the need to adopt new rules of working time management.

2. What is remote work

In the contemporary world, a modern organisation, corporation or company is an entity that quickly and decidedly responds to changing market needs. Every employee must be able to use modern technologies. Such skills turned out to be a necessity to perform tasks and professional duties, since use of cutting-edge technologies is a foundation of remote work.

The dynamic development of remote work is frequently an element that makes it difficult to create a clear-cut definition of the discussed issue; therefore, it is often not easy to grasp its essence since new elements are constantly being added to it.

Back in 1995 (the report by R. Blanpain), remote work was defined as “a work performed on behalf of an employer or a client, mainly in a place other than a traditional workplace, using IT techniques”. While in 2007, (Ciupa) it was presented as “a new form of system and performance of work, in which the nature, place and time of work, the method and conditions of its performance, the order and organization may be shaped by using advanced IT and communication technologies” (Felstead, Henseke, 2017; WFirma, 2022).

For this reason, we may assume that the notion of remote work does not relate only to the nature of work, but also the place of its performance. Another important element, which was already mentioned here, is the use of modern technologies and communication devices, which allow creation of a new space for relations between employees and employers.

Remote work is often also referred to as telework or e-work, because an employee, when using modern technologies to perform it, sends the work results to an employer via the Internet. Employees contact employers using electronic mail and various instant messengers. Therefore, in order to precisely define remote work, we must refer to the Labour Code, which accurately pinpoints the issue.

The Polish law defines telework in the Article 67(5) §2 of the Labour Code as follows: “A teleworker is a worker who performs work in conditions specified in §1 and submits the work results to their employer in particular via electronic communication means.”

On the other hand, the European Commission defines remote work as follows: “a method of organisation and performance of work, where an employee performs work outside the company that employs them for a certain part of their work time, and delivers the work results to their employer via IT and data transfer technologies, in particular via the Internet”. This definition highlights the organisational aspect of remote work, and also points to the fact that employees perform their duties outside their workplace.

After summarising all elements of the aforementioned descriptions of the discussed topic, we propose the following definition:

“Remote work (online work, flexible work, mobile work, telework or e-work) should be understood as a form of organisation of work accordant with the rules of a company, the employees of which do not perform work directly in the headquarters (department, branch or unit) of the employer, but rather via use of electronic communication means (PC, phone, Internet)” (Jeran, 2016; Oreg et al., 2011; Szluz, 2013).

However, it should be noted that, despite its current popularity, remote work will not be successful in every field. Telework is a good solution in case of employees who for most of the time analyse and process information. Results of their work do not require physical contact with an employer or are intangible. It is recommended mostly for representatives of so called independent professions, in particular: graphic designers, illustrators, copywriters, editors or translators. It is an excellent solution for young parents or persons taking care of elderly bedridden persons, who want or must work and look after children or elderly people at the same time.

Remote work may be regular or occasional. By the latter we understand emergency situations, e.g., when an employee must be home in a given day because they wait for an electrician, plumber etc. and their employer allows them to perform work from home on that day.

There is also a classification that considers the time for which an employee performs their duties remotely – according to this classification, e-work may be divided into:

- permanent – full time remote work,
- alternating – on certain days an employee works from home, and on other works in an office,
- supplementary – full time on-site work, in exceptional situations an employee takes work home and performs it remotely.

Due to the present coronavirus pandemic, most employees worked remotely for a certain period of time. The anti-crisis shield has introduced regulations related to remote work, which are currently regulated in the Act of 2 March 2020 on particular solutions related to prevention, counteracting and combating COVID-19, other contagious diseases and crisis situations caused by them (Łochnicka, 2015; Ślęzak, 2012; WFirma, 2022).

3. Advantages and disadvantages of remote work for employers

Remote work undoubtedly brings about many benefits for employers. But do they outweigh the disadvantages?

Among the benefits of remote work for employers, we may certainly point out the following (Bąk, 2006; Makowiec, Bober, 2008; Makowiec, Mikuła, 2014; Sikora, 2012; WFirma, 2022):

- significantly lower cost of functioning of a company,
- reduction of costs associated with use of real estates and providing employees with workplaces featuring an own desk equipped with a PC (when some employees work outside the office/are on a leave or a sick leave, an employer must pay for an empty workstation), reduction of costs of furnishing and office equipment, as well as saving of the office space and use of consumables,
- lower employee costs – reduction of costs associated with onboarding of employees and trainings and the ability to employ workers from regions of lower level of wages; moreover, reduction of costs of maintenance and security staff,
- less overtime – remote employees are less likely to take a day off,
- significant reduction of employee rotation since the majority of employees prefer remote work,

- and, of course, the flexibility of remote work – this form allows to employ additional employees without any changes in arrangement of office spaces.

The disadvantages of remote work for employers include (Firnkes, 2022; Zalega, 2009):

- high starting costs – a significant amount of expenditure incurred in a short time due to costs associated with the need to purchase new equipment, required software, as well as fees for use of ITC connections,
- motivation of employees becomes more difficult – lack of full control which may translate into lower level of efficiency of employees in case of sporadic contact with them; it becomes much harder to create the sense of the company's main goal, making financial motivation the main and sometimes even the only form of inducement,
- it is harder to protect data during remote work – information related to operations of a company do not stay inside the company, but are rather sent to an employee's home and back; therefore, there is a risk that information may leak during the communication process, and as a result fall into hands of competition or unauthorized persons,
- it is more difficult to settle the efficient work time – due to this, employees are usually paid for the effects of their work, and not the time spent on performing it; however, there are types of work where this form of settlement is not always applicable,
- it is more difficult to create specific standards, increasing the time needed to achieve the company's goals,
- long and frequent conversations, the costs of which are borne by an employer, which may sometimes significantly increase the cost of employment of an employee,
- lack of commitment and sluggishness, which also reduce the potential of employees, and thus their efficiency.

4. Advantages and disadvantages of remote work for employees

Remote work has a lot of advantages – for this reason it is liked and preferred by many employees. But are employees also aware of its disadvantages?

Among the benefits of remote work for employees, we may certainly point out the following:

- huge saving of time associated with preparation and journey to a workplace,
- a significant freedom in terms of selection of a place of work for an employee – if they have appropriate devices, employees may work in a park, in a garden, by a lake etc.,
- moreover, they often have freedom in terms of the time of completion of a task, provided they observe the deadlines indicated by their employer – an employee may plan the time of completion of a task according to their capabilities and needs,

- significantly greater job satisfaction and more honest assessment of an employee's work – an employee's look, contacts or acquaintances at work, as well as their working style, are insignificant – only the actual results of their work matter,
- global possibilities for greater development – significantly greater possibilities of acquiring new employers or clients,
- limitation or elimination of negative aspects of the corporate culture, including constant competition, so called “rat race”,
- mental comfort – work in a pleasant and calm atmosphere (you may work while listening to your favourite music and not disturb your colleagues), no constant supervision and stressful control by your employer,
- more efficient work – of course, given that it is well organised and an employee has good internal discipline,

The disadvantages of remote work for employees include:

- lack of possibility of actual integration with other team members necessary for mental well-being of many employees,
- it is difficult to draw the line between work and leisure time – there are many things in your house that may distract you – this change of a lifestyle is often mentioned as the greatest disadvantage of remote work since for many employees the line between their professional and private life becomes “blurred”,
- asynchronous communication – often long response times when we need information to be able to continue work “immediately”,
- isolation and feeling of loneliness of remote workers – no contact with colleagues, no traditional conversations over a cup of coffee – in case of some employees, this causes adverse mental reactions (they often feel that they are on their own, have no support or feel isolated from their work team),
- limited promotion possibilities in certain cases – many remote workers, when working outside the office, are unable to show their accomplishments, are being unnoticed or are unable to influence others (at least to a degree that would be possible during work in a traditional office),
- possible stress within your family – working from home may increase the stress level of an employee or their remaining family members, e.g., due to the necessity to remain silent, or disturb the family life due to its disorganisation,
- in certain cases – stagnation caused by lack of actual affiliation with a company.

Currently, more and more employees declare that they want to work from home. The popularity of remote work increases. It gives large and still new possibilities to develop in the Internet, as well as allows to hold meetings online. According to a research in Poland, every third person will probably select this form of work (Brosix, 2019; BSJP, 2020; E-pasje, 2022; Firnkes, 2022; Kantar TNS, 2018; Wyrzykowska, 2014).

5. Remote work and its challenges for an employee

As presented above, the popularity of remote work among employees keeps growing; therefore, we should also point out the challenges it creates for every employee.

Below, we present selected challenges of remote work for employees (Felstead, Henseke, 2017; Kamińska, Tokarsk, 2016, Lorenz, 2011; Sęczkowska, 2019):

- professional accountability: Can you focus and do you know that you can focus on independent manner of work. If not – if you need someone by your side, someone who would constantly indicate subsequent work steps and give you tasks – such a form of work will be a real challenge for you;
- career development: As a remote worker, are you sufficiently “noticed” by your boss or employer? Can you live without conversations on topics that are not directly related to your work? If you want to dynamically develop your career or have ambitious professional plans, this may cause problems;
- delegation of power and responsibilities: Are you able to efficiently deal with professional matters, including delegation of power, authorisations or responsibilities to particular employees via a phone, chat or e-mail?;
- professional infrastructure: Do you own necessary tools and have space in your apartment for a home office? Do you have appropriate working conditions, e.g., silence?;
- organizational culture: Do your colleagues and supervisors have any experience in collaboration with remote workers? Can you use their ideas and advice to improve the quality of your remote work?;
- financial conditions: Did you establish who will cover additional costs associated with having a home office? Is it accounted for in your remuneration?;
- the need for direct contact between colleagues: Do you feel the need to create close relations in your working environment? Is remote contact with your colleagues sufficient for you? Or maybe you need to maintain direct relations with other employees to stay in good mental health?;
- the necessity to draw the line between professional and private life: Are you able to draw the line between private and professional life? It is difficult when your work remotely, and when it becomes impossible, it is a huge problem.

Practical implications related to remote workers (Aguenza, Som, 2012; Baron-Polańczyk, Klementowska, 2018; Dolot, 2020; Sikora, 2012; Zieliński, 2016):

- you work from home: However, when you work remotely, you should not feel “too comfortable” and work, e.g., on a sofa, which is associated with leisure time rather than work. Feeling “good” is enough;

- video and other meetings or conferences allow insight into your private life; therefore, you should indicate a separate working area in your home;
- professional communication channels: If you can, try to separate your communication channels into professional and private ones, e.g., do not use your personal computer or smartphone for professional communication;
- work time: Establish your working hours with your employer, as well as the time of your availability and the time you are logged in. Or maybe it is not important for your employer and you may perform work in hours that are suitable for you? If so, do not forget to do your work! For many employees, a great practice is to perform work in established hours.

6. Remote work and its challenges for companies

Despite the high popularity of remote work, it is not simple, particularly at the beginning. It may also end with a failure if a company or employees are not ready for such a form of work (Antal, 2020; E-pasje, 2022; Firnkes, 2022; Łodyga, 2007):

- often, keeping in touch with your colleagues working in office proves to be challenging: Employees should feel integrated with the team. In practice, it is not that simple, since they do not contact each other personally every day. Therefore, supervisors should show good leadership skills and trust their employees.
- professional and social integration of employees: The employer should regularly organise meetings or team events, if possible. They favour team integration, which is so important for certain employees who value direct contact with others. Moreover, sometimes it is easier to discuss certain misunderstandings or uncertainties that emerged during remote work through face-to-face conversation.
- infrastructure: You should precisely establish the techniques and tools that will be necessary in the future to ensure that cooperation is efficient. Starting from video-conference systems to working time recording, if needed. Information circulation is very important here.
- important issues related to remote work: Companies should specify in writing important points related to cooperation with persons working remotely. These may include issues such as rights, responsibilities, working hours, but also very important matters associated with data protection and access to data of the company's clients.

7. Work efficiency of an employee working remotely

Are remote workers less efficient? Many companies ask themselves these questions. But can they be answered unambiguously?

Many companies refuse to allow remote work, since this means losing control over employees compared to work on-site, e.g., in an office. Many employers still think that remote work equals procrastination.

On the other hand, according to many researches related to remote work, remote workers use their time significantly more efficiently compared to employees working on-site. Very often, employees spend much more time on efficient work at home – e.g., they decide to dedicate an additional evening to continue working on a project or contract that is important to their company.

In practice, the truth probably lies somewhere in between.

At home, an employee may be tempted by many issues unrelated to professional work – walking their dog out, work in a garden, urgent cleaning or shopping – there is nothing wrong about that, but you should remember that such activities should be done during breaks in work.

On the other hand, an employee is not distracted by their colleagues – this argument should not be underestimated. Also in case of on-site work, during various meetings and conferences, at some point a substantive discussion may switch to private matters, thus prolonging the discussion, making the participants lose the thread, and forcing them to start over – everyone has been there. Often, endless “brainstorms” in an office do not bring about anything new. A remote worker is able to indicate a safe and comfort working zone, in which they will not be distracted by other people.

Therefore, the question of whether employees are more efficient at home or in an office is often not the most important one. What is important is whether employees are motivated or not – regardless of where they work. Escape and “chilling out” is also possible when working on-site. Appropriate inducement of employees is a very important issue associated with an organisational culture of a given company that must be developed using high standards – if that happens, positive results will come very quickly (ILO, 2020; Solo-Kolos Sp. z o.o., 2020; Szymczyk, 2022; Piątkowski, 2011).

Summary

What is the future of remote work? According to the data of OECD, we are currently one of the hardest working nations of Europe. In 2019, Poles spent on average 1806 hours on execution of professional duties. Other nations, such as Norwegians, Danes or Germans,

even more than 400 hours less. This makes apparent the adverse trend related to remote work – a lot of overtime. This is a proof that many employees are unable to draw the line between their professional life and private life, with a significant harm to the latter.

However, with a high degree of probability, where remote work proves to be effective, companies will combine remote and office work by deploying a hybrid work model.

Such a solution is advantageous from both social – it is important for employees to experience team work and feel that they belong to a group – and well-being – isolation is often harmful for mental health – point of view.

The conducted research identified new challenges that were set for employees. They take the form of: adapting the space of the home environment to the performance of professional work, changing the manner of performing the entrusted professional duties or implementing new rules of working time management. Each of the above-mentioned challenges may constitute the direction of further scientific research in the area under consideration.

Acknowledgements

This article was created as part of statutory work 13/010/BK_22/0065 conducted at the Institute of Economics and Informatics at the Faculty of Organisation and Management of the Silesian University of Technology.

References

1. Aguenza, B.B., Som, A.P.M. (2012). Motivational factors of employee retention and engagement in organizations. *International Journal of Advances in Management and Economics*, 1(6), pp. 88-95. Retrieved from <https://www.managementjournal.info/index.php/IJAME/article/viewFile/233/222>, 15.04.2022.
2. Antal (2020). *Raport: Elastyczność specjalistów i menedżerów w dobie zmian*. Retrieved from <https://antal.pl/wiedza/raport/elastycznosc-specjalistow-i-menedzerow-w-dobie-zmiany>, 15.04.2022.
3. Bąk, E. (2006). *Elastyczne formy zatrudnienia*. Warszawa: C.H. Beck.
4. Baron-Polańczyk, E., Klementowska, A. (2018). Od "ryнку pracodawcy" do "ryнку pracownika" – zawody deficytowe w ujęciu ogólnokrajowym i regionalnym. *Spoleczności Lokalne. Studia Interdyscyplinarne*, 2, pp. 199-208.
5. Brosix (2019). *Working Remotly*. Retrieved from <https://www.brosix.com/files/docs/Working-Remotely-Statistics-and-Data.pdf>, 10.05.2022.

6. BSJP (2020). *Telepraca a praca zdalna na gruncie Kodeksu pracy*. Retrieved from <https://bsjp.pl/pl/article/title;telepraca-a-praca-zdalna-na-gruncie-kodeksu-pracy/>, 15.04.2022.
7. Dolot, A. (2020). Wpływ pandemii COVID-19 na pracę zdalną – perspektywa pracownika. *E-mentor*, 1(83), doi: 10.15219/em83.1456.
8. E-pencje (2022). *Praca zdalna co to znaczy? Wady i zalety pracy na odległość*. Retrieved from <https://e-pasje.pl/praca-zdalna-co-to-znaczy-wady-i-zalety-pracy-na-odleglosc/>, 12.05.2022.
9. Felstead, A., Henseke, G. (2017). Assessing the growth of remote working and its consequences for effort, well-being and work-life balance. *New Technology, Work and Employment*, 32(3), pp. 195-212, doi: 10.1111/ntwe.12097.
10. Firnkes, M. (2022). *Praca zdalna: jej zalety i wady dla pracowników i firm*. Retrieved from <https://raidboxes.io/pl/blog/agencies-freelancers/remote-arbeiten/>, 12.05.2022.
11. ILO (2020). *Teleworking during the COVID – 19 pandemic and beyond. A Practical Guide*. Geneva: International Labour Organization. Retrieved from https://www.ilo.org/-wcm5/groups/public/---ed_protect/---protrav/---travail/documents/instructionalmaterial/wcms_751232.pdf, 15.04.2022.
12. Jeran, A. (2016). Praca zdalna jako źródło problemów realizacji funkcji pracy. *Opuscula Sociologica*, 2, doi: 10.18276/os.2016.2-04.
13. Kamińska, J., Tokarski, T. (2016). *Profilaktyka obciążenia wynikającego z presji czasu. Tablet, laptop, stanowisko z jednym i wieloma monitorami*. Warszawa: CIOP-PIB. Retrieved from https://www.ciop.pl/CIOPPortalWAR/file/83377/2-Z-25-Ergonomiczne-stanowisko-pracy-z-komputerem-J_Kaminska.pdf, 12.05.2022.
14. Kantar TNS (2018). Raport: The Remote Future. *Rynek pracy zdalnej a oczekiwania pracowników Edycja Polska*. Retrieved from <http://branden.biz/wp-content/uploads/2018/06/The-Remote-Rynek-pracy-zdanej.pdf>, 12.05.2020.
15. Łochnicka, D. (2015). Zaangażowanie pracownicze jako determinanta rozwoju organizacji. *Studia Prawno-Ekonomiczne*, XCIV(94), pp. 317-334.
16. Łodyga, O. (2007). Telepraca – możliwości i ograniczenia. *E-mentor*, 3(20), pp. 72-74.
17. Lorenz, K. (2011). Telepraca a środowisko naturalne. Zeszyty Naukowe Uniwersytetu Szczecińskiego. *Studia Informatica*, 27, pp. 153-158.
18. Makowiec, M., Bober, T. (2008). Wpływ pracy na człowieka zatrudnionego na zasadach telepracy. In: A. Chodyński (Ed.), *Zarządzanie rozwojem przedsiębiorstw i regionów. Wybrane aspekty ekologiczne i społeczne* (pp. 145-156). Kraków: Krakowska Szkoła Wyższa im. Andrzeja Frycza Modrzewskiego.
19. Makowiec, M., Mikula, B. (2014). Dehumanizacja w telepracy domowej. *Miscellanea Oeconomicae*, 18(1), pp. 61-70.

20. Oreg, S., Vakola, M., Armenakis, A. (2011). Change Recipients' Reactions to Organizational Change: A 60-Year Review of Quantitative Studies. *The Journal of Applied Behavioral Science*, 47(4), pp. 461-524, doi: 10.1177/0021886310396550.
21. Piątkowski, M. (2011). Znaczenie form zatrudnienia w funkcjonowaniu przedsiębiorstw. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Ekonomiczne Problemy Usług*, 73, pp. 431-442.
22. Sęczkowska, K. (2019). Konsekwencje psychospołeczne pracy zdalnej. *Problemy Nauk Humanistycznych i Społecznych. Teoria i Praktyka*, 2, pp. 10-16.
23. Sikora, J. (2012). Telepraca – o walorach i pułapkach elastycznego zatrudnienia. In: Z.E. Zieliński (Ed.), *Rola informatyki w naukach ekonomicznych i społecznych. Innowacje i implikacje interdyscyplinarne* (pp. 81-88). Kielce: Wydawnictwo Wyższej Szkoły Handlowej.
24. Ślązak, A. (2012). Przegląd badań dotyczących telepracy. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania*, 30, pp. 219-232.
25. Solo-Kolos Sp. z o.o. (2020). Zalety i wady pracy zdalnej. Retrieved from <https://joblife.pl/ciekawostki/zalety-i-wady-pracy-zdalnej/>, 12.05.2022.
26. Szluz, B. (2013). Telepraca – nowoczesna, elastyczna forma zatrudnienia i organizacji pracy. Szansa czy zagrożenie? *Modern Management Review*, 4, pp. 253-266.
27. Szymczyk, J. (2022). *Praca zdalna – poznaj jej plusy i minusy*. Retrieved from <https://poradnikpracownika.pl/-praca-zdalna-poznaj-jej-plusy-i-minusy>, 8.05.2022.
28. WFirma (2022). *Praca zdalna - jakie są za i przeciw stosowaniu takiego rozwiązania?* Retrieved from <https://poradnikprzedsiębiorcy.pl/-praca-zdalna-za-i-przeciw>, 10.05.2022.
29. Wyrzykowska, B. (2014). Przedsiębiorstwo bez pracowników – telepraca. *Logistyka*, 4, pp. 3801-3813.
30. Zalega, T. (2009). Praca zdalna – obraz przemian w Polsce i wybranych krajach Unii Europejskiej. *Master of Business Administration*, 17(4), pp. 35-45.
31. Zieliński, M. (2016). Znaczenie CSR w warunkach rynku pracownika. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, 95, pp. 567-576.

EMPLOYEE JOB SATISFACTION IN INDUSTRY 4.0 ERA: INSIGHTS FROM THE POLISH SMES

Magdalena GĘBCZYŃSKA

Silesian University of Technology, Department of Organization and Management;
Magdalena.gebczynska@polsl.pl, ORCID: 0000-0002-0463-0144

Purpose: The aim of this article is to identify the key factors influencing the achievement of job satisfaction by employees in Polish small and medium-sized manufacturing enterprises during digital transformation.

Design/methodology/approach: The research covered employees of Polish small and medium-sized manufacturing enterprises and was divided into three main stages. In the first two stages, the subjects for the research were selected, i.e. those companies that have achieved a high degree of digital maturity. Then, in order to identify and recognize which factors are most important for achieving employee job satisfaction in the Industry 4.0 era, a survey questionnaire was used for the study.

Findings: Empirical research indicates the most important factors related to job satisfaction in manufacturing SMEs with a high degree of maturity level are: job security, autonomy, and empowerment.

Research limitations/implications: The main limitation is the selection of the sample, i.e. Polish SMEs, as well as the last economic conditions and the global crisis, which can have an impact on the research results and limit the generalization of the results.

Practical implications: The conducted empirical research contributes to the science and practice of management by providing insight into the premises and factors related to achieving job satisfaction in small and medium-sized industrial enterprises in the Industry 4.0 era.

Originality/value: The results of this article may be useful for understanding the phenomenon of achieving employee job satisfaction in the Industry 4.0 era, as they identify key factors in this area.

Keywords: job satisfaction, SMEs, Industry 4.0.

Category of the paper: Research paper.

1. Introduction

Industry 4.0 has become one of the most popular topics and most chosen areas in academic and professional fields (Frank et al., 2019). Referred to as the Fourth Industrial Revolution, it was introduced in 2014 by the German Federal Government as a technology plan for German industry (Machado et al., 2020). The literature has mainly focused on the digital transformation of industries and companies to the level of 'Industry 4.0' (Dalenogare et al., 2018), however, the Fourth Industrial Revolution covers many areas and fields of activity, and the solutions introduced have implications for a state in every sphere of economic and social life. The digital transformation affects the labor market, where the adaptation of companies in terms of competencies to the requirements of Industry 4.0 becomes crucial for their competitiveness. Industry 4.0, as a broad field, includes data management, manufacturing competitiveness, production processes, and productivity.

Industry 4.0 is a term that encapsulates the integration of intelligent machines, and systems and the way in which changes are made to production processes to achieve even better productivity. It can be described as the current trends in data exchange and automation between production technologies or activities. Industry 4.0 focuses on the development of 'smart' factories that can meet dynamic production scenarios, management objectives, and new business models (Oztemel, Gursev, 2018). The digital transformation process has been supported by the implementation of four underlying technologies: the Internet of Things (IoT), Cloud Computing, Big Data, and Artificial Intelligence (AI) (Frank et al., 2019). As numerous studies have shown, digital transformation does not aim to eliminate human labor but to support and complement it by introducing collaboration between machines, people, and systems. Robots can, for example, perform tasks that require adverse working conditions. An important element of Industry 4.0 is also the increasingly far-reaching integration of CPS (cyber-physical systems), which translates into the use of artificial intelligence in production, dynamic production control, as well as real-time access to information. The past three Industrial Revolutions (Industry 1.0; Industry 2.0; Industry 3.0) were driven by mechanization, electrification, and information technology in manufacturing which enhanced resource utilization as well as productivity (Zhong et al., 2017). One of the hallmarks of the Fourth Industrial Revolution compared to previous revolutions is the continuous real-time interconnectivity among processes, products, services, and people (Chiarini et al., 2020).

The literature on the subject does not present a single, coherent, and closed catalog of technologies supporting the Industry 4.0 concept; indeed, there are some discrepancies in this respect (Fettermann et al., 2018). Based on a critical analysis of the available literature, enabling technologies for digital transformation include Big data and Analytics, the Internet of Things, Cyber-Physical Systems, Artificial Intelligence, Cloud Technology, Automation, and Industrial Robots.

Big data and analytics, i.e. the collection and analysis of large amounts of data, where data is processed in larger volumes, at higher speeds, and with greater variety (Fosso Wamba et al., 2015). The Internet of Things is an information network of physical objects that enables the collection and exchange of data, while also enabling the interaction and collaboration of these objects (Oztemel, Gursev, 2018). Cyber-physical systems, are a set of transformative technologies whose main purpose is to monitor physical systems while creating a virtual copy (Alguliyev et al., 2018). Artificial intelligence, i.e. a system that thinks rationally and in the way humans think according to six main disciplines: natural language processing, knowledge representation, automatic inference, machine learning, computer vision, and robotics (Monostori, 2003). Cloud technology is a system for storing all software, applications, and data online on a virtual server without installation (Xu, 2012). Industrial automation and robots, i.e. machines and devices that automate operational processes, allow humans and machines to work together in a shared learning environment (Ghobakhloo, 2018).

Industry 4.0 requires companies to introduce a range of solutions and to have resources with the right competencies, both soft, transversal, and traditional technical skills, including digital. Due to the rapid pace of technology development, and the resultant rapid obsolescence of skills among both low-skilled and skilled workers, employees are required and expected to develop and adapt their competencies to the requirements of Industry 4.0.

The changes associated with digital transformation, implementation, and application of Industry 4.0 solutions are not without impact on employees and their perception of job satisfaction. Job satisfaction is defined as an employee's emotional state resulting from the individual's perception of his or her job as realizing or providing the opportunity to realize the important values available at work, provided that these values coincide with his or her needs (Locke, 1969). Achieving job satisfaction for employees received the attention of many researchers because it is important for the individual's performance within the organization (Mohammad et al., 2017) and despite its wide recognition in the literature, is still a topical issue and remains of interest to theorists and practitioners. Job satisfaction is linked to a number of factors that influence and enable it to be achieved. In view of the progressive digitization of many branches of the economy and different spheres of life, where never before has technology, which links various industries and society, had such a strong impact on the type and volume of activities and production, it seems necessary to identify the factors influencing the achievement of job satisfaction. Hence, the aim of this article is to identify factors influencing the achievement of job satisfaction by employees in Polish small and medium-sized manufacturing enterprises in the Industry 4.0 era.

Based on an in-depth analysis of the literature, the following factors related to achieving employee job satisfaction were selected: (1) supervisory communication, (2) person-organization fit, (3) supervisor support, (4) rewards, (5) organizational commitment, (6) work-life balance, (7) organizational pride, (8) leadership style, (9) quality of work-life, (10) job security, (11) autonomy, (12) teamwork, (13) salary, (14) empowerment.

The article consists of three main parts. First, a brief review of the literature on selected factors affecting employee job satisfaction is made. Then the research procedure is presented and the main stages of the empirical study are described in detail. The results of the analysis and conclusions are discussed in the last section.

2. Theoretical background

Taking after Mitchell et al. (2017), job satisfaction is the Holy Grail of organizational psychology. Job satisfaction indicates the degree to which people like or dislike their jobs (Badrianto, Ekhsan, 2020). Job satisfaction can be defined as employees' attitudes toward the company, the duties performed, co-workers, and other factors that may be related to the psychological atmosphere of the work environment (Bae, Kim, 2016). Job satisfaction is one of the factors that must be managed in such a way that employees retain their enthusiasm and energy to dedicate themselves to achieving organizational goals (Nyanga et al., 2018). In addition, it is an important factor for the survival and development of enterprises, even more so during the economic recession and crisis caused by the COVID-19 pandemic and the war in Ukraine. Job satisfaction is important because an employee's attitude and beliefs can influence his behavior and relationship with the organization. Job satisfaction can also be viewed in the broader context of issues affecting an employee's work experience, or quality of work life. Moreover, employees spend most of their day in the work environment, so job satisfaction not only affects their overall well-being but translates into their attitudes and feelings in other areas of their lives as well.

Based on an extensive review of the literature on the subject, a total of fourteen of the most common and recurring factors associated with achieving employee job satisfaction were selected. These factors will be characterized below.

Supervisory communication is important in managing the organization and has been identified as a strong factor in predicting the organizational environment. Is connected with, among others, the style of leadership (Graen, Uhl, 1995) or job satisfaction (Gok et al., 2014). Even if it is not clearly defined, the function of supervisory communication serves as a large determinant of job satisfaction. Various researchers use the term interchangeably with leadership and managerial communication (Bakar et al., 2007).

Person-organization fit is a complex and multidimensional concept analyzed from the perspective of fitting a person to the environment and its various aspects, such as: fitting a person's organization, fitting a person to work, and fitting a person to the environment (Jansen, Kristof, 2006). The person-organization fit can be defined as the similarity of values, the similarity of goals and compliance of employees' needs with support in the work environment, and compliance of individual and organizational characteristics. The higher the

level of person-organization fit, the greater the impact on the results desired by the company, including increased satisfaction with work, organizational commitment, and reducing the level of departure of employees (Jin et al., 2018).

Supervisor support is the degree to which employees perceive that their superiors care about their well-being (De Clercq et al., 2016). Supervisor support creates a sense of value for the employee and builds a strong relationship between the employee and the organization (Dhir, Dutta, 2020). Feedback from the supervisor is also a form of support (van der Klink et al., 2001). Bibi et al. (2018) also explained that if employees receive adequate support from their supervisor, they will behave positively towards the organization. Anderson et al. (2002) showed that supervisory support was directly related to job satisfaction.

The reward is defined as all the monetary, non-monetary, and psychological payments that an organization provides to its employees (Bartol, Locke, 2000). Gerald and Dorothee (2004) indicate that rewards for work are a strong indicator of job satisfaction and are largely related to professionalism and job satisfaction, which depends on both financial and non-financial rewards. Organizational reward systems should therefore include both financial rewards, such as non-financial rewards. In addition, the rewards are divided into internal rewards and external rewards. Rehman et al. (2010) found that external rewards had a strong relationship with job satisfaction as compared to internal rewards. The reward can affect job satisfaction and employee productivity (Riasat et al., 2016), but an internal reward is a form of complacency that has a greater impact on job satisfaction (Putra et al., 2018).

Organizational commitment is an emotional and psychological bond and a link with the organization (Andi Kele et al., 2016). Commitment often results in positive outcomes such as increased productivity, better performance, reduced absenteeism, and employee turnover (Suliman, AlJunaibi, 2010). Organizational commitment is the level of employees' ability to identify and actively participate in the organization, which was characterized by the willingness to maintain membership in the organization, trust, and acceptance of the values and goals of the organization, and the willingness to cooperate as closely as possible in the interest of the organization (Nor et al., 2022). Organizational commitment can be defined as the bond and loyalty of an employee to his organization and work (Mahmoud et al., 2020). Organizational commitment is the predecessor of many important organizational constructs, such as motivation, stress, job satisfaction, and work commitment (Bozeman, Perrewe, 2001).

Swami (2007) defined **work-life balance** as a practice that concerns providing employees with the opportunity to balance their work with the responsibilities and interests they have outside of work. The determinants of the conflict between work and private life are organizational and industry attributes (e.g. working hours, low wages, low skills, education mismatch, lack of career development, and need for conditional employment) (Deery, 2008) and employee dimensions (e.g. stress, burnout, emotional exhaustion) (Deery, 2008). Work-life balance helps a person achieve both personal and professional goals (Oludayo et al., 2015).

Recent findings (Kasbuntoro et al., 2020) directly indicate that work-life balance has a profound effect on job satisfaction.

Organizational pride is based on certain psychological structures, with reference to the relationship between employees and these organizations (Haslam, 2004). Mischkind's (1998) definition indicates organizational pride as the positive feeling of an employee in his institution. Research has shown the effect of pride on job satisfaction (Arnett et al., 2002). Employees who identify with their work and take pride in working in the company are also satisfied with their work (Van Dick et al., 2004). Organizational pride is considered a precursor to job satisfaction as it relates to an employee's emotional attachment, identification with and commitment to the organization (Lok, Crawford, 2001).

Leadership is a process of social influence in which the leader strives for the voluntary participation of subordinates in the pursuit of organizational goals. It is a process in which one person exerts a social influence on other members of a group, the process of influencing the actions of an individual or a group of individuals striving to achieve a goal in given situations, and a concept of a relationship that includes both the influencer and the person affected (Bhatti et al., 2012). Studies in the areas of management and organizational behavior show that the **leadership style** of managers affects employee satisfaction with work (Judge et al., 2001). In addition, researchers recognize that leadership styles are a key aspect of an organization's achievements or failure (Trottier et al., 2008), and employee management is entirely dependent on the quality of leadership (Arnold et al., 2015). Most leaders adapt their leadership style to the needs and working environment of the organization (Zahari, Shurbagi, 2012), and Rowold et al. (2014) propose that the leadership style of the supervisor positively influences employees' organizational commitment and job satisfaction.

The quality of work life has for years been of interest to psychologists and sociologists, as well as scientists (Back et al., 2011). QWL is the favorable conditions and environments of a workplace that support and promote employees' satisfaction by providing them with job security and reward (Lau, 2008). The scope of QWL affects not only employee satisfaction with work (Koonmee et al., 2010), but also life outside work, such as family, other activities and social needs (Gallie, 2003).

The research directly emphasizes that the sense of **job security** is conducive to the organizational commitment of employees, which concerns the degree of identification of the employee with their work or organization and its goals (Apkan, 2013) and that the impact of occupational safety on job satisfaction is large and significant (Kraimer et al., 2005). Research by Wolff (2008) found that job insecurity showed a strong association with negative physical health conditions such as fatigue, insomnia, and body pain. In turn, Silla et al. (2009) found that high perceptions of occupational safety will also result in higher job satisfaction.

Job autonomy is characterized as the level of control an employee has over his direct tasks and planning (Liu et al., 2005) and describes the degree to which work provides the employee with freedom in planning work (Chang, Cheng, 2014). In addition, it relates to the degree of

control and discretion an employee can exercise over the way they perform their work (Voydanoff, 2004). Autonomy is a predictor of job satisfaction (Chang, Cheng, 2014) and is widely recognized as beneficial to the organization as it is generally associated with positive work outcomes (Kubicek et al., 2017).

Teamwork is a group of people who strive to achieve specific goals and relies heavily on understanding between colleagues, using communication skills (Sanyal, Hisam, 2018). Teamwork is seen as mobilizing a small number of talented people who are committed to a common goal, operational goal, and self-management (Greenberg, Baron, 2003). Working teams are groups whose members work intensively on a specific and use their positive relationships, individual and team responsibility, and cooperation skills (Robbins, Coulter, 2012). Daft (2012) suggests that building effective teamwork involves issues such as general clear goals, appropriate skills, mutual trust, commitment, good communication, negotiation skills, appropriate leadership, internal support, and external support. Teamwork influences job satisfaction, which means that better teamwork will result in higher satisfaction (Musriha, 2013).

Salary is another factor related to achieving job satisfaction. It is defined as the amount that employers pay their employees for the performance of their contractual obligations. Research indicates that salary is related to achieving job satisfaction (Prakash Sharma, Bajpai, 2011). A study by Hamermesh (1999) found that workers who receive higher wages achieve higher job satisfaction, while lower wages will lead to lower job satisfaction.

Empowerment is the willingness of the superior to give decision-making powers to his subordinates, which allows them to think, act, control, and decide on their own work for themselves. It is used as a strategy to improve the organizational commitment of employees (Limpanitgul et al., 2017) and is especially important for employees who interact with customers as it provides flexibility in meeting customer wishes (Li et al., 2018). Research shows a strong positive relationship between structured empowerment and work attitudes (job satisfaction, work commitment) (Kuo et al., 2008; Lu et al., 2019) and organizational commitment.

3. Methodology of research

The purpose of this article is to identify factors influencing employees' achievement of job satisfaction in Polish small and medium-sized manufacturing enterprises in the Industry 4.0 era. The survey, which was conducted from May to July 2022, covered Polish small and medium-sized manufacturing enterprises, located throughout the country. The survey consisted of several stages. Stage one involved the selection of the research sample, that is, the selection of Polish small and medium-sized enterprises with experience in the area of digital transformation.

Therefore, at the outset, 358 small and medium-sized manufacturing enterprises were selected from our SME database, which was created in the course of studies conducted within the framework of the university and departmental scientific and research projects, as well as the author's own shaft research, and were sent an invitation to participate in the research along with their detailed characteristics.

Of the 358 invitations sent, 223 entities responded positively, expressing their willingness to cooperate. Since digital maturity is widely recognized as a standard for assessing digital transformation performance (Li, Shi, Li, Xing, Wang, Ying, Zhang, Sun, 2018), in the next step, the author's intention was to identify entities with a high degree of digital maturity. To this end, executives of these enterprises were asked to complete a survey containing questions about the digital maturity of the organizations they manage. The digital performance assessment model of Gill and Vanboskirk (2016) was used. The model used contains four measurement items that define digital maturity for four dimensions. These include; culture, organization, technology, and insight. The digital maturity questionnaire contained a total of fourteen questions, that is, five items for each dimension mentioned earlier. Executives were asked to rate themselves on a five-point, where 1 means strongly disagree and 5 means strongly agree.

Table 1.
Sample description

Category	Statistics	
Firm size (employees)	Fewer than 50:	43,22%
	50-250:	56,77%
Respondent	Age:	
	20-30	15,25%
	31-40	27,11%
	41-50	32,21%
	> 51	25,43%
Gender:	Male	69,49%
	Female	30,51%
Industry sector	Metal industry:	19,49% 23
	Automotive industry:	18,65% 22
	Electrotechnical industry:	16,10% 19
	Pharmaceutical and cosmetic industry:	7,63% 9
	Chemical industry:	8,47% 10
	Construction industry:	11,02% 13
	Furniture industry:	15,26% 18
	Other:	3,38% 4

Source: own study.

The second stage of the survey resulted in the selection of a total of 118 small and medium-sized manufacturing companies that had a high degree of digital maturity. In the third stage of the research, employees of SMEs selected in the earlier stage of the research were asked to evaluate and rank on a scale from 1 to 14, (where 1= most important and 14 = least important) selected fourteen factors related to achieving job satisfaction, based on their own experiences. Employees were given factors to rank and were asked to assess: what they thought had the

greatest and least impact on their job satisfaction in the era of Industry 4.0. The description of the research sample is included in Table 1.

4. Results

A survey of 118 small and medium-sized manufacturing companies, among a total of 633 employees, found that job security was indicated as the most important factor related to achieving job satisfaction in the era of Industry 4.0. Job security was indicated by 449 employees as the most important element for achieving job satisfaction. The 449 indications of job security as the most important factor accounted for 71% of all responses given by respondents to this question. Autonomy was indicated as the second most important factor related to achieving job satisfaction in the age of digital transformation. It was indicated in second place by 419 SME employees, which accounted for a total of 66% of all, 633 responses under this factor. Empowerment received the third highest score in the survey and was marked as the third most related factor to achieving job satisfaction. Empowerment was indicated in third place by 59% of respondents, that is, 374 SME employees. Compensation is the fourth factor important to achieving employee job satisfaction in the Industry 4.0 era and was marked here by a total of 381 respondents, accounting for 60% of all indications on this factor. Supervisor support ranked fifth in respondents' answers (313 employees indicated this factor as the fifth most important for achieving job satisfaction, which accounted for an outlier of 49.5% of the responses given under this factor). Organizational pride, supervisory communication, and leadership style ranked next in the sixth, seventh and eighth positions in the assessment of SME employees (298 respondents, 281 respondents, and 285 respondents, respectively, rated these factors at the indicated positions of importance for achieving job satisfaction during the Fourth Industrial Revolution). Organizational pride was indicated in sixth place by 47% of respondents, supervisory communication was marked in seventh place by 44% of respondents, and leadership style was indicated by 45% of employees as the eighth most important factor associated with achieving job satisfaction. In ninth place was the reward, which was indicated by 271 respondents in this position, a percentage of 43% among all responses to this question. In tenth and eleventh place in terms of importance for achieving job satisfaction were teamwork and person-organization fit, which were indicated on these items by 41.5% (263 responses) and 44% (280 responses) of respondents, respectively. The last three factors indicated as least important in achieving job satisfaction in the Industry 4.0 era were quality of work-life, work-life balance, and organizational commitment. These factors on the indicated items were rated by 251, 213, and 244 manufacturing employees of SMEs, which accounted for almost 40%, 36.5%, and 38.5% of the total responses given to the listed factors, respectively. None of the selected and rated factors received the same number of responses and ratings regarding their importance

in achieving job satisfaction in the era of digital transformation. The results of the empirical study, along with the percentages of responses under each factor, ranking them in order of importance for achieving job satisfaction under conditions of high digital maturity, are presented in Figure 1.

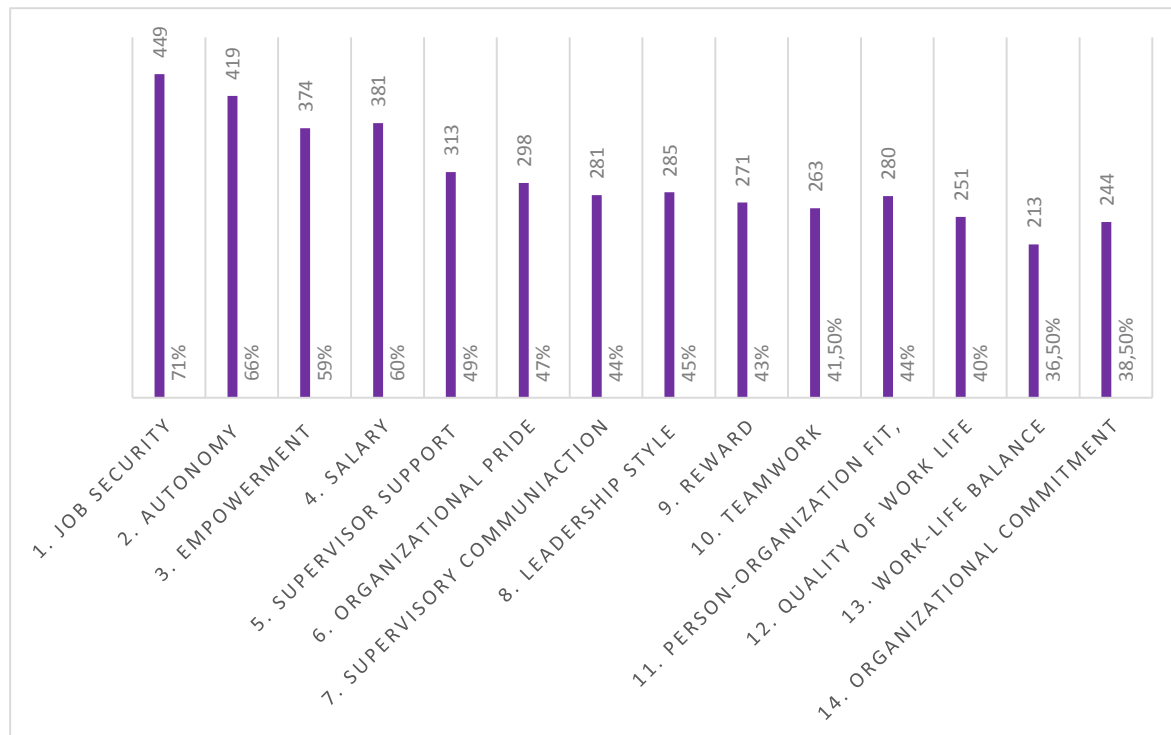


Figure 1. respondents' answers ranking the factors affecting the achievement of job satisfaction.

Source: own study.

5. Discussion and conclusion

The survey conducted among employees of Polish small and medium-sized manufacturing enterprises allowed for the identification and indication of the most important factors related to achieving employee satisfaction in the era of Industry 4.0. It is worth pointing out that research and insights into such a broad set of factors related to achieving job satisfaction in manufacturing SMEs under conditions of high digital maturity have not yet been made. The available numerous research results deal with analyses of single or fewer factors affecting job satisfaction, with few of them addressing the conditions for achieving job satisfaction in the era of Industry 4.0. The conducted study indicated that in SMEs the most important factors related to job satisfaction are: job security, autonomy, and empowerment. The sense of job security promotes the organizational commitment of employees and is related to the degree of employee identification with their work or organization and its goals. The association of job security as an important factor for achieving satisfaction at work confirms the research

conducted by Silla et al. (2009). In addition, this empirical study found that job security ranks among the three most important factors for achieving job satisfaction in manufacturing SMEs with a high degree of digital maturity. Autonomy is characterized as the employee's level of control over their immediate tasks and planning. Job autonomy, which was identified by Chang and Cheng, 2014 as a predictor of job satisfaction and as a factor positively influencing broader job performance (Kubicek et al., 2017), and in the empirical research conducted, was identified as the second most important factor for achieving satisfaction at work under conditions of digital transformation, with a high degree of digital maturity achieved. In a way, the obtained research results develop previous studies, indicating job autonomy not only as a predictor of job satisfaction but as a factor directly related to its achievement. Empowerment, ranked by respondents as the third most important factor influencing feelings of job satisfaction in the selected research sample, and is defined as a supervisor's willingness to give decision-making authority to subordinates, allowing them to think, act, control and decide their own work for themselves. The results of the study corroborate the insights of Kuo et al., (2008) and Lu et al., (2019), who highlight the strong positive relationship between empowerment and work attitudes such as job satisfaction, among others. Marking by the respondents on the basis of their own experience these 3 areas as the most important for the achievement of job satisfaction may indicate some mental conditions and barriers related to the implementation of modern technological solutions. The human approach and mentality are often one of the biggest barriers to the implementation and application of new technologies because there is a belief that the development of a machine park and implementation of modern solutions and technologies is synonymous with the reduction of jobs. Hence, perhaps such a percentage of respondents indicated a sense of security, autonomy, and empowerment as key factors for achieving job performance during the digital transformation. Other factors most important for achieving job satisfaction are salary and supervisor support. The amount of remuneration, providing some stability and being a reflection of the assessment of the contribution and commitment of employees and the support of superiors, which influences and builds a sense of value for the employee, were assessed as one of the key factors influencing job satisfaction in this uncertain and difficult time of the post-pandemic economic crisis and high inflation. Such a result is consistent with the findings of Prakash Sharma and Bajpai (2011), who emphasize the importance of compensation in achieving job satisfaction. In addition, supervisor support is the degree to which employees perceive that their supervisors care about their well-being (De Clercq et al., 2016). Anderson et al. (2002) showed that supervisory support was directly related to job satisfaction, which was also confirmed in the present study, under conditions of the Fourth Industrial Revolution. Consecutively, the respondents indicated organizational pride, supervisory communication, and leadership style as important variables related to achieving job satisfaction. This shows that positive feelings of an employee in his institution together with supervisory communication, which is related to leadership style, help employees achieve positive feelings at work or realize values that are important to them while functioning in

a highly digital environment. Earlier studies by Arnett et al. (2002) and Van Dick et al. (2004) emphasized the importance of the impact of organizational pride in achieving job satisfaction. The present empirical research confirmed this link in an era of digital transformation. Supervisory communication, which has also been assessed in previous studies as a predictor and variable affecting job satisfaction (Gok et al., 2014), was identified by respondents in the present study as the seventh most important factor associated with feelings of job satisfaction. Numerous studies in the areas of management and organizational behavior emphasize the link between managers' leadership styles on employee job satisfaction (Judge et al., 2001; Rowold et al., 2014). The empirical results obtained confirmed this link. Reward, teamwork, and person-organization fit, employees of small and medium-sized production enterprises that have achieved a high degree of digital maturity, indicated as less important factors from the point of view of achieving satisfaction from work in Industry 4.0. Reward, teamwork, and person-organization fit, employees of small and medium-sized manufacturing companies that have reached a high degree of digital maturity identified as less important factors for achieving job satisfaction in Industry 4.0. The above results confirm previous studies of the relationship between these factors and achieving satisfaction at work (Musriha, 2013; Rehman et al., 2010; Jin et al., 2018), but, interestingly, under conditions of high digital maturity, they were not among the most important factors. The empirical results indicate that financial rewards or non-financial rewards, which are mostly not a permanent salary component, work in a group of co-workers, the compliance of individual and organizational characteristics do not have such a connection with the feeling of satisfaction at work in the era of integration of technologies and digital solutions. The factors of least importance for achieving job satisfaction, according to respondents, are quality of work life, work-life balance, and organizational commitment. The results of the survey thus confirm the work of Lau, (2008) and Koonmee et al. (2010) regarding the link between the quality of work-life and job satisfaction, Kasbuntoro et al.'s (2020) research on the impact of work-life balance on job satisfaction, and Bozeman and Perrewé's (2001) analysis linking organizational commitment to job satisfaction. However, these factors, despite the slightest connection, are not entirely without influence on achieving job satisfaction. It should be emphasized that the cited studies confirming the links between job satisfaction and these three factors involved research samples other than the one selected for this study. In addition, the conditions for the implementation and use of digital technologies are also specific, where the selected SMEs have achieved a high degree of digital maturity. The circumstances of the global economic crisis and the war in Ukraine are not insignificant. The results of the study, concerning the factors of least importance for achieving job satisfaction in the era of Industry 4.0, indicate that achieving work-life balance, having satisfying experiences in various aspects of life, and achieving some balance between work and non-work responsibilities are not as strongly as the other selected factors related to achieving job satisfaction under conditions of digital technology application. The conducted empirical research certainly contributes to the science and practice of management by providing insight

into the premises and factors related to achieving job satisfaction in small and medium-sized industrial enterprises in the Industry 4.0 era. It is worth noting that the timing of the survey - after the pandemic coincided with the economic crisis, very high inflation, and the possible vision of armed conflict on a larger scale, i.e. outside Ukraine. These factors create a sense of fear, danger, and instability in society and are unlikely to have been unaffected by respondents' experiences and feelings about their job satisfaction during the Fourth Industrial Revolution. The above, along with the selection of the research sample, i.e. Polish SMEs, are a certain limitation that makes it difficult to generalize the results.

References

1. Alguliyev, R.M., Mamertine, Y.N., Sukhostat, L.V. (2018). Cyber-physical systems and their security issues. *Computers in Industry, Vol. 100*, pp. 212-223.
2. Anderson, S.E., Coffey, B.S., Byerly, R.T. (2002). Formal organizational initiatives and informal workplace practices: links to work-family conflict and job-related outcomes. *Journal of Management, Vol. 28(6)*, pp. 787-810, DOI: 10.1177/014920630202800605.
3. Andi Kele, A.T.B., Mohsin, A., Bertinetti Lengler, J.F. (2016). *Employee empowerment: A case of luxury hotels in East Malaysia*. CAUTHE 2016: The changing landscape of tourism and hospitality: The impact of emerging markets and emerging destinations, p. 611.
4. Apkan, C.P. (2013). Job security and job satisfaction as determinants of organizational commitment among university teachers in Cross River State, Nigeria. *British Journal of Education, Vol. 1(2)*, pp. 82-93.
5. Arnett, D.B., Laverie, D.A., McLane, C. (2002). Using job satisfaction and pride as internal marketing tools. *Cornell Hospitality Quarterly, vol. 43(2)*, pp. 87-96.
6. Arnold, K.A., Connelly, C.E., Walsh, M.M., Martin Ginis, K.A. (2015). Leadership styles, emotion regulation, and burnout. *Journal of occupational health psychology, Vol. 20(4)*, pp. 481-490.
7. Back, K.J., Lee, C.K., Abbott, J. (2011). Internal relationship marketing: Korean casino employees' job satisfaction and organizational commitment. *Cornell Hospitality Quarterly, Vol. 52(2)*, pp. 111-124.
8. Badrianto, Y., Ekhsan, M. (2020). Effect of Work Environment and Job Satisfaction on Employee Performance in PT. Nesainak Industries. *Journal of Business Management Accounting, Vol. 2*, pp. 85-91.
9. Bae, K.B., Kim, D. (2016). The Impact of Decoupling of Telework on Job Satisfaction in U.S. Federal Agencies. *American Review of Public Administration, Vol. 46*, pp. 356-371.
10. Bakar, H.A., Mohamad, B., Mustafa, C.S. (2007). Superior–Subordinate Communication Dimensions and Working Relationship: Gender Preferences in a Malaysian Organization.

- Journal of Intercultural Communication Research*, Vol. (36)1, 51-69, DOI: 10.1080/17475750701265282.
11. Baron, A.R., Greenberg, J. (2003). *Organizational Behaviour in Organization*. Understanding and managing the human side of work. Canada: Prentice Hall.
 12. Bartol, K.M., Locke, E.A. (2000). Incentives and motivation. In: S.L. Rynes, B. Gerhart (Eds.), *Compensation in Organizations* (pp. 104-147). Current Research and Practice. San Francisco, CA: Jossey-Bas.
 13. Bhatti, N., Maitlo, G.M., Shaikh, N., Hashmi, M.A., Shaikh, F.M. (2012). The impact of autocratic and democratic leadership style on job satisfaction. *International Business Research*, Vol. 5(2), pp. 192.
 14. Bibi, P., Ahmad, A., Majid, A.H.A. (2018). The Impact of Training and Development and Supervisors Support on Employees Retention in Academic Institutions in Pakistan: The Moderating Role of the Work Environment. *Gadjah Mada International Journal of Business*, Vol. 20, 1, pp. 113-131.
 15. Bozeman, D.P., Perrewe, P.L. (2001). The effect of item content overlap on Organizational Commitment Questionnaire-turnover cognitions relationship. *Journal of Applied Psychology*, Vol. 86, pp. 161-173.
 16. Chang, M., Cheng, C. (2014). How balance theory explains high-tech professionals' solutions of enhancing job satisfaction. *Journal of Business Research*, vol. 67, pp. 2008-2018.
 17. Chiarini, A., Belvedere, V., Grando, A. (2020). Industry 4.0 strategies and technological developments. An exploratory research from Italian manufacturing companies. *Production Planning and Control*, Vol. 30, No. 16, pp. 1-14. DOI: 10.1080/09537287.2019.1710304.
 18. Daft, L.R. (2012). *New Era of Management*. International Edition. South-Western, Cengage Learning.
 19. Dalenogare, L.S., Benitez, G.B., Ayala, N.F., Frank, A.G. (2018). The expected contribution of Industry 4.0 technologies for industrial performance. *International Journal of Production Economics*, 204(July), pp. 383-394. doi:10.1016/j.ijpe.2018.08.019.
 20. De Clercq, D., Dimov, D., Belausteguigoitia, I. (2016). Perceptions of adverse work conditions and innovative behavior: The buffering roles of relational resources. *Entrepreneurship: Theory and Practice*, Vol. 40(3), pp. 515-542.
 21. Deery, M. (2008). Talent management, work-life balance, and retention strategies. *International Journal of Contemporary Hospitality Management*, Vol. 20(7), pp. 792-806.
 22. Dhir, S., Dutta, T. (2020). Linking supervisor-support, person-job fit and person-organization fit to company value. *Journal of Indian Business Research*, Vol. 12(4), pp. 549-561. doi: 10.1108/JIBR-04-2019-0124.
 23. Fettermann, D.C., Gobbo Sá Cavalcante, C., de Almeida, T.D., Tortorella, G.L. (2018). How Does Industry 4.0 Contribute to Operations Management? *Journal of Industrial and Production Engineering*, Vol. 35(4), pp. 255-268. doi:10.1080/21681015.2018.1462863.

24. Fosso Wamba, S., Akter, S., Edwards, A., Chopin, G., Gnanzou, D. (2015). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, Vol. 165, pp. 234-246. doi:10.1016/J.IJPE.2014.12.031.
25. Frank, A.G., Dalenogare, L.S., Ayala, N.F. (2019). Industry 4.0 Technologies: Implementation Patterns in Manufacturing Companies. *International Journal of Production Economics*, Vol. 210, pp. 15-26. doi:10.1016/j.ijpe.2019.01.004.
26. Gallie, D. (2002). The Quality of Working Life: Is Scandinavia Different? *European Sociological Review*, Vol. 19(10), pp. 61-79, <https://doi.org/10.1093/esr/19.1.61>
27. Gerald, M., Dorothee, L. (2004). Relationship of professionalism, rewards, market orientation and job satisfaction among medical professionals; the case of Certified Nurse–Midwives. *Journal of Business Resource*, Vol. 57(2), 1042-1053.
28. Ghobakhloo, M. (2018). The Future of Manufacturing Industry: A Strategic Roadmap Toward Industry 4.0. *Journal of Manufacturing Technology Management*, Vol. 29(6), pp. 910-936. doi:10.1108/JMTM-02-2018-0057.
29. Gill, M., Vanboskirk, B.S. (2016). The digital maturity model 4.0. Retrieved from: <https://forrester.nitro-digital.com/pdf/Forrester-20Digital%20Maturity%20Model%204.0.pdf>.
30. Gok, S., Karatuna, I., Karaca, P.O. (2014). The role of perceived supervisor support and organizational identification in job satisfaction. *Procedia-Social and Behavioural Sciences*, Vol. 177, 38-42.
31. Graen, G.B., Uhl-Bien, M. (1995). Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years: Applying a multi-level multi-domain perspective. *The Leadership Quarterly*, Vol. 6(2), pp. 219-247.
32. Hamermesh, D. (1999). The Changing Distribution of Job Satisfaction. *Journal of Human Resources*, University of Wisconsin Press, vol. 36(1), pp. 1-30.
33. Haslam, S. (2004). *Psychology in Organizations: The Social Identity Approach*. London: Sage Publications Ltd.
34. Jansen, K.J., Kristof-Brown, A.L. (2006). Toward a multidimensional theory of person-environment fit. *Journal of Managerial Issues*, Vol. 18, 193-212.
35. Jin, M.H., McDonald, B., Park, J. (2018). Person–organization fit and turnover intention: Exploring the mediating role of employee followership and job satisfaction through conservation of resources theory. *Review of Public Personnel Administration*, Vol. 38(2), pp. 167-192.
36. Judge, T, Thoresen, C, Bono, J, Patton, G. (2001). The job satisfaction-job performance relationship: a qualitative and quantitative review. *Psychological Bulletin*, Vol. 127, pp. 376-398.

37. Kasbuntoro, K., Irma, D., Maemunah, S., Mahfud, I., Fahlevi, M., Parashakti, R.D. (2020). Work-Life Balance and Job Satisfaction: A Case Study of Employees on Banking Companies in Jakarta. *International Journal of Control and Automation, Vol. 13(4)*, pp. 439-451.
38. Koonmee, K., Singhapakdi, A., Virakul, B., Lee, D.-J. (2010). Ethics institutionalization, quality of work life, and employee job-related outcomes: A survey of human resource managers in Thailand. *Journal of Business Research, Vol. 63(1)*, pp. 20-26.
39. Kraimer, M.L., Wayne, S.J., Liden, R.C., Sparrowe, R.T. (2005). The Role of Job Security in Understanding the Relationship Between Employees' Perceptions of Temporary Workers and Employees' Job Performance. *Journal of Applied Psychology, Vol. 90(2)*, pp. 389-398.
40. Kubicek, B., Paskvan, M., Bunner, J. (2017). The Bright and Dark Sides of Job Autonomy. In: *Job Demands in a Changing World of Work: Impact on Workers' Health and Performance and Implications for Research and Practice* (pp. 45-63). Berlin: Springer International Publishing. https://doi.org/10.1007/978-3-319-54678-0_4.
41. Kuo, H.-T., Yin, T.J.-C., Li, I.-C. (2008). Relationship between organizational empowerment and job satisfaction perceived by nursing assistants at long-term care facilities. *Journal of Clinical Nursing, Vol. 17(22)*, pp. 3059-3066. doi:10.1111/j.1365-2702.2007.02072.x.
42. Lau, C.M., Wong, K.M., Eggleton, I.R. (2008). Fairness of performance evaluation procedures and job satisfaction: The role of outcome-based and non-outcome-based effects. *Accounting and Business Research, Vol. 38(2)*, 121-135.
43. Li, H., Shi, Y., Li, Y., Xing, Z., Wang, S., Ying, J., Zhang, M., Sun, J. (2018). Relationship between nurse psychological empowerment and job satisfaction: A systematic review and meta-analysis. *Journal of Advanced Nursing, Vol. 74(6)*, pp. 1264-1277. <https://doi.org/10.1111/jan.13549>
44. Limpanitgul, T., Boonchoo, P., Kulviseachana, S., Photiyarach, S. (2017). The relationship between empowerment and the three-component model of organizational commitment. *International Conference Tokyo Japan, 11(2)*, pp. 227-242. <https://doi.org/10.1108/ijcthr-07-2015-0069>.
45. Liu, C., Spector, P., Jex, S. (2005). The relation of job control with job strains: A comparison of multiple data sources. *Journal of Occupational and Organizational Psychology, Vol. 78(3)*, pp. 325-336. doi:10.1348/096317905X26002.
46. Locke, E. (1969). What is job satisfaction? *Organizational Behavior and Human Performance, Vol. 4(4)*, pp. 479-493.
47. Lok, P., Crawford, J. (2001). Antecedents of organizational commitment and the mediating role of job satisfaction. *Journal of Managerial Psychology, Vol. 16(8)*, pp. 594-613.
48. Lu, H., Zhao, Y., While, A.E. (2019). Job satisfaction among hospital nurses: a literature review. *International Journal of Nurse Studies, Vol. 94*, 21-31.

49. Machado, C.G., Winroth, M.P., Ribeiro da Silva, E.H.D. (2020). Sustainable Manufacturing in Industry 4.0: An Emerging Research Agenda. *International Journal of Production Research*, Vol. 58, pp. 1462-1484.
50. Mahmoud, A.B., Sitladin, M., Tehseen, S., Fuxman, L., Reisel, W.D., Purkayastha, H., Grigoriou, N. (2020). *Job satisfaction as a mediator between performance appraisal effectiveness and organisational outcomes in the caribbean*. BAM2020 Conference, Alliance Manchester Business School.
51. Mischkind, L. (1998). Pride – The Hidden Corporate Asset. Retrieved from: http://www.sirota.com/pdfs/Pride_The_Hidden_Corporate_Asset.pdf, March 2020.
52. Mitchell, M.S., Reynolds, S.J., Treviño, L.K. (2017). The study of behavioral ethics within organizations. *Personnel psychology*, Vol. 70(2), pp. 313-314.
53. Mohammad, J.U., Miah, M.A.S., Rahman, M.M., Rahaman, M.S. (2017). Mediation role of job satisfaction on HRM-operational performance relationship: A three-way moderation effect by gender. *The Journal of Developing Areas*, Vol. 51(3), pp. 437-452.
54. Monostori, L. (2003). AI and Machine Learning Techniques for Managing Complexity, Changes and Uncertainties in Manufacturing. *Engineering Applications of Artificial Intelligence*, Vol. 16, pp. 277-291. doi:10.1016/S0952-1976(03) 00078-2.
55. Musriha, H. (2013). Influence of Teamwork, Environment on Job Satisfaction and Job Performance of the Cigarette Rollers at Clove Cigarette Factories in East Java, Indonesia. *Developing Country Studies*, Vol. 2(3), pp. 32-40.
56. Nor, R., Gani, A.J.A., Saleh, C., Fadillah, A. (2022) Organizational commitment and professionalism to determine public satisfaction through good governance, public service quality, and public empowerment. *International Review Public Nonprofit Mark*, Vol. 19, pp. 191-217. <https://doi.org/10.1007/s12208-021-00297-0>.
57. Nyanga, T., Sibanda, R., Kruger, J.W. (2018). Financial Growth and Stability in Armed Conflict Society: Does Job Satisfaction Play a Role? *Amity Journal of Management Research*, Vol. 3(1), pp. 27-39.
58. Oludayo, O, Gberevbie, D., Popoola, D. (2015). A study of multiple work-life balance initiatives in banking industry in Nigeria. *International Research Journal of Finance and Economics*, Vol. 133, pp. 108-109.
59. Oztemel, E., Gursev, S. (2018). Literature Review of Industry 4.0 and Related Technologies. *Journal of Intelligent Manufacturing*, Vol. 3, pp. 127-182.
60. Prakash Sharma, J., Bajpai, N. (2001) Salary Satisfaction as an Antecedent of Job Satisfaction: Development of a Regression Model to Determine the Linearity between Salary Satisfaction and Job Satisfaction. *Public and a Private Organization*, vol. 18.
61. Putra, S.S., Prasetya, A. (2018). The Influence of Reward, Work Place Environment, and Career Growth to Job Satisfaction and Their Impact on Organizational Commitment (Study on employees of Hotel Sahid Montana Dua Malang). *Juornal Administrasi Bisnis*, Vol. 64(1), pp. 36-45.

62. Rehman, Muhammed Zai, Khan, Muhammad Riaz, Ziauddin, Lashari, AliJ (2010). Effect of job rewards on job satisfaction, moderating role of age differences: an empirical evidence from Pakistan. *African Journal of Business Management*, Vol. 4(6), pp. 1131-1139.
63. Riasat, F., Aslam, S., Nisar, Q.A. (2016). Do intrinsic and extrinsic rewards influence the job satisfaction and job performance? Mediating role of reward system. *Journal of Management Info*, Vol. 11(1), pp. 16-34.
64. Robbins, S.P., Coulter, M. (2012). *Management*. New Jersey: Prentice Hall, Inc. upper Saddle River.
65. Rowold, J., Borgmann, L., Bormann, K. (2014). Which leadership constructs are important for predicting job satisfaction, affective commitment, and perceived job performance in profit versus nonprofit organizations? *Nonprofit Management and Leadership*, Vol. 25(2), 14-164.
66. Sanyal, S., Hisam, M.W. (2018). The impact of teamwork on work performance of employees: A study of faculty members in Dhofar University. *IOSR Journal of Business and Management*, Vol. 20(3), pp. 15-22.
67. Silla, I., De Cuyper, N., Gracia, F.J., Peiro, J.M., De Witte. H. (2009). Job insecurity and well-being: Moderation by employability. *Journal of Happiness Studies*, Vol. 10(6), pp. 739-751. <http://dx.doi.org/10.1007/s10902-008-9119-0>.
68. Suliman, A., Al-Junaibi, Y. (2010). Commitment and turnover intention in the UAE oil industry. *The International Journal of Human Resource Management*, Vol. 21(9), pp. 1472-1489.
69. Swami (2007). Work-life Balance: Organizational strategies for sustainable growth. *HRM Review* (HRMWB10710), pp. 33-37.
70. Trottier, T., Van Wart, M., Wang, X.H. (2008). Examining the nature and significance of leadership in government organizations. *Public Administration Review*, 68, pp. 319-333. <http://dx.doi.org/10.1111/j.1540-6210.2007.00865.x>.
71. Van der Klink J.J., Blonk, R.W., Schene, A.H., Dijk, F.J. (2001). The benefits of interventions for work-related stress. *American Journal of Public Health*, Vol. 91, pp. 270-276.
72. Van Dick, R., Christ, O., Stellmacher, J., Wagner, U., Ahlswede, O., Grubba, C., Tissington, P.A. (2004). Should I stay or should I go? Explaining turnover intentions with organizational identification and job satisfaction. *British Journal of Management*, vol. 15(4), pp. 351-360.
73. Voydanoff, P. (2004). Implications of work and community demands and resources for work-to-family conflict and facilitation. *Journal of Occupational Health Psychology*, Vol. 9(4), pp. 275-285. doi:10.1037/1076-8998.9.4.275.
74. Wolff, A.D. (2008). *Employment insecurity and health*. National Collaborating Centre for Determinants of Health. Retrieved from <http://alicedewolff.ca/Employment%20Insecurity%20Review.pdf>.

-
75. Xu, X. (2012). From Cloud Computing to Cloud Manufacturing. *Robotics and Computer-Integrated Manufacturing, Vol. 28(1)*, pp. 75-86. doi:10.1016/j.rcim.2011.07.002.
 76. Zahari , I.B., Shurbagi, A.M.A. (2012),. The eff ect of organizational culture and the relationship between transformational leadership and job satisfaction in petroleum sector of Libya. *International Business Research, Vol. 5(9)*, pp. 89-97.
 77. Zhong, R.Y., Xu, X., Klotz, E., Newman, S.T. (2017). Intelligent Manufacturing in the Context of Industry 4.0: A Review. *Engineering, Vol. 3*, pp. 616-630.

ISO 50001 ENERGY MANAGEMENT SYSTEM EFFECTIVENESS INDICATORS IN A CHEMICAL SECTOR ENTERPRISE

Bolesław GORANCZEWSKI^{1*}, Grzegorz KĄDZIELAWSKI²

¹ Grupa Azoty ZAK S.A.; Uniwersytet Opolski; boleslaw.goranczewski@grupazoty.com, ORCID: 0000-0001-9081-083X

² Grupa Azoty SA, Tarnów; Akademia WSB, Dąbrowa Górnicza; grzegorz.kadzielawski@gmail.com, ORCID: 0000-0003-0804-2232

* Correspondence author

Purpose: The article presents a set of indicators for assessing the effectiveness of an energy management system (EnMS) based on the authors' own research findings.

Design/methodology/approach: The work uses qualitative methods such as systematic review of literature, analysis of the content of existing documentation, participatory observation and self-observation.

Findings: The literature on the subject features few publications dedicated specifically to energy management systems. Moreover, no practical solutions with a set of practical metrics to be applied in the regular process of realising energy programs and goals exist. Hence, the authors propose a model of assessment.

Practical implications: The set of indicators presented in the article offers good practical value and high application and adaptation potential. The model may be applied in individual businesses in the chemical sector or as a benchmarking tool in capital groups or a group of entities demonstrating functional connections. Consisting of the universal part (indicators for goals and processes) and the sector-relevant indicators, the model may be adapted for use in other sectors through appropriate corrections for the sector-relevant criteria.

Originality/value: The assessment model presented in the article fills a publication void and represents an innovation. It is intended for use in managing and supervising energy-related activities in various organisations. It shall prove of assistance to system users and auditors alike.

Keywords: effectiveness, effectiveness indicators, energy management, systems.

Category of the paper: Research paper.

1. Introduction

The available scientific databases feature only individual publications relating to the effectiveness of energy management systems for compliance with ISO 50001 (Włas, 2017; Dzik, Dzik, 2017; Hajduk-Stelmachowicz, 2018; Olkiewicz, Bober, 2017; Marimon,

Casadesus, 2017; Jovanović, Filipović, 2016; Gopalakrishnan, Ramamoorthy, Crowe, Chaudhari, Latif, 2014; Kanneganti et al., 2017). Arguably, this is due to the fact that the systems are a relatively recent development thus:

- firstly, as the standard for energy management systems is a relatively ‘young’ document compared to other normalized systems, there are still few organisations that use energy management systems for compliance with ISO 50001,
- secondly, realizing their energy efficiency programs, some businesses employ – predominantly for continual improvement – environmental systems or the quality base standard.

Effectiveness is a praxeological category, an attribute of efficient operation, where – together with efficiency – it constitutes one of the most important pillars of such activity (Pszczolowski, 1978; Kieżun, 1997; Kotarbiński, 2019; Zieleniewski, 1969). Such understanding of effectiveness was embodied in the terminology standard (PN-EN ISO 9000:2015) where “effectiveness” is defined as the ‘extent to which planned activities are realized and planned results are achieved’. Therefore, effectiveness may refer to the degree of realisation of a goal expressed either in a binary format: the goal was either achieved fully or not, or as a percent of its realisation. In praxeological terms, individual actions may be effective, ineffective or counterproductive. The last term describes actions that set one further from achieving the desired goal.

As the standard implies that efforts ought to be focusing exclusively on those activities that are efficient, the authors of this paper attempted to study how an energy management system may provide practical support for such activities. Are the tools mentioned in the standard sufficient, or is there a need to enhance the process of assessing effectiveness with a suitable set of indicators comprising parameters to facilitate it? According to the standard, decisions ought to be made based on analysing and assessing data, preferably from multiple sources to counter the inherently high degree of uncertainty. The measurement model proposed by the authors shall be a step towards such triangulation.

The process of developing a set of metrics to assess the effectiveness of an energy management system (as of any other) ought to consider its specific nature where the main reference criteria in the system are energy efficiency and continual improvement - programs and activities aimed at reducing energy consumption. Therefore, putting process efficiency aside, the authors focused on such categories as: energy use, energy consumption, energy performance, significant energy use, energy efficiency indicator or energy baseline (EN ISO 50001:2018).

The goal of the article is to develop, based on own research, a set of metrics to measure the effectiveness of an energy management system.

2. Methodology

Due to the use of qualitative methods in the study, no hypothesis was formulated (Kostera, 2003).

In order to realize the goal stated above, it is necessary to define and then resolve the following research problems:

- P1. Are any analytical tools used by the organisation subject to the study in order to assess the effectiveness of processes and the energy management system?
- P.2. What are the current, or feasible, effectiveness metrics for an ISO 50001 energy management system?

The following research methods were applied in the study:

1. Systematic review of the literature (Czakon, 2013). The search for relevant records took into account key phrases, such as ‘effectiveness of energy management systems’, ‘effectiveness of processes’, ‘energy review’ (‘management review’ in the nomenclature of the quality standard), ‘effectiveness of audits of energy management systems’, or ‘effectiveness as a praxeological category’. Then, a query of selected scientific databases such as Google Scholar, EBSCO, Business Source Ultimate, etc. was performed. Once records were identified suggesting convergence with the purpose of the study, a preliminary selection process was carried out on the basis of the content contained in the abstracts. The main focus was put on papers concerning: energy management systems for compliance with ISO 50001 (articles on other standardized systems were rejected); classics of praxeology in terms of effectiveness as an attribute of efficient operation; as the content and purpose hereof fall within the discipline of management and quality sciences, purely technical works relating to energy audits were rejected. The content of the selected articles and studies was then studied. Due to their limited number, mapping was abandoned in favour of a thorough review of all the available publications.
2. The internal documentation specified in the research part was reviewed using the method of content analysis. Next, the literature and documented information were organized (Łuczewski, Bednarz-Łuczewska, 2012; Kostera, 2003).
3. The research also employed the participatory observation method (e.g. during the management review and during an audit performed by a certified unit, as well as self-observation of methods and tools used by unit auditors) (Ciesielska, Wolanik Boström, Öhlander, 2012).

The selection of research methods described above is consistent with methodological guidelines used in the disciplines of management and quality (Creswell, 2013; Easterby-Smith, Thorne, Jackson, 2015).

The research problems specified in this study are practical in nature. This, together with the applicability of the indicators put forward herein, places them within the functional-systemic paradigm (Lisiński, Szarucki, 2020).

The research was carried out in a fertilizer and chemical production company in September 2022 as part of a wider study covering also the categories of efficiency of energy management systems.

3. Research results

The studied organisation maintains an energy management system for compliance with ISO 50001 which, together with the ISO 31000 risk management system, is not included in the company's integrated quality, environment, health and safety system, although shared areas exist. They are mainly procedures and instructions relating to the past improvement and supervision procedures, which used to be referred to as 'mandatory components'. The following internal documents were reviewed in the course of the research:

1. Integrated system ledger.
2. Procedures and instructions concerning the operation of the integrated system and the energy management system, including: internal audits, corrective actions, energy review, control of energy consumption and energy use, risk management, control of manufacturing processes, supervision of compliance with legal and other requirements, corporate directive on agreeing future demand for energy utilities.
3. Reports from: energy review; unit consumption of energy utilities; the rules for providing technical security services; annual energy consumption and production balance.
4. Internal and third-party reports from audits conducted as part of activities aimed at energy management system improvement.
5. Results of a study conducted to assess the feasibility of integrating the energy and the environment management systems were included in the research (Kądziaławski, Goranczewski, 2022).
6. Results of a study on the evaluation of praxeological aspects of energy management systems we included in the research (Goranczewski, Kądziaławski, 2022). The results indicate that the system used in the studied organisation supports the realisation of energy-related objectives, especially that the recent implementation of the system enables a comparative analysis of pre- and post-implementation documentation. Energy-related aspects whose supervision is currently not required under the standard but which are supervised on the operational level of the environmental management system.

7. The guidelines of the benchmarking model for assessing the effectiveness and efficiency of management systems in a collective heating company were included in the research. The model had been validated and applied in the group of collective heating companies by the ISO in Collective Heating Consultation Team operating within the Chamber of Commerce Polish District Heating (*pol. Izba Gospodarcza Polskie Ciepłownictwo*) and subsequently used within one of capital groups of the collective heating sector.

As a result of applying the research methods (literature review, content analysis of existing documentation, participatory observation, self-observation) and analysing the above specification of internal documentation, the authors propose a proprietary set of indicators aimed to support both the users and the auditors of energy management systems in assessing the effectiveness of the system and its components.

Table 1.

Set of indicators for assessing the effectiveness of energy management systems and processes

Pos.	Indicator name	Symbol	Formula	Interpretation
1	Indicator of effectiveness (dynamics) of processes related to energy management	SP	$\frac{S_{n+1}}{S_n} \times 100\%$ <p>where: S_n is the number of corrective actions in a given process in the preceding year</p>	<p>Desired trend: falling. The number of corrective actions within a given process should be falling, which means goals are realized effectively. Otherwise, it may imply misidentification of the cause of nonconformity, insufficient level of awareness among the system users, inadequate implementation of corrective actions, etc.</p>
2	Indicator of the structure of corrective actions	SDK	$\frac{S_n}{S_o} \times 100\%$ <p>where: S_n is the number of corrective actions in a given process in relation to the total number of corrective actions (S_o) implemented in a given year under the energy management system</p>	<p>Desired trend: falling. A decreasing number of corrective actions means higher process realisation effectiveness, assuming reliable performance of process documentation and auditing activities.</p>
3	Indicator of the average number of corrective actions in relation to process 1, 2, ..., n under the energy management system	LDK	$\frac{\sum_{i=1}^n}{n}$ <p>where: n is the total no. of entities</p>	<p>Desired trend: falling. The indicator may be applied in the analysis of:</p> <ul style="list-style-type: none"> – number of actions in relation to a given process in the period of several years, – benchmarking comparisons, provided comparison-relevant documentation is available from the compared entities. <p>The indicator may be applied for internal and external benchmarking.</p>

Cont. table 1.

Energy management system effectiveness indicators				
4	Indicator of the degree of implementation of the energy management system	SW	$\frac{\text{no. of audits without nonconformities}}{\text{total no. of audits}} \times 100\%$	Desired trend: rising. Caution is advised in applying and interpreting this indicator. Audits which yield no nonconformities may not be the final confirmation of achieving a given level energy management system implementation or excellence. Highly competent auditors and audit reliability and accuracy is required, which are not always the case. It ought to be noted that audits are based on a random sample.
5	Indicator of white certificate dynamics	DBC	$\frac{B_{n+1}}{B_n} \times 100\%$ where: B_n number of certificates obtained in the previous year	Desired trend: rising. Values expressed in [toe]. May be presented quantitatively or in terms of value, in which case the indicator measures system effectiveness.
6	Energy efficiency indicator	WWE	$\frac{\sum EF}{\sum P}$ where: $\sum EF$ is final energy consumption needed to manufacture a given product, e.g. in a quarter, $\sum P$ total output of a given product, e.g. in a quarter	Desired value: [comment] The share of energy expressed in GJ needed to produce a unit of product should be falling
7	Indicator of energy consumption against energy baseline	ZLB	$\frac{\text{current energy consumption}}{EnB}$ where: EnB average energy converted to GJ consumed for manufacturing the product in the selected reference period (minimum 1 year)	Desired value: [comment] The participation of energy for manufacturing a given product expressed in GJ should be falling
8	Indicator of the degree of realisation of energy management system goals and targets	SOC/S	$\frac{\text{no. of realised goals and targets}}{\text{no. of goals to be realised in a given year}} \times 100\%$	Desired value = 100% Applicability of the indicator is conditional upon the methodical setting of objectives, cascading them, linking to the strategy, etc., or using the Management By Objectives (MBO) method or the SMART tool
9	Indicator of effectiveness (dynamics) of EnMS goal and target realisation	SCO/S	$\frac{C_{n+1}}{C_n} \times 100\%$ where: C_n is the value of the indicator in the base year	Desired value: 100%. Failure to reach 100% of the goal completion may result from: Processes being realised inconsistent with requirements, Overambitious goals, e.g. based on wrong data.

Source: Own research: indicators: 1-4, 8, 9 based on: B. Goranczewski, *Effectiveness and efficiency of energy management systems in collective heating companies in Poland*, a doctoral thesis, University of Opole, 2006 (unpublished material); indicators 6 and 7 – documentation of the energy management system in the enterprise where the study was conducted.

Indications included in comments referring to the desired trend may be inconclusive due to numerous situational factors.

In reference to the first research problem [P1], having analysed the content of the available documents, as well as through self-observation and participatory observation, it was found that the studied organisation used no analytical methods to assess the system effectiveness other than the classic auditing methods performed routinely under the ISO 19011 and ISO 9004 standards, especially for monitoring trends within particular processes. However, it shall be reiterated that the system had been introduced fairly recently and viable trend assessment requires a time period of several years.

In reference to the second research problem [P.2], it was concluded that the literature on the subject offers no ready-made, adaptable models for assessing the effectiveness of energy management systems. As all systems, it is governed by the base ISO 9001 standard with a process-oriented focus. Therefore, the authors have put forward a proprietary effectiveness assessment model which had previously been applied in the collective heating sector. The model takes into account all the vital aspects of the process- and system-based approaches and may be further developed and adapted for other sectors and industries.

System effectiveness is best reflected in the dynamics and the structure of the corrective actions as shown by indicators 1 and 2. Indicator 3 may serve as a benchmarking tool, especially that the studied organisation forms parts of a large capital group. The paper features no indicators referring to the effectiveness of corrective actions as in the new edition of the ISO 50001 standard the notion was replaced with risk and opportunity assessment. Another group consists of the following energy management system indicators:

- the degree of system implementation expressed as the number of audits which detected nonconformities in relation to the total number of audits, subject to the comments featured in the table;
- the dynamics of obtaining white certificates in quantitative terms; another way of employing this indicator to measure system effectiveness could be as a cost effect (year on year) of limiting spending on CO₂ emission allowances, expressed in [toe], taking into account the cost of asset modernisation, including repairs and investments;
- indicators 6 and 7 refer respectively to energy consumption per unit of product and current consumption to the average value over a given calculation period;
- the remaining two indicators refer to the effectiveness of goal attainment, both in static and dynamic dimensions.

Conclusions and summary

Rather than being a fixed specification, the set of energy management system effectiveness indicators proposed in the research part of the paper shall form a base tool to be developed depending on current needs. This may be achieved through a modification of the proposed indicators or the addition of new ones. Ultimately, appropriate measures will depend on local conditions as well as practices used, both in terms of system users and auditor competence. Undoubtedly, enhancing audit findings with effectiveness assessment parameters makes for a better-informed decision-making process based on the course of a given trend. The dynamics indicators proposed in the table serve that very purpose, while the structure indicators present a given process in the context of the entire system, adding an explanatory dimension.

The set of indicators put forth herein offers a considerable potential for development. It may be applied as a benchmarking tool for:

- internal, cross-area comparisons in a single enterprise, e.g. between business units (the studied organisation comprised fertilizer production, chemical production, and energy-generation units), between individual production plants, etc., taking into account the cost specificity, especially in terms of expenditure on energy efficiency,
- internal comparisons between a capital group subsidiaries or entities with functional connections,
- external, mesoeconomic (industry-specific), and other comparisons, e.g., in the activities of economic self-governments.

In the case of benchmarking applications, attention shall be paid to the appropriate selection of the entities for comparison or, alternatively, to the development of appropriate indicators to achieve comparability of the studied population.

The proposed set of indicators is so universal that it allows comparative analyses to be carried out both at the level of processes, products, systems, and organizational areas. Depending on the type of process, device, installation or product, e.g. back-pressure energy-generation systems, production of demineralized water, production of nitric acid, production of aldehydes, etc., the sum of all energy carriers used in the production process is converted into GJ per unit of product expressed, depending on its character, as mg, dam³, m³, etc. The benchmarking approach is one of the elements of the synergy effect, especially in a capital group. It also provides the basis for proper brand management through the dissemination of good practices to entities recording sub-benchmark results, provided that such a transfer is viable considering the technological or raw material conditions.

Based on the conclusions stemming from the solved research problems, the purpose of the study is deemed to have been realised, with the proposed measuring tool offering practical applications.

Further research on the topic is required to validate the proposed model, especially for its application as a benchmarking tool.

From a praxeological point of view, effectiveness is only one of the two basic attributes of efficient operation, hence future research shall also take efficiency into account.

References

1. Babbie, E. (2009). *Podstawy badań społecznych*. Warszawa: PWN.
2. Ciesielska, M., Wolanik Boström, K., Öhlander, M. (2012). Obserwacja. In: D. Jemielniak, *Badania jakościowe. Metody i narzędzia*. Warszawa: PWN.
3. Creswell, J.W. (2013). *Projektowanie badań naukowych. Metody jakościowe, ilościowe i mieszane*. Kraków: Wyd. UJ.
4. Czakon, W. (2013). *Metodyka systematycznego przeglądu literatury*. In: W. Czakon (ed.), *Podstawy metodologii badań w naukach o zarządzaniu*. Warszawa: Oficyna Wydawnicza Wolters Kluwer Business.
5. Dzik, T., Dzik, R. (2017). Efektywność energetyczna i ekonomiczna funkcjonowania przedsiębiorstwa - doświadczenia z wdrożenia systemu zarządzania energią. *Czasopismo Inżynierii Łądowej, Środowiska i Architektury*, 64, 4/II, pp. 403-412. Wyd. Politechniki Rzeszowskiej. DOI: 10.7862/rb.2017.258.
6. Easterby-Smith, M., Thorne, R., Jackson, P. (2015). *Management and business research*. Los Angeles-Singapore: SAGE.
7. Gopalakrishnan, B., Ramamoorthy, K., Crowe, E., Chaudhari, S., Latif, H. (2014). A structured approach for facilitating the implementation of ISO 50001 standard in the manufacturing sector. *Sustainable Energy Technologies and Assessments*, Vol. 7.
8. Goranczewski, B., Kądziaławski, G. (2022). Prakseologiczne aspekty zastosowania systemu zarządzania energią w przedsiębiorstwie sektora chemicznego. *Przemysł Chemiczny*, 101(10), DOI: 10.15199/62.2022.10.3.
9. Hajduk-Stelmachowicz, M. (2018). Atrybuty systemu zarządzania energią. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 538.
10. Jovanović, B., Filipović, J. (2016). ISO 50001 standard-based energy management maturity model – proposal and validation in industry. *Journal of Cleaner Production*, Vol. 112, Part 4.
11. Kądziaławski, G., Goranczewski, B. (2022). Przesłanki integracji systemów ISO14001 oraz ISO 50001 w przedsiębiorstwie chemicznym. *Przemysł Chemiczny*, 101(10), DOI: 10.15199/62.2022.10.4.
12. Kanneganti, H., Gopalakrishnan, B., Crowe, E., Al-Shebeeb, O., Yelamanchi, T., Nimbarte, A., Currie, K., Abolhassani, A. (2017). Specification of energy assessment methodologies

- to satisfy ISO 50001 energy management standard. *Sustainable Energy Technologies and Assessments, Vol. 23*.
13. Kieżun, W. (1997). *Sprawne zarządzanie organizacją; zarys teorii i praktyki*. Warszawa: SGH.
 14. Kostera, M. (2003). *Antropologia organizacji. Metodologia badań terenowych*. Warszawa: PWN.
 15. Kotarbiński, T. (2019). *Traktat o dobrej robocie*. Łódź. Wyd. UŁ.
 16. Lisiński, M., Szarucki, M. (2020). *Metody badawcze w naukach o zarządzaniu i jakości*. Warszawa: PWE.
 17. Łuczewski, Ł., Bednarz-Łuczewska, P. (2012). Analiza dokumentów zastanych. In: D. Jemielniak (ed), *Badania jakościowe. Metody i narzędzia*. Warszawa: PWN.
 18. Marimon, F., Casadesús, M. (2017). Reasons to Adopt ISO 50001 Energy Management System. *Sustainability, 9(10)*, 1740, <https://doi.org/10.3390/su9101740>.
 19. Olkiewicz, M., Bober, B. (2017). Zarządzanie energią determinantą ochrony środowiska. *Zeszyty Naukowe. Organizacja i Zarządzanie, z. 100*. Politechnika Śląska.
 20. *PN-EN ISO 50001:2018, Systemy zarządzania energią. Wymagania i wytyczne dotyczące stosowania* (2018). Warszawa: PKN.
 21. *PN-EN ISO 9000:2015, Systemy zarządzania jakością. Podstawy i terminologia* (2015). Warszawa: PKN.
 22. Pszczołowski, T. (1978). *Mała encyklopedia prakseologii i teorii organizacji*. Wrocław: Ossolineum.
 23. Włas, M. (2017). System zarządzania energią w praktyce inżynierskiej. *Zeszyty Naukowe Wydziału Elektrotechniki i Automatyki Politechniki Gdańskiej, nr 56*.
 24. Zieleniewski, J. (1969). *Organizacja i zarządzanie*. Warszawa: PWN.

CAPITAL STRUCTURE FORMATION IN STOCK EXCHANGE LISTED COMPANIES OF THE VISEGRAD GROUP: A DYNAMIC APPROACH

Magdalena GOSTKOWSKA-DRZEWICKA^{1*}, Ewa MAJEROWSKA²

¹ Department of Corporate Finance, Faculty of Management, University of Gdańsk; magdalena.gostkowska-drzewicka@ug.edu.pl, ORCID: 0000-0002-4383-7711

² Department of Econometrics, Faculty of Management, University of Gdańsk; ewa.majerowska@ug.edu.pl, ORCID: 0000-0003-0991-3714

* Correspondence author

Purpose: The article aims to analyze the impact of selected factors on the level of financial leverage in stock exchanges listed companies of the Visegrad Group, and to determine whether the direction of this impact is consistent with the assumptions of the trade-off theory or the pecking order theory.

Design/methodology/approach: The analysis covered 259 non-financial companies listed in the years 1998-2020 on the stock exchanges in the Visegrad Group countries. The results of the dynamic panel econometric model estimates were verified via appropriate statistical tests. The calculations were carried out using the Gretl package. The subject of the analysis entailed the impact of profitability, liquidity, growth opportunities, company size and asset structure on the capital structure of the entities under examination.

Findings: Taking the country-specific effect into account, it has been demonstrated that the company capital structure decisions are consistent with the pecking order theory. Considering the companies surveyed as separate panels, in distribution by each individual country, a negative, a statistically significant correlation has been confirmed between debt and profitability only. Relative to other factors, divergent results were obtained for individual Visegrad Group countries, which does not negate the validity of the statement that the capital structure decisions of the companies analyzed are consistent with the pecking order theory. The dynamic nature of capital structure was confirmed for all Visegrad Group companies, considered collectively and individually, except for Poland.

Research limitations/implications: The research takes into account only quoted companies, so its results do not explain capital structure behavior of other companies. The research is a contribution to further analyses of the capital structure, which covers all types of enterprises.

Practical implications: Knowing the characteristics describing the activities of a given company and the country in which the company operates, analysts can determine on the basis of estimated models what capital structure is typical for a given company. In addition, the analyst is able to identify the effect of the country, i.e. compare companies in terms of capital structure.

Originality/value: The study takes into account the impact of 'country factor'. It made possible to identify main internal factors characterizing capital structure of the enterprises operating in different economic conditions. Moreover, dynamic nature of capital structure was taken into

account. The results can be generalized for all V4's companies listed on the stock exchange. The conducted research may be addressed to analysts, investors and managers of companies as well as researchers conducting research in this area.

Keywords: capital structure, pecking order theory, trade-off theory, panel modeling, Visegrad Group countries.

Category of the paper: Research paper.

1. Introduction

The issue of capital structure formation constitutes one of the key research streams in corporate finance. Despite the passage of more than half a century, it remains a relevant subject of scientific discussion. The research results on the financing source choices are inconclusive and often contradictory. Various concepts are known to explain the principles of capital structure formation, nevertheless, no universal solutions applicable in business practice have been developed. The set of the factors affecting capital structure decisions is expanding continually, which prompts the modification of the existing theories and the development of new ones, based on distinct assumptions (Agraval, 2013). What is more, by-country analysis of capital structure poses additional problems, one of which entails the so-called 'country factor'. The different economic conditions and the varying degree of capital market development in individual countries or groups of countries are indicated as one of the reasons underlying the diversity of the factors affecting capital structure (Kędzior, 2012), as exemplified by the Visegrad Group (V4). The idea of cooperation among Poland, the Czechia, historically known as Bohemia, and Hungary dates back to the 14th century, when during a congress held at the Visegrad Castle, the rulers of these countries agreed on close collaboration, both politically and economically. This event inspired the declaration signed in the early 1990s on the cooperation among Poland, Hungary and initially Czechoslovakia, later the Czechia and Slovakia, on the road to European integration. During the period of economic transition, these countries represented a similar level of socio-economic development. Despite all the similarities, the Visegrad Group countries did not develop at the same pace thereafter. The differences entailed the conditions determining and the level of financial market development in the V4 countries. Moreover, V4's countries participation in the EU can be called difficult. However, the countries managed to advance in further integration into the EU while maintaining the heterogeneity of economic results within the Visegrad Group itself (Chetverikova, 2020). The article aims to assess the impact of selected factors on the capital structures of the companies listed in the Visegrad Group countries, and to determine whether the direction of this impact is consistent with the assumptions of the trade-off theory or pecking order theory.

Two main research hypotheses were formulated:

Hypothesis 1: The capital structure of the stock exchange listed companies differs significantly for individual countries of the Visegrad Group.

Hypothesis 2. The capital structure of the entities under examination is dynamic in nature and is mainly determined by the internal factors characterizing these companies.

To verify the main hypotheses, several questions regarding the links between the various factors of capital structure needed to be answered. Accordingly, six auxiliary hypotheses were formulated:

1. A negative relation between growth opportunities and debt level can be observed.
2. Financial liquidity and debt level are negatively related.
3. The relation between investment tax shield and debt level is negative.
4. A negative relation exists between profitability and debt.
5. Company size and the debt level are positively related.
6. The relation between asset structure and debt level is positive.

The level of debt (D), acting as an endogenous variable, has been expressed by the ratio of total debt to total assets. As such, it describes the capital structure identified with the structure of financing. The remaining variables are exogenous in nature. Growth rate (GR) has been denoted as the percentage change in sales revenue with respect to previous year. Liquidity (LIQ) has been determined through the ratio of current assets to current liabilities. Investment tax shield (NDTS) was calculated as the depreciation to total assets ratio. Profitability (ROE) has been expressed as return on equity, i.e., the ratio of net income to total assets. The natural logarithm of total assets has been adopted to express company size (SIZE). The tangible assets to total assets ratio represents the asset structure (TANG).

The hypotheses formulated were verified using appropriate statistical tests. The calculations were carried out using the Gretl package. The analysis covered 259 companies listed between 1998 and 2020 on the stock exchange markets in the Visegrad Group countries.

The article consists of an introduction, four parts and a conclusion. The second part deals with capital structure formation, in the context of the trade-off or the pecking order theories. The third part entails an overview of the studies drawing on the two concepts. The next section explains the links between capital structure and the factors analyzed, providing justification for the research hypotheses formulated in this work. The fifth part presented research methodology. Results and discussion are presented in the sixth part, followed by a conclusion and final remarks.

2. The structure of capital in the light of the pecking order and the trade-off theories

Capital structure is an ambiguous concept, interpreted and measured variously. In the most general terms, it can be defined as the proportion of debt and own capital in business activity financing (Jerzemowska, 2013). In this context, the structure of capital is equated with the structure of balance-sheet liabilities, i.e., with the structure of financing. Understood as such, it refers to a company's sources of asset financing, taking long-term and short-term as well as interest-bearing and non-interest-bearing equity and debt capital into account.

Another approach views capital structure in terms of fixed (long-term) capital division into equity and long-term liabilities. Fixed capital is defined as the sum of equity and long-term liabilities. According to yet another view, capital structure expresses the combination of a company's issued debt and equity securities (Duliniec, 1998).

In the last approach, capital structure reflects equity and long-term as well as short-term liabilities, excluding liabilities to suppliers, tax liabilities, wages and salaries. This approach distinguishes capital structure from the structure of balance-sheet liabilities, as it only takes interest-bearing liabilities into account (Duliniec, 2011).

Decisions on capital structure formation - along with investment decisions - are among the most important and difficult corporate decisions. Despite nearly sixty years of research, the issue of how an optimal capital structure, i.e., one which allows maximum company value and minimum weighted average cost of capital, should be shaped has not yet been explicitly clarified. The numerous attempts to solve this problem have led to the formulation of many theories. A pioneering study by Durand (1952), aiming to organize and integrate the research on capital structure, mentions three different approaches, which today are referred to as the original theories of capital structure, i.e., the net profit theory, the net operating profit theory, and the traditional theory - as a compromise between the former two.

Contemporary theories of capital structure are based on the concept of Modigliani and Miller, who in 1958 formulated the theory of irrelevance, known as the MM theorem/model. The authors concluded that, assuming a perfect capital market and no taxation, company value does not depend on leverage, and the weighted average cost of capital is not dependent on capital structure. According to these authors, company value is only contingent on the expected rate of return on assets discounted at an asset class-specific rate (Modigliani, Miller, 1958). Developing their theory, they took the taxation of corporate income into account, concluding that the use of debt results in an increase in the value of the company (Modigliani, Miller, 1963).

In response to the concepts developed by Modigliani and Miller, the theories of capital structure were further developed, based on separate assumptions, taking the different factors affecting the choice of financing sources into account. The most important of these include the trade-off theory, the pecking order theory, the signaling theory, the agency theory,

and the market timing theory (Miglo, 2011; Chaklader, Chawla, 2016). The study objective adopted in work has limited Authors to analyses based on the trade-off and the pecking order theories.

The static trade-off theory represents a development of the Modigliani and Miller's work (1958, 1963), as an approach most commonly indicated in the literature on the subject (Lambrinouidakis, 2016). It was first presented by Kraus and Litzenberger (1973), modified several times in subsequent years by such authors as Jensen and Meckling (1976), Myers (1977, 1984) and Haugen and Senbet (1978).

The main assumption of the static trade-off theory posits that an optimal capital structure results from balancing the interest tax benefits with the so-called costs of financial distress (bankruptcy costs) and the agency costs associated with equity and debt capital. Such optimal capital structure maximizes the market value of an enterprise, as it simultaneously minimizes its weighted average cost of capital. This cost determines the level of the discount rate used in the company valuation. The trade-off theory assumes calculation of the optimal level of the interest-bearing liabilities to equity ratio, i.e., the leverage. In practice, however, there is no fixed optimal capital structure, as corporate financial standing and market environment change continually. The balance of the costs and benefits associated with the amount of debt therefore changes as well, forcing modification of the static trade-off theory (Leary, Roberts, 2005). Considering the dynamic model of the trade-off theory, one important factor affecting the choice of financing sources is the pursuit of a target capital structure, which due to the volatility of operating conditions, is subject to frequent modifications (Duliniec, 2015). Target capital structure differs significantly from company to company. Entities using low-risk tangible assets and generating significant sales revenues tend to have higher debt. Conversely, low-profit companies with high proportions of risky intangible assets should finance their operations with equity mainly.

In economic practice, it turns out that the trade-off theory offers an explanation for the capital structure variation across sectors, e.g., high-tech companies characterized by elevated percentage of risky, intangible assets. These companies mainly finance their operations with equity. The trade-off theory does not, however, explain why many of the highly profitable companies are characterized by low leverage (Borová, 2006).

The pecking order theory represents an opposite approach to capital structure formation. Donaldson (1961), whose approach was continued and described by Myers and Majluf (1984), Myers (1984), had been a precursor in this regard. The concept elucidates the order in which specific sources of financing are selected. Organizations are mainly oriented at the use of internal sources, which include retained earnings, surplus cash and short-term financial assets. Then, companies decide to use external sources secondarily, primarily credit and loans. When these options are exhausted, they issue debt securities, then hybrids and ultimately shares. The theory does not set a target capital structure. The key factor affecting the capital structure entails the choice of individual sources of financing (Duliniec, 2015).

The pecking order theory provides an answer to the question of why with highly profitable companies are characterized by low levels of debt, which is related to the preference for internal financing rather than the establishment of low leverage (Borová, 2006). Conversely, companies with low profitability choose debt, as they lack adequate internal financing resources. Correspondingly, debt financing comes next after internal financing.

One of the primary pecking order theory assumptions pertains to the existence of information asymmetry between the management and investors. Companies therefore avoid financing sources which generate the so-called information costs, as these costs have negative impact on the enterprise market value. The asymmetry theory links the pecking order theory with the signaling theory (Ross, 1977). The concept explains the negative or positive capital market reaction to corporate issuance of securities. As such, it constitutes an extension of the pecking order theory.

A variety of factors modify companies' preferences for particular sources of financing. Considering stock exchange listed companies, these factors mainly include market valuation and capital market conditions, which is why managers base their financing decisions on the market circumstances, rather than on the capital needs and the internal financing availability only. Such conduct is in line with the market timing theory. Baker and Wurgler (2002) proved that a company's decision to issue shares depends on its market value to book value ratio. The higher a given company's current market valuation, compared to its book value and previous listings, the more interest it shows in issuing new shares. Conversely, when the market value is low, companies opt for share buybacks. The literature on the subject, however, shows no consensus as to whether financial decisions based on the market timing theory assumptions yield short-term effects on capital structure (Alti, 2006), or whether these effects are long-term (Baker, Wurgler, 2002).

3. Overview of the trade-off theory-based and the pecking order theory-based research on the capital structure in the Visegrad Group countries

The rationales deriving from the trade-off theory and the pecking-order theory are commonly used to explain the impact of the factors shaping the structure of financing. The research to date has not led to clear conclusions on this matter, however. This section presents the results of the available trade-off theory-based and pecking order theory-based studies conducted in the Visegrad Group countries. Alas, most of these studies cover short periods and involve small research samples, which is why the results thereof can be considered contributive to further analyses.

During the economic transition, i.e., throughout the first half of the 1990s, profitability and indebtedness in Polish, Hungarian and Slovak enterprises were negatively related, which is consistent with the pecking order theory (Bostyn, Boytsun, 2002). This was mainly associated with the low availability of debt capital and its high cost. The credit markets in these countries were in crisis at the time. Banks were unable to provide business activity financing in the extent satisfying the needs of enterprises. What is more, on the one side, the outdated portfolios of the physical assets held by companies that had originated in the days of centrally controlled economy oftentimes did not provide proper credit collateral, and on the other, there were no secondary markets enabling productive tangible asset liquidation. Banks were therefore faced with difficulties in selling the assets seized as part of companies' defaulting on a loan agreement (Szemán, 2011). Similar conclusions were reached by Colombo and Revoltella (2003), who indicate that the companies listed in the Czech Republic and Hungary at the time of the economic transition were shaping their capital structure in compliance with the assumptions of the pecking order theory.

Mazur (2007), based on a survey of 238 Warsaw Stock Exchange listed public entities, proved that companies with high profitability and liquidity prefer internal sources of financing. This conclusion is consistent with the pecking order theory. Furthermore, the trade-off theory was not applied in the companies examined (Mazur, 2007). Similar results have been presented by Hamrol and Siczko (2006), who indicate that the pecking order theory serves as most accurate explanation of capital structure formation in Polish listed companies. Both these studies were carried out in a similar period. Jaworski and Czerwonka (2019) analyzed 335 service sector companies listed on the Warsaw Stock Exchange in 1998-2012. They also confirm the validity of the pecking order theory. Różański and Bogołębska (2022) studied Polish enterprises producing for the domestic and foreign markets in 2015-2019. They found that the primary source of financing with equity was retained earnings and with debt capital it was bank credit and leasing. It is consistent with the pecking order theory.

Koralun-Bereźnicka (2019) obtained less conclusive research results. The author underlines that the pecking order theory is primarily applicable to long-term debt level formation. The trade-off theory, on the contrary, poses as the rationale behind short-term debt decisions. Moreover, in the case of long-term debt, one important factor shaping the level thereof entails a given company's sectoral affiliation, whereas short-term debt levels show significant association with company size. The results of an analysis conducted by Białek-Jaworska and Nehrebecka (2016), in turn, indicate that the pecking order theory is primarily applied in large companies characterized by high profitability and self-financing capacity. Compared to small and medium-sized enterprises, these entities tend to finance their operations with credit to a lesser degree. By contrast, the relation between liquidity and leverage is negative, regardless of the company size, which is also in line with the pecking order theory. Unlike previous studies cited Hartwell and Malinowska (2018) argued that neither the trade-off nor the pecking order theories fully explain corporate capital structure in Poland. The authors indicate that the strength

of property rights and stock market capitalization are driving forces behind corporate financing decisions.

Research on Czech listed companies was conducted by Poulová (2017), who demonstrated that agricultural, industrial and construction companies shaped their capital structure in accordance with the assumptions of the two theories mentioned above. The level of leverage in these companies was affected by their sectoral affiliation and the type of ownership structure. Bauer (2004), in turn, analyzed Czech non-financial companies and proved that they were functioning in compliance with the pecking order theory, i.e., the level of debt was negatively related to the companies' profitability.

Režňáková, Svoboda, Polednáková (2010) analyzed the capital structure of Slovak non-financial companies. Based on their study, it can be concluded that positive relation occurs between the level of debt and the asset structure, profitability, and company size, while the relationship between the debt level and the growth opportunities, liquidity, and non-interest tax shield is negative. These results confirm the validity of the pecking order theory.

Hungarian public companies were shaping their capital structure in compliance with the pecking order theory, during the economic transition period (Nivorozhkin, 2002; Dević, Krstić, 2001). Another study carried out by De Jong, Kabir and Nguyen (2008) showed a negative relationship between debt and profitability, liquidity, and income tax rate. Debt and company size, in turn, were characterized a positive relation, which again confirms the companies' compliance with the pecking order theory.

Majerowska and Gostkowska-Drzewicka (2019) analyzed 328 non-financial companies listed in the Visegrad Group countries. The study confirms the earlier conclusions regarding the Polish and Czech companies' propensity to shape their capital structure in accordance with the assumptions of the pecking order theory. Research results on Hungarian and Slovak companies, by contrast, were less unambiguous. In Slovak companies, the level of debt was positively related with growth opportunities, whereas profitability and company size were characterized by a negative relationship, confirming compliance with the pecking order theory. The positive relation between liquidity and debt, in contrast, indicates compliance with the trade-off theory. Conversely, the negative relationship between the Hungarian companies' levels of debt and such factors as liquidity and profitability indicate compliance with the pecking order theory, while the negative relationship between growth opportunities and debt confirms the validity of the trade-off theory.

Kluzek and Schmidt-Jessa (2022) analyzed 8120 domestic and multinational enterprises operating in the Visegrad Group countries used data from 2012-2018. Among internal determinants of the capital structure which most often appeared as significant, in the case of all companies in all countries analyzed were sales profitability, tangibility and the age of the company. Moreover, a negative relation was observed between profitability and the level of debt what is in line with pecking order theory. In the contrary, asset structure and the level of debt were positively related. This conclusion is consistent with the trade-off theory.

Table 1 outlines the period covered by the study, indicating the subjects of the research and the capital structure-affecting factors analyzed by the authors of the works cited.

Table 1.

Selected studies by author, period covered and research subject as well as specification of the capital structure shaping factors analyzed in the works cited

Autor	Research period	Research subject	Factors
Mazur (2007)	2000-2004	238 Polish Warsaw Stock Exchange listed companies	Asset structure, profitability, liquidity, growth opportunities, size, product uniqueness, business risk, tax shield, dividend policy
Hamrol, Sieczko (2006)	2002-2004	134 Warsaw Stock Exchange listed companies	Asset structure, profitability, growth opportunities, size, product uniqueness, investment tax shield, cost of capital
Jaworski, Czerwinka (2019)	1998-2012	335 Warsaw Stock Exchange listed service sector companies	Asset structure, size, growth opportunities, profitability, liquidity, non-interest tax shield
Koralun-Bereźnicka (2019)	2005-2015	Polish small, medium and large private companies representing various sectors	Return on capital, size, sectoral affiliation, interaction between company size and profitability as well as between sectoral affiliation and profitability
Białek-Jaworska, Nehrebecka (2016)	1995-2012	Polish small, medium and large enterprises representing the non-financial sector	Profitability, liquidity, fixed assets, growth opportunities, tax shield, impact of monetary policy
Poulová, (2017)	2010-2014	624 Czech agricultural, industrial and construction companies	Asset structure, profitability, liquidity
Bauer, (2004)	2000-2001	74 non-financial sector companies listed on the Prague Stock Exchange	Size, profitability, asset structure, growth opportunities, income tax rate, non-interest tax shield, risk, sectoral affiliation
Režňáková, Svoboda, Polednáková, (2010)	2002-2007	1100 Slovak non-financial sector companies	Asset structure, profitability, growth opportunities, size, investment tax shield, liquidity
de Jong, Kabir, Nguyen (2008)	1997-2001	15 Hungarian companies	Asset structure, profitability, growth opportunities, size, income tax rate, liquidity, risk
Nivorozhkin, (2002)	1992-1995	25 non-financial sector companies listed on the Budapest Stock Exchange	Asset structure, profitability, growth opportunities, size, ownership structure, sectoral affiliation
Dević, Krstić (2001)	1996-1998	20 non-financial sector companies listed on the Budapest Stock Exchange	Profitability, size, asset structure, growth opportunities
Majerowska, Gostkowska-Drzewicka (2019)	1998-2016	328 non-financial companies listed in the Visegrad Group countries	Growth opportunities, liquidity, non-interest tax shield, profitability, company size, asset structure
Kluzek, Schmidt-Jessa (2022)	2012-2018	8120 domestic and multinational enterprises operating in the Visegrad Group countries	Taxation, tangibility, age, size, profitability, liquidity

Source: Own elaboration.

4. The links between capital structure and the factors analyzed

As discussed in the previous section, various capital structure factors are identified in the literature on the subject. These factors constitute the subject of the empirical studies, on the basis of which the direction and strength of the impact thereof on the level of financial leverage have been determined. These dependencies have also been linked with specific concepts of capital structure. Six such factors were selected for the study. The research hypotheses were formulated based on the available empirical studies, taking the direction of each factor's impact on the level of financial leverage into account.

Companies characterized by high development (growth) potential strive to maintain low leverage. This is in line with the trade-off theory, as realization of growth opportunities is associated with elevated risk and higher expected costs of financial difficulties, which results in reduction of debt. It should be underlined that high growth potential is often reflected in an increased market value to book value ratio, which, according to the theory of market timing, promotes the use of external sources of equity (issuance of shares) rather than debt capital (Duliniec, 2015). Accordingly, hypothesis one has been formulated as follows:

A negative relation between growth opportunities and the level of debt is observed.

Companies with high liquidity are able to finance their operational and growth activity by engaging the highly liquid assets held. This leads to a reduced demand for debt capital (Mazur, 2007), which is in line with the pecking order theory. Deriving on that, hypothesis two has been formulated as follows:

Financial liquidity and debt volume are negatively related.

The tax shield effect is one of the reasons leading to increased debt. Such conduct, however, is only attractive to companies which generate income that allows tax benefits, but do not show other costs acting similarly to the tax shield. Such costs primarily include depreciation, which, in relation to total assets, determines the level of the so-called investment tax shield. Unlike the tax shield, it leads to debt reduction (De Angelo, Masulis, 1980). Since this regularity is consistent with both the trade-off theory and the pecking order theory, hypothesis three assumes that:

The relation between investment tax shield and debt size is negative.

Companies with high profitability ratios tend to display lower levels of debt, which is consistent with the pecking order theory, for these entities are more capable of financing growth via internal sources (Myers, Majluf, 1984). As a result, they show lower demand for debt capital. Accordingly, hypothesis four has been formulated as follows:

A negative relation exists between profitability and the level of debt.

Large companies display higher levels of debt. These entities tend to diversify their operations, owing to which they are at low risk of losing liquidity, which reduces the cost of

financial distress and allows for higher leverage (Duliniec, 2015). This is in line with the trade-off theory, hence hypothesis five assumes that:

Company size and debt volume are positively related.

Companies holding significant stocks of physical assets show higher levels of leverage. This is because physical assets, by providing collateral for liabilities, allow for reduction of direct costs of bankruptcy, which promotes higher levels of debt (Duliniec, 2015; Chaklader, Chawla, 2016). This conclusion is consistent with the trade-off theory, and thus leads to the sixth hypothesis formulated on this basis:

The relation between asset structure and the level of debt is positive.

5. Methods

The subjects of the analysis entailed companies listed in 1998-2020 (as of November 19, 2021) on the main stock exchange markets in the Visegrad Group countries, i.e., Poland, the Czechia, Slovakia and Hungary. The Warsaw Stock Exchange sample encompassed 415 companies. Financial sector entities were excluded from the analysis, which is why 97 companies were eliminated from the sample. Entities which did not publish full financial statements during the period under examination, i.e., 24 companies, were also excluded from the sample. Furthermore, only the entities listed on the Warsaw Stock Exchange continuously for a period of at least 5 years were included in the analysis, which is why 92 companies were additionally eliminated from the sample. Ultimately, 212 companies, i.e., 51% of the entities selected initially, were qualified for the study.

Another stock market covered by the study was the Budapest Stock Exchange. Equities-listed companies, i.e., 34 entities, were selected for the study. Six financial sector companies and four entities listed for a period of less than five years were excluded from the sample. In total, 24 entities, i.e., 70% of the pre-selected sample, were included in the analysis.

Out of the 16 companies listed on the Prime Market and Standard Market of the Prague Stock Exchange, 9 companies, i.e., 56% of the entire sample, were qualified for the study. Companies listed for a period of less than 5 years (1 entity) as well as financial sector companies (6 entities) were excluded from the sample.

The Bratislava Stock Exchange is the smallest stock market in the Visegrad Group. In this case, 22 entities were included in the sample, 8 of which (financial sector companies) were excluded. Ultimately, the sample covered 14 entities, i.e., nearly 64% of the total number of Slovak listed companies.

Based on the above-mentioned literature, estimation of a linear panel data model has been propounded, in order to verify the hypotheses presented in the introduction:

$$Y_{it} = f(Y_{it-1}, X_{1it}, \dots, X_{6it}, Z_{1it}, \dots, Z_{4it}, \xi_{it}) \quad (1)$$

where the endogenous variable Y denotes the level of debt (D), while the ratio of total debt to total assets acts as an explanatory variable in current period (t) and as an explanatory variable in previous period ($t-1$). Selected exogenous variables used in the model include:

X_1 – growth rate (GR), the percentage change in sales revenue, with respect to previous year,

X_2 – liquidity (LIQ), the ratio of current assets to current liabilities,

X_3 – investment tax shield (NDTS), the ratio of depreciation to total assets,

X_4 – profitability (ROE), the ratio of net income to total equity,

X_5 – size (SIZE), the natural logarithm of total assets,

X_6 – asset structure (TANG), the ratio of physical assets to total assets.

Variables Z_1, \dots, Z_4 represent dummy variables, taking the value of 1 when a given company is associated with a given country and zero otherwise. The subscript i denotes the number of the company in question, t the period number, and ξ the random component.

6. Results and discussion

In the first stage of the study, the values of the correlation coefficients between each company's level of current debt and its previous-period debt and other factors were determined (Table 2). It can be noted that these coefficients differ significantly from country to country, both in terms of value and statistical significance.

Table 2.

Correlation coefficients between debt ratio and selected factors

	ALL COUNTRIES	CZECHIA	SLOVAKIA	HUNGARY	POLAND
D(-1)	0.4595*	0.9914*	0.9480*	0.0936	0.5595*
GR	-0.0022	0.1610*	0.0663	-0.0068	-0.0020
LIQ	-0.0081	-0.2248*	-0.3053	-0.0170	-0.0194
NDTS	-0.0016	-0.2296*	0.2489*	-0.0402	0.0066
ROE	0.0012	-0.3531*	0.1611*	0.0043	-0.0010
SIZE	-0.0686*	0.3091*	-0.0598	-0.1793*	-0.0692*
TANG	-0.0323*	0.3296*	0.2583*	-0.0739	-0.0305

*) statistically significant at 0.05 significance level.

In the second step, the dynamic model propounded (1) was estimated using pooled OLS, taking the Arellano–Bond estimator into account and incorporating all the capital structure factors selected. The estimation results are presented in Table 3.

Table 3.*Panel regression estimates for entire sample*

	Pooled OLS (1)	Fixed effects (2)	Pooled OLS (3)	Fixed effects (4)
const	1.7261*	11.2637***	0.3370***	10.3107***
D(-1)	0.4469***	0.3359***	0.4498***	0.3359***
GR	-0.0003	0.0007		
LIQ	-0.0007	-0.0004	-0.0006*	
NDTS	1.3826	1.5021		
ROE	0.0018	-0.0039		
SIZE	-0.1049***	-0.7746***		-0.7775***
TANG	-0.3718	-0.1738***		
Joint test stat.	1.7840#		1.5227#	
Breusch-Pagan test stat.	N/A		N/A	
Hausman test stat.	463.736#		391.714#	

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

#) at 0.05 significance level, the null hypothesis should be rejected.

Source: Own estimation.

The model (1) estimation results indicate occurrence of explanatory variables for which the statistical parameters proved statistically insignificant at 0.05 level of significance. The diagnostic tests for the panel data suggest the use of fixed effects models. Taking both these conditions into account, the result denoted in Table 3 as (4) was ultimately obtained. As such, it can be concluded that the estimation of the panel model accounting for company performance with respect to each country analyzed has led to factors shaping current debt, i.e., the level of previous year's debt and company size. The negative relationship between the level of debt and company size suggests that most accurate explanation of the capital structure formation in the stock exchange listed companies of the Visegrad Group involves the pecking order theory. According to this concept, large entities tend to display lower levels of debt, owing to their ample capacities to finance operations via internal sources. It should be underlined that the pecking order theory does not explicitly indicate the direction of the links between a company's size and its debt. This relation can be both positive and negative.

In the next stage of the study, dummy variables identifying the companies' country affiliation were added to the model. The results of the estimations are presented in Table 4.

Table 4.*Panel regression estimated for the entire sample*

	Pooled OLS (1)	Pooled OLS (2)	Pooled OLS (3)	Pooled OLS (4)
const	2.3487***	2.0788***		
D(-1)	0.4446***	0.4454***	0.4446***	0.4495***
GR	-0.0002		-0.0002	
LIQ	-0.0011		-0.0012	
NDTS	0.8663		0.8663	
ROE	0.0001		0.0001	
SIZE	-0.1576***	-0.1410***	-0.1576	
TANG	-0.3575		-0.3575	
CZECHIA	0.5276		2.8763	0.1954***
SLOVAKIA	-0.4519		1.8967*	0.2691***
HUNGARY	0.6498**	0.5860***	2.9985*	0.4703*
POLAND			2.3487	0.3273***

Cont. table 4.

Joint test stat.	1.7727#			
Breusch-Pagan test stat.	N/A			
Hausman test stat.	455.682#			

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

#) at 0.05 significance level, the null hypothesis should be rejected.

Source: Own estimation.

Table 4 shows statistically significant differences in the level of Hungarian listed entities' debt, compared to Polish companies (version 2 of the model). Inferring from the model with statistically significant structural parameters, it can be concluded that the level of debt in Hungarian listed entities differed notably from that of the companies listed in the other V4 countries. Relations identical to those indicated by the results presented in Table 3 have been observed as well. As such, it can be concluded that the level of debt in the companies under examination is shaped in accordance with the pecking order theory, with significant impact of previous year's debt.

Lastly, estimation of model (1) was proposed, by treating the sample companies in distribution by each country, due to the significant differences in the number of the companies listed in each V4 country. Estimates of the most accurate models are given in Table 5.

Table 5.

Panel regression estimated for the entire sample

	CZECHIA	SLOVAKIA	HUNGARY	POLAND
	Fixed effects	Fixed effects	Fixed effects	Fixed effects
const	-0.6753***	0.1060***	20.8459***	8.7347***
D(-1)	0.7140***	0.7916***	-0.0914*	0.4462***
GR		0.0075*		
LIQ		-0.0050***		
NDTS				
ROE	0.3498***	0.0132*		
SIZE	0.0465***		-1.2818***	-0.6776***
TANG				

*)***) statistically significant at 0.1; 0.05 and 0.01 significance levels.

Source: Own estimation.

The above estimates indicate that, taking the research sample entities in distribution by country, the use of the fixed effects models proved to be most appropriate in terms of company performance. In the case of the Czech listed companies, the level of debt is positively affected by previous year's debt, the level of ROE, and company size. It can thus be concluded that these companies shape their capital structure in accordance with the trade-off theory.

The factors shaping the level of debt in Slovak listed companies include the level of previous year's debt, growth rate, liquidity and ROE. The Slovak companies' functioning in compliance with the trade-off theory principles has been confirmed by the positive relation with respect to profitability. The positive relation with the growth rate and the negative with liquidity, in turn, indicate that the capital structure formation in these entities can be explained on the grounds of the pecking order theory assumptions.

The estimate results obtained for Hungarian companies are ambiguous, yet largely confirm compliance with the pecking order theory, as evidenced by a negative relationship between leverage and company size. It is worth noting that a negative relation between the level of debt in a given year and the year preceding can be observed with respect to Hungarian companies.

Poland, just as the other V4 countries, shows a significant dependence of debt on its previous year's level. Another factor negatively affecting debt at a significant level was company size. It is noteworthy that this impact was also negative, as in the case of Hungarian companies. This confirms the compatibility of the capital structure decisions made by Polish listed companies with the pecking order theory. The conclusions formulated on the basis of the research conducted are therefore in line with the results obtained by the authors of other works (March, 2010; Janus, 2006; Mazur, 2007; Hamrol, Sieczko 2006; Lisińska, 2012; Barbuski, 2014, Wrońska-Bukalska, 2014; Jaworski, Czerwonka 2019).

7. Summary

According to the research conducted, capital structure decisions of non-financial companies listed in the Visegrad Group countries are generally in line with the pecking order theory. Slovak companies, however, show dependencies consistent with the trade-off theory. With regard to the totality of the V4 companies examined, the preliminary analysis of the dependencies between the level of debt and selected debt shaping factors showed a statistically significant positive relationship between debt and previous year's debt, and a statistically significant negative relation between debt and company size as well as asset structure. These relationships differed for each country. The estimation of the panel model of debt indicated the need for fixed effects models. The results confirmed a statistically significant dependency between current debt and prior period debt. Taking the effect specific to each country into account, the above conclusions have again been confirmed, allowing a conclusion that the levels of company debt in each V4 country differ with statistical significance.

Profitability has a positive impact on debt in the Czech and Slovak companies only, which is consistent with the trade-off theory. Such relationships, as already mentioned, do not negate the validity of the statement that the capital structure decisions made by the companies analyzed are consistent with the pecking order theory, however. Divergent results were obtained in relation to the other factors under analysis, depending on the country. Company size positively affected the level of debt in the Czech Republic, and negatively in Hungary and Poland, whereas in Slovakia, it proved statistically insignificant. No statistically significant impact of non-interest tax shield and asset structure has been observed when analyzing the research sample companies in distribution by each V4 country.

Ultimately, it can be concluded that the first hypothesis posed in the introduction, assuming a significant difference in the capital structure of the companies listed in individual Visegrad Group countries has been confirmed. The second hypothesis assuming a dynamic nature of capital structure formation has been confirmed as well. What is more, despite the fact that the companies examined operate in a single geographic region (the European Union) and share common cultural roots, the impact of the individual factors shaping these entities' capital structures varies. Last of all, it is worth mentioning that the research results obtained fall within the scope of the conclusions formulated in the works mentioned in this article.

References

1. Agarwal, Y. (2013). *Capital Structure Decisions. Evaluating Risk and Uncertainty*. Singapore: John Wiley & Sons.
2. Alti, A. (2006). How Persistent Is the Impact of Market Timing on Capital Structure? *Journal of Finance, Vol. 61, Iss. 4*.
3. Baker, M., Wurgler, J. (2002). Market Timing and Capital Structure. *Journal of Finance, Vol. 57, Iss. 1*.
4. Barburski, J. (2014). Kapitały własne jako podstawa bezpieczeństwa działalności gospodarczej na przykładzie przedsiębiorstw WIG 20. *Finanse, Rynki Finansowe, Ubezpieczenia, Vol. 67*.
5. Bauer, P. (2004). Determinants of Capital Structure Empirical Evidence from the Czech Republic. *Finance a úvěr, Vol. 54, Iss. 1-2*.
6. Białek-Jaworska, A., Nehrebecka, N. (2016). Preferencje polskich przedsiębiorstw w zakresie finansowania długiem. *Ekonomista, Vol. 4*.
7. Borová, R. (2006). Capital Structure determinants: Contemporary Considerations. *Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego, Vol. 1*.
8. Bostyn, F., Boytsun, A. (2002). *Ownership an Privatisation in Poland. Governance Implications of Poland's Accession to the European Union*. Antwerpen-Apeldoorn: Garant.
9. Chaklader, B., Chawla, D. (2016). A study of Determinants of Capital Structure through Panel Data Analysis of Firms Listed in NSE CNX 500. *Vision, Vol. 20, Iss. 4*.
10. Chetverikova, A. (2020). The Visegrad Countries in the EU: Economic Results. *World Economy and International Relations, Vol. 64, Iss. 2, 63-70*.
11. Colombo, E., Revoltella, D. (2003). *Corporate capital structure in transition: Evidence from Hungarian and Czech firms*, in: *Contributions to Economics*, Heidelberg: Physica-Verlag.
12. Czerwonka, L., Jaworski, J. (2019). *Determinants of Enterprises' Capital Structure in Poland: Evidence from Warsaw Stock Exchange*. In: M. Bilgin, H. Danis, E. Demir, U. Can,

- (Eds.), *Eurasian Economic Perspectives. Eurasian Studies in Business and Economics, Vol. 10/2*. Cham: Springer.
13. de Jong, A., Nguyen, T.T., Kabir, R. (2008). Capital Structure Around the World: The Roles of Firm- and Country-Specific Determinants. *Journal of Banking & Finance, Vol. 32, Iss. 9*.
 14. DeAngelo, H., Masulis, R.W. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics, Vol. 8 Iss. 1*.
 15. Dević, A., Krstić, B. (2001). Comparable analysis of the capital structure determinants in Polish and Hungarian Enterprises – empirical study. *Facta Universitatis. Series: Economics and Organization, Vol. 1, Iss. 9*.
 16. Donaldson, G. (1961). *Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determinants of Corporate Debt Capacity*. Division of Research, Boston: Harvard Graduate School of Business Administration.
 17. Duliniec, A. (1998). *Struktura i koszt kapitału w przedsiębiorstwie*. Warszawa: PWN.
 18. Duliniec, A. (2011). *Finansowanie przedsiębiorstwa. Strategie i instrumenty*. Warszawa: PWE.
 19. Duliniec, A. (2015). Wybór źródeł finansowania a optymalna struktura kapitału w przedsiębiorstwie. *Finanse, Rynki Finansowe, Ubezpieczenia, Vol. 74, Iss. 855*.
 20. Durand, D. (1952). *Cost of Debt and Equity Funds for Business: Trends and Problems of Measurement*. New York: Conference on Research in Business Finance, National Bureau of Economic Research.
 21. Hamrol, M., Siczko, J. (2006). Czynniki kształtujące strukturę kapitału polskich spółek giełdowych. *Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego, Vol. 1*.
 22. Hartwell, A., Malinowska, A.P. (2018). Corporate Capital Structure in Poland: New Evidence from the Warsaw Stock Exchange. *Finance a úvěr, Czech Journal of Economics and Finance, Vol. 68 Iss.2*.
 23. Haugen, R.A., Senbet, L.W. (1978). The Insignificance of Bankruptcy Costs to the Theory of Optimal Capital Structure. *Journal of Finance, Vol. 33, Iss. 2*.
 24. Janus, A. (2006). Kapitał własny jako źródło finansowania działalności małych i średnich przedsiębiorstw. *Folia Oeconomica, Vol. 200*.
 25. Jensen, M.C., Meckling, W.H. (1976). The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, Vol. 3, Iss. 4*.
 26. Jerzemowska, M. (2013). *Kształtowanie struktury kapitału w przedsiębiorstwie*. In: M. Jerzemowska (Ed.), *Analiza ekonomiczna w przedsiębiorstwie*. Warszawa: PWE.
 27. Kędzior, M. (2012). Capital Structure in EU Selected Countries – Micro and Macro Determinants. *Argumenta Oeconomica, Vol. 1, Iss. 28*.
 28. Kluzek, M., Schmidt-Jessa, K. (2022). Capital structure and taxation of companies operating within national and multinational corporate groups: evidence from the Visegrad

- Group of countries. *Journal of Business Economics and Management*, Vol. 23, Iss. 2, 451-481.
29. Koralun-Bereźnicka, J. (2019), *Reconsidering the Profitability–Capital Structure Relation: Findings from Poland*. In: K. Jajuga, H. Locarek-Junge, L.T. Orłowski, K. Staehr (Eds.), *Contemporary Trends and Challenges in Finance, Springer Proceedings in Business and Economics*. DOI: 10.1007/978-3-030-15581-0_9.
 30. Lambrinoudakis, C. (2016). Adjustment Cost Determinants and Target Capital Structure. *Multinational Finance Journal*, Vol. 20.
 31. Leary, M.T., Roberts, M.R. (2005). Do Firms Rebalance Their Capital Structure? *Journal of Finance*, Vol. 60, Iss. 6.
 32. Lisińska, K. (2012). Struktura kapitałowa przedsiębiorstw produkcyjnych w Polsce, Niemczech i Portugalii. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, Vol. 27.
 33. Majerowska, E., Gostkowska-Drzewicka, M. (2019). *The factors shaping the capital structure of the stock-exchange-listed companies in the Visegrad Group countries*. In: M. Papież, S. Śmiech, S. (Eds.), *The 13th professor Aleksander Zelias International Conference on Modelling and Forecasting of Socio-Economic Phenomena: conference proceedings*. C.H. Beck.
 34. Marzec, J. (2010). Złote reguły finansowania w praktyce małych i średnich przedsiębiorstw w Polsce. *Ekonomiczne problemy usług*, Vol. 51.
 35. Mazur, K. (2007). The Determinants of Capital Structure Choice: Evidence from Polish Companies. *International Advances in Economic Research*, Vol. 13, Iss. 4.
 36. Miglo, A. (2011). *Trade-Off, Pecking Order, Signaling, and Market Timing Models*. In: H.K. Baker, G.S. Martin (Eds.), *Capital Structure and Corporate Financing Decisions. Theory, Evidence, and Practice*. John Wiley & Sons.
 37. Modigliani, F., Miller, M.H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *American Economic Review*, Vol. 48, Iss. 3.
 38. Modigliani, F., Miller, M.H. (1963). Corporate Income Taxes and the Cost of Capital: A Correction. *American Economic Review*, Vol. 53, Iss. 3.
 39. Myers, S.C. (1977). Determinants of Corporate Borrowing. *Journal of Financial Economics*, Vol. 5, Iss. 2.
 40. Myers, S.C. (1984). The Capital Structure Puzzle. *Journal of Finance*, Vol. 39, Iss. 3.
 41. Myers, S.C., Majluf, N.S. (1984). Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have. *Journal of Financial Economics*, Vol. 13, Iss. 2.
 42. Nivorozhkin, E. (2002). Capital structures in emerging stock markets: the case of Hungary. *The Developing Economies*, Vol. 40, Iss. 2.
 43. Poulová, L. (2017). Capital Structure of Czech joint stock companies. *Český finanční a účetní časopis*, Vol. 12, Iss. 4.

44. Režňáková, M., Svoboda, P., Polednáková, A. (2010). Determinants of Capital Structure: Empirical Evidence from Slovakia. *Ekonomický časopis*, Vol. 58, Iss. 3.
45. Ross, S.A. (1977). The Determination of Financial Structure. The Incentive-Signaling Approach. *Bell Journal of Economics*, Vol. 8, Iss. 1.
46. Róžański, J., Bogołębska, J. (2022). Capital Structure of Enterprises in the Process of Internationalization. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, Vol. 157.
47. Szemán, J. (2011). *An Analysis of the Capital Structure of the Hungarian Corporate Sector. Club of Economics in Miskolc*, Vol. 7, Iss. 2.
48. Wrońska-Bukalska, E. (2014). Zróźnicowanie branżowe poziomu i struktury kapitału własnego. *Annales Universitatis Mariae Curie-Skłodowska*, Vol. 48, Iss. 3.

BUILDING VALUE IN HIGH-GROWTH ENTERPRISES IN AN UNCERTAIN ENVIRONMENT

Marlena GRABOWSKA^{1*}, Iwona OTOLA²

¹ Czestochowa University of Technology, Faculty of Management; marlena.grabowska@pcz.pl,
ORCID: 0000-0003-2248-5531

² Faculty of Management, Czestochowa University of Technology; iwona.otola@pcz.pl,
ORCID: 0000-0003-4931-7394

* Correspondence author

Purpose: Our attention was directed to high-growth enterprises (HGEs) whose development is associated with an accelerated cycle of growth and value creation that is a result of the scalability of their business models. The primary research objective of the article is to analyze the value components in the business models of high-growth enterprises divided into three size groups (small, medium, large). We pose the research question: which components build value in HGE enterprises' business models under uncertainty?

Design/methodology/approach: An empirical study for HGEs was conducted after the third wave of the pandemic in October 2021 using a survey questionnaire on the sample consisted of a total of 125 Polish companies.

The relationships between variables were analyzed using structural equation modelling (SEM) based on the maximum likelihood method. Empirical research in relation to theoretical constructs in business models divided into three size groups of businesses allowed us to notice that only in the case of small enterprises, the creation and delivery of value affect the value proposition.

Findings: Empirical research in relation to theoretical constructs in business models divided into three size groups of businesses allowed us to notice that only in the case of small enterprises, the creation and delivery of value affect the value proposition. Exploration of business models of high-growth companies allows for a conclusion that building value in conditions of uncertainty should be based on stable foundations, which are regular customers and key customers, as well as well-proven products/services created under license.

Originality/value: The novelty of the paper are conducted researches on business models of HGEs during pandemic Covid-19.

Keywords: value proposition, value creation and delivery, value capture, business model, high-growth enterprises, uncertainty.

Category of the paper: Research paper.

1. Introduction

Companies operate today in a highly uncertain environment in which the processes taking place are difficult to predict and control. The unprecedented turbulence of changes in all spheres of the environment (i.e., economic, social, technological, environmental, and political) makes it quite challenging for companies to make business-related decisions. The management process carried out in enterprises in order to achieve appropriate economic results or increase the value of the enterprise implies choosing a course of action from among several possible alternatives (Minciu et al., 2020). Unfortunately, the state of uncertainty that indicates the lack of full knowledge possessed by the decision maker prevents proper conclusions about the future and thus complicates the management process. In such an environment, companies that can quickly adapt their business model to market changes without losing value do best. Our attention was directed to high-growth enterprises (HGEs), as they are the ones referred to as business gazelles. Studying fast-growth enterprises allows us to understand how they develop differently in comparison to other developing enterprises (Delmar et al., 2003; Demir et al., 2017). In addition, in the study, we paid attention to the size of the company, i.e. small, medium and large. This approach is based on the fact that companies' growth patterns are related to their demographic characteristics such as age, size, and industry affiliation (Delmar et al., 2003; Coad, 2009). Research conducted by Coad and Karlsson (2022) indicates that the largest number of high-growth companies can be found among small companies and especially among young, small companies, while the smallest number can be found among large companies. Young and small companies in order to survive in a competitive market must follow a path of rapid growth, as opposed to large companies, which can afford stable growth, scheduled over a longer time horizon. It should be noted that the development of HGEs is associated with an accelerated cycle of growth and value creation that is a result of the scalability of the business models of these companies (Monteiro, 2019). The primary research objective of the article is to analyze the value components in the business models of high-growth companies. Therefore, we pose the following research question. Which components build value in HGE companies' business models under uncertainty?

This paper is organized as follows. First, we discuss the theoretical background about value in business models. Then, we outline the methodology and data samples of the research. In the following section, we present the results of the conducted research and finally, we present concluding remarks.

2. Value in business models

Value is an inherent category related to the theoretical and practical aspects of management. The subject literature emphasizes that in the modern economy, its creation and growth are among the strategic imperatives of business activity (Brzóška, 2018). In the broader stream of management sciences, value is considered in many contexts. One of them concerns the reflection of the essence of the business model. An analysis of the rich set of definitions of this concept indicates that when describing the business model, researchers focused very often on the concept of value and the way it is created. The integral relationship between the essence of the business model and value can be found in such renowned authors dealing with this topic as Amit and Zott (2001; 2012), Osterwalder and Pigneur (2010), Chesbrough (2007), and Teece (2010). An example of interpreting a business model through the value dimension is pointing out that it expresses the content, structures and principles of managing transactions to create value by exploiting business opportunities (Amit, Zott, 2001). Furthermore, it is emphasized that the business model is a way that allows an organization to create, deliver, and capture value (Osterwalder, Pigneur, 2010; Otolá et al., 2020). In a similar approach, it can be noted that the business model describes the creation and acquisition of value (Chesbrough, 2007).

Definitions of business model point to the direct beneficiaries of value. These most often include the company's customers and the company itself, implementing a given business model. In this dimension, Teece (2010) interprets the issue narrowly as the logic of creating and delivering value to customers. Magretta (2002) relates the business model to the basic economic logic that explains the ability to deliver value to customers at an appropriate cost. On the other hand, from a broader perspective, the business model highlights how a company identifies and creates value for customers and captures some of that value in the form of income (Casadesus-Masanell, Ricart, 2010). In this context, two basic dimensions of the business model are noticeable in its concepts. The first relates to the creation of value for the customer by identifying the elements of the business model that play a fundamental role in this respect and the method of delivering this value. The second illustrates capturing value for the company that brings it income (Knop, Brzóška, 2016). Based on literature analysis of the definitions of this concept, that the creation of customer value and the capture of value for the benefit of the enterprise are the keynotes of the "business model" (Otolá et al., 2020; Falencikowski, 2013; Brendzel-Skowera, 2021).

The explanatory value of a business model is not a homogeneous category. It is captured in a variety of meaningful contexts. The detailed form of the business model categorizes the concept of value. In the literature on the subject, we can distinguish business model frameworks focused around the concept of value. They concern value proposition, its creation and delivery, and value capture (Richardson, 2008; Gomes et al., 2022).

The value proposition refers to the reasons why a customer values a company's offer. Richardson (2008) points out that its essential elements include: determining the offer to the customer, identifying the target group of customers, or markets, and determining ways to acquire customers. The value proposition is therefore expressed by the groups of customers to whom a given product or service offer is addressed. It takes both tangible and intangible forms. A major challenge for companies is to identify the needs and interests of their target group. The consequence of these activities is determining value for individual customers which has the form of a specific offer prepared by the company. The subject literature distinguishes two main approaches in this regard, called the 'cab' and 'bus' systems (Baden-Fuller, Mangematin, 2013). The first is to generate a value proposition based on customer integration to solve specific problems. The second, on the other hand, is to standardize the offer. In addition, the value proposition includes a complex of activities related to the delivery and operation of the product. This points to the "servitization" of business models, which involves integrating physical product offerings with the corresponding service offerings. This allows companies to create additional benefits for consumers (Biloshapka, Osiyevskyy, 2018).

In terms of ways and methods of creating and delivering value, activities related to the creation, production, sale, and transfer of the offer to customers are included (Richardson, 2008; Otolá et al., 2021). The combination of resources and capabilities at the company's disposal necessary to generate value is determined. The necessary resources enable the company to create and offer a customer value proposition, reach out to markets, and maintain customer relationships. Value creation requires a systemic and holistic analysis of a company's potential, followed by its effective use while matching this potential with market opportunities (Jabłoński, A., Jabłoński, M., 2013). Based on the resource-based view (RBV) approach proposed by Barney (1991), it is noted that the ownership of scarce and valuable resources is the basis for value creation. Resources are considered valuable if they serve to exploit emerging opportunities or counter threats (Sirmon et al., 2007). Huemer and Wang (2021), however, emphasize the need to focus on value creation through a resource bundle perspective. In this sense, it is noted that a resource creates value when it provides matching resource interfaces and enhances cogency effects to other resources. Value creation, therefore, manifests itself in the proper alignment of the business model of a company's resources and capabilities.

Once value is created, it is transferred. This is done through appropriate customer communication and distribution channels. Value delivery is carried out based on marshalling functions related to marketing, sales, and external logistics activities. Falencikowski (2013) points out that providing value can become a source of additional revenue, as well as a source of additional knowledge drawn from reaching out to customers. It should be noted that the process of value creation and delivery in the business model is ontologically convergent with the concept of Porter's value chain model, where any enterprise is a set of activities expressed through the design, manufacture, marketing, delivery, and after-sales support of a product (Kabalska, 2021).

Value capture refers to the methods and means of returning to the company the value transferred to customers. Thus, there is a kind of feedback loop in the transfer of value between the customer and the company. “Value capture is an activity of making profits and appropriating from the value what floats on the process of value delivery” (Daeyoup, Jaeyoung, 2015). The most common form of value capture identified in the literature refers to the price the buyer is willing to pay for the goods or services provided (Minerbo et al., 2021). In this context, the relationship occurring between usable value and exchange value is considered (Lepak et al., 2007). Richardson (2008) notes that the value capture reflected in the revenue model, which specifies the various ways of generating revenue for the goods sold, also has its expression in the economic model, which further illustrates the costs, margins, and other financial aspects of the company. Moreover, additional support instruments are indicated in capturing value by the company. These include, among others, business relationships (Oliński, 2016), the presence of multiple competitors in the same industry who are able to imitate solutions used by others (Dyduch, 2021), or combinations among core value dimensions (operational performance, capabilities, quality of relationships), change in buyers' supply strategies, and power (Minerbo et al., 2021). In general, value capture by an enterprise is possible when it illustrates the customer's needs and benefits, and thus becomes an expression of the customer's acceptance of the value proposition.

3. Methodology

An empirical study for high-growth companies was conducted after the third wave of the pandemic in October 2021 using a survey questionnaire. The research sample consisted of a total of 125 Polish companies further classified by size distinguished by the number of employees. High-growth companies are defined by the OECD (2010) as those with sales revenue or employment growth of more than 20% on average per year over the past three years. Companies that met one of the two conditions above were qualified for the study. Table 1 shows the size and age distribution of the companies included in the analysis. The youngest companies included in the study were 7 years old. The largest group of entities surveyed (40.8%) were medium-sized enterprises with 50 to 250 employees.

Table 1.
Size and age of the surveyed companies

Age	Total(n)	Small	Medium	Large
≤ 10	17	6	8	3
11-20	70	21	30	19
21-30	34	12	13	9
31-40	2	1	0	1

Cont. table 1.

≥ 41	2	1	0	1
Total(<i>n</i>)	125	41	51	33
Total (%)	100	32.8	40.8	26.4

n – number of companies; % – percentage of the sample.

Relationships between variables were analyzed using structural equation modelling (SEM) based on the maximum likelihood method. This method has the advantage of being able to test research hypotheses with a high complexity of relationships between variables by including both observable and latent variables in the model (Bowen, Guo, 2011; Loehlin, Beaujean, 2017). The statistical analysis took into account observable variables (the so-called explicit variables) representing subfactors measured during the survey, and variables derived from theory, unobservable variables (so-called latent variables), depicting the business model framework centred around the concept of value, i.e. value proposition, value creation and delivery, and value capture.

First, the measurement models for each latent variable were analyzed. The factor loadings obtained in the measurement models of value proposition, value creation and delivery, and value capture were determined.

Then the differences in terms of the relationships between the latent variables analyzed in the two models distinguished, based on theoretical assumptions, between small, medium and large enterprises were verified. Differences in factor loadings and regression coefficient values were analyzed. In the first model (Model 1), value proposition and value creation and delivery were analyzed as predictors of value capture and assessments of future revenue stability, positive financial result in the last 5 years, the positive financial result in the last 3 years, and the positive financial result in the last year. In the second model (Model 2), the value proposition was analyzed in the role of mediating the relationship between value creation and delivery and value capture, as well as the evaluations of the stability of future revenues, the positive financial result in the last 5 years, the positive financial result in the last 3 years and the positive financial result in the last year.

4. Results and findings

The values of the factor loadings of the measurement model for value proposition are shown in Table 2. Additional intercorrelations were added based on modification indexes at a threshold value of 4.0. The values of the fit indexes were CFI = 0.97, RMSEA = 0.03. The visualized model was not statistically significantly different from the data analyzed, $\chi^2(24) = 26.48$, $p > 0.05$.

Table 2.*Factor loading values obtained in the value proposition measurement model*

Observable variables		Construct	<i>f</i>
we enter into new types of business (VP1)	<---	VP	0.06
we enter into new industries and markets (VP2)	<---	VP	0.13
we offer original products services (VP3)	<---	VP	-0.15
we systematically increase the number of products/services offered (VP4)	<---	VP	0.30
the company has regular customers for products/services (VP5)	<---	VP	0.50
the company has a key customer recipient (VP6)	<---	VP	0.86
the company has regular suppliers of products/services (VP7)	<---	VP	0.14
the company has a key supplier of products services (VP8)	<---	VP	0.27
products services are targeted at specific market industries (VP9)	<---	VP	0.02

VP – value proposition.

The observable variables with the highest factor loadings were: we systematically increase the amount of products|services offered (VP4), the company has regular customers for products|services (VP5) and the company has a key customer|recipient (VP6). These observable variables saturated the value proposition to the greatest extent.

Table 3 shows the factor loadings of the measurement model for value creation and delivery. Additional intercorrelations were added based on modification indexes at a threshold value of 4.0. Matching index values were CFI = 0.99, RMSEA = 0.03. The visualized model was not statistically significantly different from the data analyzed, $\chi^2(11) = 12.41$, $p > 0.05$.

Table 3.*Factor load values obtained in the value creation and delivery measurement model*

Observable variables		Construct	<i>f</i>
products developed under license (VCD1)	<---	VCD	0.72
the company implements the around-product/around-service (VCD2) services	<---	VCD	0.24
products were developed on the basis of cooperation (VCD3)	<---	VCD	0.51
the company obtains licenses, trademarks, and copyrights from key suppliers (VCD4)	<---	VCD	0.47
the company obtains databases from key suppliers (VCD5)	<---	VCD	0.31
resources relevant to the production of key products/services – technological resources (VCD6)	<---	VCD	-0.35
resources relevant to the production of key products/services – other intangible resources (e.g., licenses, databases) (VCD7)	<---	VCD	0.55

VCD – value creation and delivery.

The observable variables with the highest factor loadings were products developed through licensing (VCD1), products developed through collaboration (VCD3), and resources relevant to the production of key products/services, other intangible resources (VCD7). These observable variables saturated value creation and delivery to the greatest extent.

Table 4 shows the factor loadings of the measurement model for value capture. Additional intercorrelations were added based on modification indexes at a threshold value of 4.0. Matching index values were CFI = 0.98, RMSEA = 0.05.

Table 4.*Factor loading values obtained in the value capture measurement model*

Observable variables		Construct	<i>f</i>
most of the revenue comes from the key customer (VC1)	<---	VC	1.47
most of the revenue comes from the key market industry (VC2)	<---	VC	0.11
there is revenue diversification (revenue from different business segments) (VC3)	<---	VC	0.05

VC – value capture.

The observable variable with the highest factor loading was most revenue from a key customer (VC1). This observable variable saturated the value capture to the greatest extent.

The results for the model in which value proposition, value creation, and value delivery were analyzed as predictors of value capture (Model 1) are shown in Table 5.

Table 5.*The values of the relationships difference test in the analyzed between small, medium, and large enterprises*

Differences	χ^2	<i>df</i>	<i>p</i>
factor loadings	61.69	48	0.089
regression coefficients	10.57	4.	0.032

 χ^2 – value of invariance test; *df* – number of degrees of freedom; *p* – statistical significance.

It was found that there were differences in the values of regression coefficients in the data obtained.

Table 6 shows the values of regression coefficients obtained for the relationship between latent variables in small, medium, and large enterprises.

Table 6.*Values of regression coefficients obtained for the relationship between latent variables in small, medium and large enterprises*

			Small enterprise	Medium enterprise	Large enterprise
VC	<---	VP	0.04	-0.01	-0.15
VC	<---	VCD	0.01	0.14	0.17

VP – value proposition, VCD – value creation and delivery, VC – value capture, **p* < 0.05.

No statistically significant relationships were found in any of the three compared groups of companies.

The results for the model in which value proposition was analyzed in the role of mediator of the relationship between value creation and delivery and value capture (Model 2) are presented in Table 7.

Table 7.*The values of the relationships difference test in the analyzed between small, medium, and large enterprises*

Differences	χ^2	<i>df</i>	<i>p</i>
factor loadings	60.04	40	0.022
regression coefficients	74.24	4.	0.003

 χ^2 – value of invariance test; *df* – number of degrees of freedom; *p* – statistical significance.

It was found that there were differences in the values of factor loadings in the obtained data.

Table 8 shows the factor loadings values obtained for small, medium and large enterprises. The factor loadings values obtained for the observable variables: we start new activities (VP1) and products/services are targeted at specific market industries (VP9) were higher for small businesses. The load value obtained for the observable variable company has regular/regular customers for products/services (VP5) was higher for medium-sized companies.

Table 8.

Values of regression coefficients obtained for the relationship between latent variables in small, medium and large enterprises

Observable variables		Construct	Small enterprise	Medium enterprise	Large enterprise
we enter into new types of business (VP1)	<---	VP	3.17	0.25	0.31
we enter into new industries and markets (VP2)	<---	VP	0.07	0.05	-0.15
we offer original products/services (VP3)	<---	VP	0.06	-0.38	-0.28
we systematically increase the number of products/services offered (VP4)	<---	VP	-0.03	0.06	0.45
the company has regular customers for products/services (VP5)	<---	VP	0.09	1.03	0.45
the company has a key customer/recipient (VP6)	<---	VP	-0.12	0.33	0.67
the company has regular suppliers of products/services (VP7)	<---	VP	-0.10	0.21	0.35
the company has a key product/service provider (VP8)	<---	VP	-0.07	0.22	0.30
products/services are targeted at specific market industries (VP9)	<---	VP	2.23	0.19	-0.28
products were developed under license (VCD1)	<---	VCD	0.84	0.86	0.50
the company provides around-product around-service services (VCD2)	<---	VCD	0.22	0.20	0.31
products were developed on the basis of cooperation (VCD3)	<---	VCD	0.46	0.60	0.40
the company obtains licenses, trademarks, copyrights from key suppliers (VCD4)	<---	VCD	0.58	0.45	0.45
the company obtains databases from key suppliers (VCD5)	<---	VCD	0.54	0.07	0.45
resources relevant to the production of key products/services – technological resources (VCD6)	<---	VCD	-0.30	-0.37	-0.25
resources relevant to the production of key products/services – other intangible resources (e.g., licenses, databases) (VCD7)	<---	VCD	0.49	0.53	0.46
most of the revenue comes from the key customer (VC1)	<---	VC	0.02	0.05	0.14
most of the revenue comes from the key industry (VC2)	<---	VC	0.02	-0.05	-0.10
there is revenue diversification (revenue from different business segments) (VC3)	<---	VC	2.35	2.03	1.99

VP – value proposition, VCD – value creation and delivery, VC – value capture.

There were also statistically significant differences between the data obtained for small, medium, and large enterprises in terms of the relationships between latent variables.

Table 9 shows the values of regression coefficients obtained for the relationships between the latent variables obtained for small, medium, and large enterprises.

Table 9.

Values of regression coefficients obtained for the relationship between latent variables in small, medium and large enterprises

			Small enterprise	Medium enterprise	Large enterprise
VP	<---	VCD	0.08*	-0.43	-0.44
VC	<---	VP	0.04	-0.14	-0.21

VP – value proposition, VCD – value creation and delivery, VC – value capture, *p < 0.05.

It was found that the positive relationship between value creation and delivery and value proposition occurred only in small companies.

5. Conclusions

It is worth noting that despite the turbulent market conditions and uncertainty in the corporate environment, and above all the pandemic during which this empirical research was conducted, there are companies that belong to the HGE group and are able to grow rapidly.

The empirical research we conducted allowed us to analyze value in business models considering three constructs: value proposition, value creation and delivery, and value capture. The analysis of the first construct, i.e. value proposition, indicates that under conditions of uncertainty it is important for companies to have regular customers for products/services and also a key customer/recipient. This is an expression of the company's stability in an uncertain market situation. Having both regular and key customers/recipients indicates the marketability of the products/services offered. It is also a signal for the company that there is a certain fixed percentage of sales revenue. The analysis of the second construct, i.e., value creation and delivery, made it possible to detail the resources relevant to the production of key products/services. Other intangible resources, i.e. databases and licenses, were identified as such resources. Access to these resources makes it possible to create and offer a value proposition to the customer, which is especially important for relatively young entities that need access to databases and operate under license. Cooperation is also important for these companies. Analysis of the third construct, i.e. value capture, also confirms what has already been noted for the value proposition construct. Sales revenue from a key customer factor has a clearly visible influence on this business model construct. In addition, we included a model by company size in our study. The construction of value propositions in small business models indicates the development of offerings by starting new activities while targeting specific market industries. On the other hand, when it comes to building a value proposition in the business models of medium-sized entities, the factor of regular buyers of products/services emerges. Research indicates that small businesses must operate dynamically in an uncertain environment, taking into account the relationships already developed with the customers for whom they provide value.

Empirical research in relation to theoretical constructs in business models divided into three size groups of businesses allowed us to notice that only in the case of small enterprises, the creation and delivery of value affect the value proposition. Exploration of business models of high-growth companies allows for a conclusion that building value in conditions of uncertainty should be based on stable foundations, which are regular customers and key customers, as well as well-proven products/services created under license.

References

1. Amit, R., Zott, C. (2001). Value Creation in E-Business. *Strategic Management Journal*, Vol. 22, Iss. 6- 7, pp. 493-520, <https://doi.org/10.1002/smj.187>.
2. Amit, R., Zott, C. (2012). Creating value through business model innovation. *MIT Sloan Management Review*, pp. 36-44.
3. Baden-Fuller, C., Mangematin, V. (2013). Business models, A challenging agenda. *Strategic Organization*, Vol. 11, Iss. 4, pp. 418-427, <https://doi.org/10.1177/1476127013510112>.
4. Barney, J.B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, Vol. 17, Iss. 1, pp. 99-120, <https://doi.org/10.1177/01492063910170010>.
5. Biloshapka, V., Osiyevskyy, O. (2018). Value creation mechanisms of business models, Proposition, targeting, appropriation, and delivery. *International Journal of Entrepreneurship and Innovation*, Vol. 19, Iss. 3, pp. 166-176, <https://doi.org/10.1177/1465750318782774>.
6. Bowen, N.K., Guo, S. (2011). *Structural equation modeling*. New York: Oxford University Press.
7. Brendzel-Skowera, K. (2021). Circular Economy Business Models in the SME Sector. *Sustainability*, Vol. 13, pp. 7059, <https://doi.org/10.3390/su13137059>.
8. Brzóska, J. (2018). Koncepcje tworzenia wartości a zmiany modeli biznesu. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, Vol. 121, pp. 41-59, <https://doi.org/10.29119/1641-3466.2018.121.3>.
9. Casadesus-Masanell, R., Ricart J.E. (2010). From Strategy to Business Models and onto Tactics. *Long Range Planning*, Vol. 43, Iss. 2-3, pp. 195-215, <https://doi.org/10.1016/j.lrp.2010.01.004>.
10. Chesbrough, H.W. (2007). Business model innovation, it's not just about technology anymore. *Strategy & Leadership*, Vol. 35, No 6, pp. 12-17, <https://doi.org/10.1108/10878570710833714>.
11. Coad, A. (2009). *The growth of firms, A survey of theories and empirical evidence*. Cheltenham, UK and Northampton, MA: Edward Elgar Publishing.

12. Coad, A., Karlsson, J. (2022). A field guide for gazelle hunters, Small, old firms are unlikely to become high-growth firms. *Journal of Business Venturing Insights*, Vol. 17, pp. e00286, <https://doi.org/10.1016/j.jbvi.2021.e00286>.
13. Daeyoung, K., Jaeyoung, K. (2015). Business Model Innovation through Value Delivery Differentiation, Multiple Case Studies. *Indian Journal of Science and Technology*, Vol. 8, No. 21, pp. 1-7, <https://doi.org/10.17485/ijst/2015/v8i21/78271>.
14. Delmar, F., Davidsson, P., Gartner, W.B. (2003). Arriving at the high-growth firm. *Journal of Business Venturing Insights*, Vol. 18, pp. 189-216, [https://doi.org/10.1016/S0883-9026\(02\)00080-0](https://doi.org/10.1016/S0883-9026(02)00080-0).
15. Demir, R., Wennberg, K., McKelvie, A. (2017). The Strategic Management of High-Growth Firms, A Review and Theoretical Conceptualization. *Long Range Planning*, Vol. 50, Iss. 4, pp. 431-456, <https://doi.org/10.1016/j.lrp.2016.09.004>.
16. Dyduch, W. (2021). Tworzenie i przechwytywanie wartości w przedsiębiorstwach w Polsce, ocena podejmowanych działań, identyfikacja kluczowych zmiennych oraz ich wpływ na efektywność. *Przegląd Organizacji*, No. 6, pp. 7-16. <https://doi.org/10.33141/po.2021.06.01>.
17. Falencikowski, T. (2013). *Spójność modeli biznesu. Koncepcja i pomiar*. Warszawa: CeDeWu.
18. Gomes, J.G.C., Okano, M.T., Guerra, R.S., Cordeiro, D.d.S., Santos, H.C.L.d., Fernandes, M.E. (2022). Analysis of Sustainable Business Models, Exploratory Study in Two Brazilian Logistics Companies. *Sustainability*, Vol. 14, pp. 694, <https://doi.org/10.3390/su14020694>.
19. Huemer, L., Wang, X. (2021). Resource bundles and value creation, An analytical framework. *Journal of Business Research*, Vol. 134, pp. 720-728, <https://doi.org/10.1016/j.jbusres.2021.06.018>.
20. Jabłoński, A., Jabłoński, M. (2021). Cykl życia wartości przedsiębiorstw wobec kondycji modelu biznesu. *Kwartalnik Nauk o Przedsiębiorstwie*, No. 29, pp. 57-63.
21. Kabalska, A. (2021). In Quest for the Ultimately Sustainable Business Model. *Zeszyty Naukowe Politechniki Częstochowskiej. Zarządzanie*, No. 43, pp. 32-42, <https://doi.org/10.17512/znpcz.2021.3.03>.
22. Knop, L., Brzóška, J. (2016). Rola innowacji w tworzeniu wartości przez modele biznesu. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, No. 99, pp. 213-232.
23. Lepak, D.P., Smith, K.G., Susan, T.M. (2007). Value Creation and Value Capture, A Multilevel Perspective. *Academy of Management Review*, Vol. 32, Iss. 1, pp. 180-194, <https://doi.org/10.5465/amr.2007.23464011>.
24. Loehlin, J.C., Beaujean, A.A. (2017). *Latent Variable Models: An Introduction to Factor, Path and Structural Equation Analysis*. New York-London: Routledge.
25. Magretta, J. (2002). Why Business Models Matter? *Harvard Business Review*, No. 80, pp. 1-8.

26. Minciu, M., Berar, F.A., Dobrea, R.C. (2020). New decision systems in the VUCA world. *Management & Marketing. Challenges for the Knowledge Society, Vol. 15*, pp. 236-254, <https://doi.org/10.2478/mmcks-2020-0015>.
27. Minerbo, C., Kleinaltenkamp, M., Brito, L.A.L. (2021). Unpacking value creation and capture in B2B relationships. *Industrial Marketing Management, Vol. 92*, pp. 163-177, <https://doi.org/10.1016/j.indmarman.2021.06.002>.
28. Monteiro, G. F. A. (2019). High-growth firms and scale-ups, a review and research agenda. *RAUSP Management Journal, Vol. 54*, pp. 96-111, <https://doi.org/10.1108/RAUSP-03-2018-0004>.
29. OECD (2010). *High-Growth Enterprises, What Governments Can Do to Make a Difference. Studies on SMEs and Entrepreneurship*. OECD Publishing.
30. Oliński, M. (2016). Tworzenie oraz przechwytywanie wartości w modelach biznesu – ujęcie relacyjne. *Przedsiębiorstwo we współczesnej gospodarce - teoria i praktyka, No. 4*, pp. 65-75, <https://doi.org/10.19253/rem.2016.04.005>.
31. Osterwalder, A., Pigneur, Y. (2010). *Business Model Generation, A Handbook for Visionaries, Game Changers, and Challengers*. Hoboken, NJ: John Wiley & Sons.
32. Otolá, I., Grabowska, M., Kozak, M. (2021). What Constitutes the Value in Business Model for Social Enterprises? *Polish Journal of Management Studies, Vol. 24, Iss. 2*, pp. 336-353, DOI, 10.17512/pjms.2021.24.2.21.
33. Otolá, I., Grabowska, M., Szajt, M. (2020). Value Composition for Business Models of High-Growth Enterprises. In: I. Otolá, M. Grabowska (Eds.), *Business Models, Innovation, Digital Transformation, and Analytics* (pp. 33-48). Boca Raton, FL: Taylor & Francis Group.
34. Richardson, J. (2008). The business model, an integrative framework for strategy execution. *Strategic Change, Vol. 17*, pp. 133-144, <https://doi.org/10.1002/jsc.821>.
35. Sirmon, D.G., Hitt, M.A., Ireland, R.D. (2007). Managing firm resource in dynamic environments to create value, Looking inside the black box. *Academy of Management Review, Vol. 32, Iss. 1*, pp. 273-292, <https://doi.org/10.5465/AMR.2007.23466005>.
36. Teece, D.J. (2010). Business models, business strategy and innovation. *Long Range Planning, Vol. 43*, pp. 172-194, <https://doi.org/10.1016/j.lrp.2009.07.003>.

DUAL STUDIES AS A RESPONSE FOR THE NEEDS OF THE CONTEMPORARY MARKET

Jadwiga GRABOWSKA

Silesian University of Technology, Faculty of Organization and Management, Department of Logistics;
jadwiga.grabowska@polsl.pl, ORCID: 0000-0001-6596-2217

Purpose: Dual studies, a modern educational programme combining conventional academic classes with professional work, they are enjoying a growing popularity among students and companies. Dual studies are an alternative form of obtaining employees by employers. Employers during the work placement they have the opportunity to offer to the students the internships and employment in their company. For the students it is a chance to gain the experience. The research presented in the article are referring to the dual studies at the Faculty of Organization and Management at the Silesian University of Technology in the field of Logistics 2nd rank. These studies began in February 2019 and it will take three terms. The purpose of the article is to answer for the questions if dual studies are the best answer for the requirements of the contemporary labor market and if dual studies are the optimal model of graduate education. The research will be conducted in 4 steps: after the 1st term and terminated work placement; after terminated internship; after the third term and after one year from the defense of the master's thesis.

Design/methodology/approach: In this article were used the interview and questionnaire method. Interviews and questionnaire were conducted with both students and companies where the practice and internships taken place.

Findings: Obtained results provide preliminary information regarding to the effects of the first term, usefulness of classes, use of the knowledge gained during the work placements and internships. The results of the research present the expectations of the employer towards graduates in scope to their competences: knowledge from the field which they are studying, and soft competences in the scope of teamwork or communication.

Originality/value: Dual studies are a new form of education, having a practical nature and combining the acquisition of knowledge and experience at the same time. Students are theoretically prepared, thanks to which they can find themselves in the industry in practice. Dual studies are a source of potential benefits for various groups of stakeholders (universities, employers, students). Dual studies are presented in the article as a form of development of entrepreneurial attitudes and professional competences of students (including social competences highly valued in the labor market). These studies are a great opportunity to prepare for the requirements posed by the labor market for each graduate.

Keywords: logistics, dual studies, modern educational model, trainings, market requirements.

Category of the paper: general review.

1. Introduction

Defining quality and quality assurance in the context of higher education presents significant challenges. The literature review confirms that there is no consensus on one definition of quality (Green, 1994; Schindler, 2015). The quality of education can be defined, inter alia, as the degree of meeting the requirements for the education process and its effects, formulated by stakeholders, taking into account internal and external conditions (Grudowski, Lewandowski, 2012). The growing pressure to deal with quality issues in higher education resulted in various national and international initiatives focused on developing recommendations and procedures for ensuring the quality of education (Hrnčiar, Madzík, 2013). The topic is becoming more and more topical, especially in the era of Industry 4.0. Graduates of universities not only must have the appropriate amount of knowledge, skills or competences, and they must be precisely matched to the needs of the market (Chmielecka, 2019). The issue of the quality and connection of education with practical requirements is one of the central topics of extensive discussion. The Constitution for Science emphasizes the need to improve the quality of education. Graduates leaving the university walls must be equipped with the skills and competences necessary on the labor market (Ostoj, 2016). One of the best methods of effective higher education is to involve the socio-economic environment in the process.

The Constitution for Science defines dual studies as a type of alternate education in which - apart from the university - also the employer participates¹. Undoubtedly, the aim of this study model is for students to reach another milestone in their studies. Part of the learning outcomes is achieved through the student's work in the company. So dual studies bring benefits to all parties. The student gains practical knowledge and experience, and the entrepreneur has a real influence on the development of the future employee (Bura, 2014). In this model, universities and companies become equal partners, aware of the responsibilities and benefits of dual studies for the science sector, employers, students and their contribution to the economic development of the region (Bielecka, 2019). Many reports on the employment needs of employers and competency requirements for the employees sought indicate the need, among others, of increasing work experience while studying². These studies are created in response to the reported demand by companies for the profile of a graduate of the studies. It is worth noting that dual studies have been practiced for a long time in Germany and the concept of these studies was also developed there (Deissinger, 1997). It is popular with students as it provides academic education as well as hands-on experience (www.mygermanuniversity.com/..., www.daad.de/..., www.alumniportal-deutschland.org/...). The advantages of dual studies go far beyond academic

¹ Constitution for Science - ACT of July 20, 2018 Law on Higher Education and Science.

² Including report "Who do the employers want to employ?" PARP 2012; Analysis of the demand for competences in the economy and the labor market along with the study of the target value of the joint long-term POWER indicator in the area of higher education, NCBIR 2019.

or practical relevance and include contractual relationships between companies and the students they employ over a period of time ([www.studying-in-germany.org/...](http://www.studying-in-germany.org/)). The aim of this article is to present the concept of dual studies in the field of Logistics of the second-cycle study as a form of combining higher education with the acquisition of professional experience, which prepares future graduates to smoothly enter the labor market and continue to effectively compete in the requirements declared by employers.

The subject of the research was to find answers to the questions whether dual studies are the best answer to the needs of the labor market and whether it is an optimal model for educating graduates. This article uses the interview method and the survey method. Interviews and surveys were conducted with both students and employers in enterprises where students undergo internships and internships. The study covered 26 students of dual studies and 6 representatives of enterprises participating in the implementation of dual studies.

2. Implementation of dual studies on the example of the faculty of organization and management of the Silesian University of Technology

The basic idea behind the creation of dual studies at the Faculty of Organization and Management at the Faculty of Logistics of the 2nd degree was to increase the competences of people participating in higher education, corresponding to the needs of the economy, labor market and society. The opportunity to achieve this plan was the launch of a competition for the creation of dual studies by the National Center for Research and Development (NCBR). The "Dual Studies" competition is another initiative of the National Center for Research and Development, which was aimed at increasing the competences of people participating in higher education. Its aim was to adapt the curricula to the expectations of future employees and their potential employers ([https://archiwum.ncbr.gov.pl/...](https://archiwum.ncbr.gov.pl/)).

The main objective of the proposed project was to improve the competences of students of the 2nd degree Logistics major, with broad practical skills, with the acquired specialist theoretical knowledge in the field of logistics³. Thus, increasing the competitiveness on the labor market, through the participation of students in dual studies in the field of alternate education in parallel in the form of didactic classes at the Faculty of Organization and Management and practical classes at employers from the transport - forwarding-logistics industry as well as in production and commercial enterprises, taking into account implementation of all learning outcomes provided for in the education program of a specific

³ The project lasted from July 2018 to September 2020. Dual studies in the field of Logistics of the second degree were carried out during three semesters. The first and third semesters were conducted at the university as part of didactic classes. The second semester was carried out as an internship in a company. Students acquired a total of 9 months of practical experience (as a 3-month internship from June to August 2019 and as a 6-month internship, carried out from September 2019 to February 2020). 26 people participated in the project.

field of study with a practical profile. Research on academic entrepreneurship conducted for over 10 years at the Silesian University of Technology shows that the awareness of graduates is growing that in the knowledge-based economy, intellectual resources determine the competitiveness of a region and even a country. On the other hand, intellectual property is treated as a scientific achievement without attaching importance to its market value. This attitude is undoubtedly changed by studies conducted in cooperation with the socio-economic environment. The more so that in the changing market realities, the Department of Organization and Management, on the basis of signed cooperation agreements and as part of the Faculty's Stakeholder Council, has been cooperating for several years in the field of improving production, logistics and organizational processes with enterprises. In addition, representatives of these companies are actively interested in the possibility of acquiring new ideas for the development of their activities as part of the internships and internships carried out, as well as in the employment of young, creative graduates of the Faculty. For this reason, the target group were students who, after completing dual studies in the field of Logistics, will have knowledge, skills and competences corresponding to the expectations of employers. As part of the studies, these students are to be prepared for professional work by achieving learning outcomes in the field of skills and social competences as a result of performing specific tasks in the work environment. This form of education is to enable the theoretical knowledge acquired at the university to be verified under working conditions at specific job positions in enterprises. The defined main goal of the project thus translates directly into the tasks that will be carried out within the entire project.

As part of the project, support was provided to a group of 26 people who met the formal criteria related to the recruitment procedure. The project was directed, on the one hand, to people who require professional activation, but on the other hand, who want to raise their qualifications by acquiring knowledge and skills to match the requirements of future employers. Detailed skills and competences have been defined within the framework of the candidate's profile, developed taking into account the requirements set by enterprises that are organizers of internships. The target group consisted of people who graduated from first-cycle studies, who were not participants of other studies or training financed by the ESF, currently not working professionally, not having the status of an unemployed person, not running their own business. The project was addressed to both women and men, respecting the principle of equal opportunities and gender, and taking into account people with disabilities (Report Women...). The choice of the target group resulted primarily from the requirements of employers from the logistics industry (including experience, IT competences, specialist knowledge and skills, higher education, the ability to solve problems independently), analysis of job advertisements and many reports, e.g. Labor market seen through the eyes employers (Kacprzak, Król, 2015; [www.parp.gov.pl/...](http://www.parp.gov.pl/)).

Graduates of the 1st degree engineering studies (with a logistic or related profile, e.g. transport, production engineering), choosing the 2nd degree studies, expect a strong adaptation of knowledge and skills to the needs of the labor market. In particular, the need for contact with the industry is emphasized, ensuring the acquisition of experience and broadening the practical skills of future graduates.

Recruitment for studies was carried out in accordance with the adopted rules and respecting the principle of equal opportunities, gender and taking into account disabled people. Due to the fact that the number of places for studies was limited - the person applying for admission had to have first-cycle qualifications and competences necessary to continue education in full-time second-cycle studies in Logistics. In order to carry out the recruitment process efficiently, regulations have been prepared, specifying the detailed requirements for candidates for studies and the procedure for conducting the recruitment process. The qualification procedure included two stages of the procedure, which were aimed at defining the competences of the candidates and allowed them to be adapted to the requirements of enterprises implementing internships. These include: the use of the prepared electronic application form with the questionnaire, interviews with the recruitment committee of the company organizing the internship. In order to enroll for studies, candidates are first asked to send their CV and cover letter to the e-mail address provided. Then the recruitment committee verified the applications - the condition of the title of engineer, then representatives of the internship company conducted recruitment interviews and selected appropriate candidates. After confirming admission to the company, candidates applied in the recruitment system to study at the Silesian University of Technology. The condition for admission to dual studies was a positive result from both stages of recruitment.

3. Dual education from student's perspective

Candidates pointed to the need to gain practical experience both in companies from the TSL industry as well as in production and trade companies in the area of planning, organizing and controlling material flows. The database of partner companies declaring their participation in the project undoubtedly provided such a wide spectrum of gaining skills and experience in logistics. Through dual studies, students were given the opportunity to improve their qualifications while carrying out logistic projects for profit, which was and is a response to the contemporary needs of many people undertaking second-cycle studies and is an excellent alternative to part-time studies. The candidates' expectations include, first of all, the availability of logistics, production and commercial companies declaring their willingness to accept students for paid internships and engaging them in specific logistic tasks, allowing them to gain experience and practical skills related to planning, organizing and controlling material flows.

Additional needs reported by students was the access to specialized computer laboratories, allowing for the simulation of logistic processes. Conducting the initial research among candidates for dual studies, they asked about the barriers that students may encounter while pursuing this type of studies. Among the most frequent responses it was noted:

- Barrier at the recruitment stage - it is necessary to pass an interview with one of the project partners' companies. The students were concerned as to whether they would pass the interview well enough to be able to complete an internship in a company of their choice.
- The second barrier was related to the limits of internship places in individual enterprises. Enterprises involved in the project declared their willingness to employ one or two people for an internship.
- Another barrier resulted from the different locations of partner companies. The companies joining the project were located in the Śląskie and Opolskie voivodships. This, in turn, was associated with mobility and availability.
- Students also showed uncertainty as to the connection of rigid requirements arising from the organization of the academic year, which do not facilitate the study together with internships in enterprises. The work of some companies (sending on business trips) could be difficult to reconcile with the academic calendar.
- Some students also indicated difficulties in communicating in a foreign technical language. There was an issue of insufficient knowledge of a foreign technical language.
- Another barrier to undertaking this type of studies was the necessity to give up the period of the inter-semester break (vacations) in favor of the internships and internships.
- Students also pointed out that dual studies may be too difficult to implement, due to the too high level of education for them (students), the spectrum of new subjects of a more practical than theoretical nature and the requirements for the verification of theoretical knowledge acquired during studies with the employer.

The needs and barriers were determined on the basis of a survey conducted among a group of 200 students of the last semester of the 1st degree of Logistics and Management and Production Engineering at the Faculty of Organization and Management. The results of these surveys were used to clarify (modify) both the study program, the internship program, invitations to cooperate with well-known companies from the industry, and to create an appropriate advertising offer encouraging students to undertake this type of study as an opportunity to gain academic knowledge with practical experience. It is worth noting that the guaranteed remuneration for the internship was a great motivator to undertake this type of studies. This remuneration was financed by the project. Additionally, enterprises offered students paid internships. Subsequent studies on the implementation of the course of studies were carried out after the first semester and practice. The students were asked the difficulties in implementing the first semester as well as the internship. The results of the questionnaires were

very optimistic, as all participants did not indicate any difficulties in implementing the study program and successfully completing the first semester. In the case of several students, the place of internship was changed and another company was selected for the internship. This change resulted from the student's willingness to change the type of enterprise (e.g. from production to transport) and to acquire other competences and skills.

The next questionnaire survey among students was conducted after the completion of the internship. Students had to answer, *inter alia*, to questions regarding the degree of mastering the ability to apply the knowledge acquired in solving specific practical problems, the degree of involvement in solving tasks/works/projects carried out in the enterprise, the scope of duties assigned to the intern, success in the implementation of projects during internships and a proposal to obtain further employment in an internship company⁴.

The results of the received questionnaires were very positive. Students emphasized that they had acquired knowledge about the workplace and its principles of operation, taking into account the practical aspects of the entity's operation in a given sector. They had the opportunity to see:

- with the management methods used in the enterprise, as well as the criteria for assessing the efficiency of the organization's functioning,
- with the implemented strategy,
- with methods of influencing customers,
- with order fulfillment processes,
- with group discussions on problem solving and involving trainees in solving them.

Students emphasized the possibility of acquiring practical skills in diagnosing and solving problems in a given area. They also emphasized the possibility of shaping practical skills of effective communication, negotiation and teamwork, as well as shaping specific professional skills related directly to the place of internship. Each of the students could receive the necessary information and materials to prepare their diploma thesis. Many students emphasized the fact that the implementation of the 3-month internship and the 6-month internship was a great challenge for them and they are glad that they managed to do it. Noteworthy is the extraordinary happiness that dual students had during the internships. The internships lasted until the end of February 2020, and there was a lock down in March.

The penultimate research was conducted after the defense of the thesis. They concerned, *inter alia*, the form of the written master's thesis - was it analytical or practical? and expressing an opinion on this type of studies and professional activity. Master's theses were analytical and practical in nature and solved a real problem that arose in the enterprise. All students expressed their satisfaction with the completion of this type of studies, and the completed studies with a "very good" degree prepared them to enter the labor market. They expressed the opinion that they would make the same choice again - that is, they would choose a dual mode of education.

⁴ Similar questions about the scope, method, form of internship and the type of tasks entrusted to students to be solved and the degree of acquiring new skills and competences were asked by trainees' supervisors in enterprises.

When it comes to professional activity, 92% of students were employed. The only drawback of the implementation of the study plan, which the students pointed to, was the lack of language classes during the second semester. 75% of the surveyed students assessed the acquired knowledge "very highly" during their studies. When it comes to the assessment of the acquired skills, over 70% of graduates assessed the acquired skills "highly" and "very high".

The last research was conducted three months after the end of education and concerned professional activity on the labor market. The results were very optimistic, because despite the pandemic that befell the graduates of dual studies, all people were professionally active (in internship or other companies). The change of the place of employment, as emphasized by the graduates even in the pandemic conditions, did not pose a major problem for them, because their professional experience was undoubtedly a great asset. The graduates emphasized in their statements that during the internship they learned the practical side of the knowledge acquired during their studies and expanded their knowledge of logistics in the enterprise and acquired practical skills as future specialists in the industry.

In summary, it can be written that the objectives of the project, and thus the objectives of the dual studies (which was to educate graduates of the Logistics of the 2nd degree, with broad practical skills, with the acquired specialist theoretical knowledge in the field of logistics, and thus increasing their competitiveness on the labor market) were achieved. Thanks to the implementation of dual studies, the competences of graduates were raised, corresponding to the needs of the economy, labor market and society.

4. Dual education from the perspective of employers

The need to create this form of studies, in addition to what has already been mentioned above, resulted from inquiries regarding the possibility of establishing dual studies at the Faculty of Organization and Management by companies cooperating with the Faculty. These enterprises willingly engaged in discussions on the plan and program of this type of study. In the process of creating the study plan, companies were asked to list the most important competences needed to work in a specific position. Three types of competences have been mentioned as the most important:

- self-organizing - related to skills such as: management, sometimes independence, decision-making and showing initiative, resistance to stress and willingness to work,
- professional - specific skills necessary to perform tasks appropriate for a given job position,
- interpersonal - the ability to contact people, be communicative, cooperate in a group, as well as solve interpersonal conflicts.

The developed plan and program of studies as well as the internship program took into account the possibility of acquiring these skills.

Like the students, the internship supervisors were also asked questions about the internship and the achievement of the learning outcomes by the students. During the interviews with the trainees' tutors, the following questions were asked, inter alia, o mastering the ability to apply the knowledge possessed by trainees in solving specific practical problems, establishing direct contacts with potential employers or educating trainees in the ability to identify emerging problems. In the opinion of the trainees' supervisors, the enterprises created appropriate conditions for deepening the knowledge acquired during the classes and confronting it with practice, they made it possible to develop skills and gain experience that contributed to the achievement of specific competences of the graduate. The vast majority of trainees broadened and deepened the knowledge acquired during their studies and developed the skillful use of it. Also, according to the tutors, the trainees had the opportunity to develop the skills necessary for their future professional work, including skills: analytical, organizational, teamwork, networking, negotiation, etc. According to the tutors, the trainees were well prepared for independent work and responsibility for the tasks entrusted to them, as well as for effective and ethically responsible activities in social and professional life. Thanks to the internships, students had the opportunity to shape personal and social competences, subjectivity and individual activity, and to develop the skills of cooperation and creativity in solving problems. It is worth emphasizing that 92% of interns found employment in enterprises where they carried out internships.

Representatives of partner enterprises emphasized that dual studies are a very good solution in the current market situation, because companies increasingly face the challenges of acquiring qualified employees with a technical profile. Such a system of education creates great opportunities and prospects for both students and employers. It will give young people the opportunity to acquire practical technical skills already during their studies and get to know the industrial sector closely, and employers the opportunity to train and acquire qualified employees in accordance with their needs. The justification for conducting dual studies for the second degree full-time studies is the fact that employers are looking for fully educated people with experience and specialist knowledge. During the interviews, employers were asked whether they were generally satisfied with the competences of their employees (interns). More than half of the employers were very satisfied with the skills of their employees. Those employers who were not completely satisfied with the competences of their employees or who admitted that it is still worth training them, were asked about "what missing skills and competences can be developed more in the current employees". As it turns out, according to employers, the most worthwhile is to raise those competences that were considered the most useful and, at the same time, missing for trainees: self-organizing, interpersonal, linguistic, computer.

5. Conclusive remarks

Dual studies are certainly a good form both for the development of entrepreneurial attitudes among students and their professional competences. Therefore, it is reasonable to launch this form of education at selected fields of study of universities in Poland. The dual study program allows for the acquisition of substantive and practical knowledge, which prepares participants to meet the growing requirements of employers. Studies give the opportunity to gain experience, knowledge and contacts, which in the future will certainly make it easier to find a suitable job. It can also be said that dual studies allow you to be an employee that all employers are looking for - a young person with higher education and many years of experience in the industry. Dual studies are an opportunity not only for students who will have the opportunity to combine the acquisition of academic knowledge with practical experience, but also for companies that will obtain staff perfectly prepared for their work. The recipe for success is to effectively combine learning with work, possible thanks to the implementation of alternate education programs, which assume the simultaneous participation of students in didactic classes at the university and their employment in the company. The result of such activities will be closer and closer cooperation between the sectors of science, business and administration, which will translate into the development of innovative areas of the national economy.

References

1. Bielecka, M. (2019). *Model studiów dualnych w Polsce po roku 2018 w: Studia dualne szansą na wdrażanie innowacji i rozwój gospodarki*. Lublin: Innovatio Press Wydawnictwo Naukowe Wyższej Szkoły Ekonomii i Innowacji w Lublinie.
2. Bura, A., Barańska, M., Cieślak, W. (2014). Dualny system kształcenia na przykładzie Politechniki Poznańskiej. *Logistyka*, 6.
3. Chmielecka, E, Kraśniewska, N. (ed.) (2019). *Edukacja dla przyszłości – jakość kształcenia*. Warszawa: Politechnika Warszawska.
4. Deissinger, T. (1997). The German dual system - a model for Europe? *Education + Training*, Vol. 39, No. 8, pp. 297-302. doi.org/10.1108/00400919710190090.
5. Green, D. (1994). *What Is Quality in Higher Education?* London: Society for Research into Higher Education, Ltd.
6. Grudowski, P., Lewandowski, K. (2012). Pojęcie jakości kształcenia i uwarunkowania jej kwantyfikacji w uczelniach wyższych. *Zarządzanie i Finanse*, 10(3), 394-403.

7. Hrnčiar, M., Madzik, P. (2013). Improving the Quality of Higher Education in Central Europe: Approach Based On GAP Analysis. *Higher Education Studies; Vol. 3, No. 4*, doi:10.5539/hes.v3n4p75.
8. Kacprzak, M., Król, A. (2015). Kapitał ludzki na rynku pracy. *Journal of Tourism and Regional Development, No. 4*.
9. Konstytucja dla Nauki – Ustawa z dnia 20 lipca 2018 r. Prawo o szkolnictwie wyższym i nauce, p. 36.
10. Ostoj, I. (2016). Studia dualne z perspektywy przyszłej tranzycji studentów kierunków ekonomicznych na rynek pracy. *Studia i Prace WNEIZ US, No. 44/3*, DOI: 10.18276/sip.2016.44/3-15.
11. Projekt Studia dualne na kierunku Logistyka II stopnia POWR.03.01.00-IP.08-00-DUO/18 projekt realizowany w latach 2018-2020. Kierownik projektu dr inż. Jadwiga Grabowska.
12. *Raport - Rynek pracy widziany oczami pracodawców* (2015). Warszawa, www.parp.gov.pl/component/publications/publication/rynek-pracy-widziany-oczami-pracodawcow.
13. Schindler, L., Puls-Elvidge, S., Welzant, H., Crawford, L. (2015). Definitions of Quality in Higher Education: A Synthesis of the Literature September 2015. *Higher Learning Research Communications, 5(3)*, 3. DOI: 10.18870/hlrc.v5i3.244.
14. www.archiwum.ncbr.gov.pl/o-centrum/aktualnosci/szczegoly-aktualnosci/news/studia-dualne-z-dofinansowaniem-od-ncbr-40533/, 15.09.2021.
15. www.daad.de/en/study-and-research-in-germany/plan-your-studies/dual-study-programmes/, 15.09.2021.
16. www.mygermanuniversity.com/articles/dual-study-programs-in-germany, 3.09.2021.
17. www.studying-in-germany.org/dual-studies-germany/, 3.09.2021.
18. www.welcome-center-germany.com/dual-studies-in-germany/, 3.09.2021.

DO NON-CASH PAYMENTS AFFECT ECONOMIC GROWTH? EMPIRICAL EVIDENCE FROM EU COUNTRIES

Marlena GRZELCZAK^{1*}, Michał SOLIWODA²

¹ Department Corporate Finance, Institute of Finance, University of Lodz;
marlena.grzelczak@eksoc.uni.lodz.pl, ORCID: 000-0002-3653-3920

² Department Corporate Finance, Institute of Finance, University of Lodz; michal.soliwoda@eksoc.uni.lodz.pl,
ORCID: 0000-0003-4207-4641

*Correspondence author

Purpose: to assess the impact of traditional forms of non-cash payments on economic growth measured by real GDP per capita in Central and Eastern Europe (CEE) and Western Europe.

Design/methodology/approach: the following research hypothesis was formulated: the impact of non-cash payments on economic growth is stronger in Central and Eastern European countries than in Western European countries. The research hypothesis was verified based on empirical analysis of panel data for the years 2005-2018 for the CEE and Western European countries. The following 10 CEECs participated in the research: Slovakia, Bulgaria, Poland, Czech Republic, Hungary, Romania, Lithuania, Latvia, Estonia, Slovenia and eight countries from Western Europe: France, Austria, Belgium, Germany, Netherlands, Luxembourg, Ireland, the United Kingdom.

Findings: in CEECs the value of transactions with payment cards had the largest impact on economic growth – an increase in the value of transactions using this payment instrument by one percentage point causes real GDP per capita increase by 0,23 percentage point. On the other hand, an increase in the value of transactions using credit transfers by one percentage point increased real GDP per capita by 0,10 percentage point. the direct debit transactions had a positive impact on the explained variable in the CEE countries – real GDP growth by 0,06 percentage point.

Research limitations/implications: The results of the empirical study, likewise in literature, indicated a significant, positive impact of non-cash payments on real GDP per capita growth. The impact on real GDP per capita is only effective for the CEE countries. In Western European countries the level of non-cash transactions reached a certain level of saturation. That was a proved by ineffective iterations performed on various functional forms of the econometric model on panel data. In the group of CEE countries, the value of transactions with payment cards has the greatest impact on real GDP per capita.

Originality/value: analysis of current literature on the impact of non-cash payments on economic growth and an empirical analysis.

Keywords: household financial management, non-cash turnover, economic growth, real GDP per capita, public management.

Category of the paper: Research paper.

1. Introduction

Cash and non-cash transactions are complementary elements of the payment system (Bank for International Settlements, 2003). Non-cash turnover is defined as cash settlements in which both sides – the debtor and the creditor have a bank account and no cash is used at any stage (NBP, 2008, p. 9). Paul and Friday (Paul, Friday, 2012, pp. 31-32) formulated a similar definition. Therefore, non-cash settlements may be treated as substitute for cash because since they play various functions of real money: value measure, accumulation, exchange, unit of account (Arnold, 2007, pp. 574-581).

New payment instruments because of technological and IT development are enabling noncash payments. Among the traditional payment instruments the following instruments may be distinguished: credit transfer, direct debit, checks, payment cards, and recently electronic payments are of increasing importance. Unlike traditional cash, non-cash payments may have many advantages. One of them is the reduction of thefts and other crimes associated with cash payments (Armeij et al., 2014, pp. 46-57). Furthermore, non-cash payments are treated as beneficial for counterparties. The various available forms of payment increase their income, which improves their operational efficiency and reduces operating costs (Alliance, 2003). Non-cash payments are considered hygienic for food sellers (Paul, Friday, 2012, pp. 31-36). Electronic payments are regarded as key factor in the growth of consumption, production, domestic product, and employment (Zandi et al., 2016, pp. 3-7).

The aim of the article is to assess the impact of traditional forms of non-cash payments on economic growth measured in real GDP per capita in the countries of Central and Eastern Europe (CEECs) and Western Europe. The following research hypothesis is formulated: *the impact of non-cash payments on economic growth is stronger in Central and Eastern European countries than in Western European countries.*

The study involved 10 CEE countries such as: Slovakia, Bulgaria, Poland, Czech Republic, Hungary, Romania, Lithuania, Latvia, Estonia, Slovenia and eight countries from Western Europe: France, Austria, Belgium, Germany, Netherlands, Luxembourg, Ireland, Great Britain. European Union (EU) countries were grouped according to the geographical classification of the United Nations (ONZ, 2019).

The study is structured as follows. In the first part, a review of the literature on the impact of non-cash turnover on economic growth is presented. In the second part, research hypotheses and the method of their verification are indicated. The third part contains the description of the research methodology, and the fourth one – the results of the empirical study on the example of European countries – the CEE and Western European countries. The paper ends with concluding remarks with recommendations.

2. Impact of non-cash turnover on economic growth – a literature review

The impact of non-cash payments on the economy may be analyzed from the perspective diffusion of innovation theory. This concept appeared in 1962 and was developed by Rogers (Rogers, 1995). In this context, the dissemination of non-cash payments should occur right where consumers seek improvement, convenience during transactions, and companies search for new profit opportunities. The consequences of diffusion in non-cash payments depend on how the society may be ready to quickly accept non-cash payments at various stages of the innovation process including knowledge of the existence of non-cash payments, belief in a positive attitude to non-cash payments, the decision to accept non-cash payments, implementation of non-cash payments and confirmation of accepting a non-cash payment on a basis of positive results.

The literature review based on including theoretical studies on the impact of cashless turnover on the economy, as well as the results of current empirical studies on this issue and numerous reports indicate the positive impact of cashless turnover on the economy. Among others, positive relations between non-cash payments and economic growth were noticed by I. Hasan, T. Renzis and De H. Schmiedel (Hasan et al., 2012, pp. 1-41). They examined the relationship between retail payments and general economic growth based on data from twenty-seven countries over the years 1995-2009. Their research results have shown that electronic retail payments (e-payments) stimulate overall economic growth, consumption, and trade (Hasan et al., 2012, pp. 21-22). Electronic payment may be defined as a payment that is initiated, executed, and received electronically (European Central Bank, 2010). E-payments made through payment cards maybe treateda distinctive feature of modern economics (Arai, 2004, pp. 1-24). The strongest impact on economic growth was observed in case of card payments and then in case of credit transfer and direct debit. Furthermore, research results indicated that checks had a small impact on economic growth as well as on consumption and trade. The hypothesis that the processes of harmonization and integration of retail markets have a positive impact on the development of trade and consumption – due to the creation of the payment-integration area (SEPA) – was positively verified. In addition, research shows that the impact of retail payments on economic growth was more evident in euro area countries than in countries that do not belong to the euro area.

Cirasino et al. noticed a beneficial effect of non-cash transactions on economic growth (Cirasino et al., 2008, pp. 1-78). They reckoned that's system simplified commercial transactions not only for consumers, but also for businesses, which had a significant impact on the economy. The main advantages of using non-cash payment methods were speed of transactions and security (Cirasino et al., 2008, p. 21).

The positive impact of non-cash payments on the economy was also noticed by O. Slozko and A. Pelo. In their research, they proved that there was a positive correlation between the growth of e-payments and the growth of GDP. They concluded that the use of non-cash payments was closely related to the level of economic development of a given country (Slozko, Pelo, 2014, pp. 130-140). On the one hand, a higher level of prosperity and financial system development in richer countries encourages cashless transactions, while on the other hand, non-cash payments contribute to economic acceleration. O.S. Oyewole, El-Maude, J. Gambo, M. Abba, and M.E. Onuh had a similar opinion on the previously mentioned issue. Moreover, they pointed out that only cash machines had a positive impact on economic growth, while other electronic payment channels had a negative impact (Oyewole et al., 2013, pp. 913-918).

H.H. Tee and H.B. Ong analyzed the effects of using non-cash payments such as: check, payment card, telegraphic transfer – payment via real-time or offline request and electronic money in five European Union countries: Austria, Belgium, France, Germany, and Portugal over the years 2000-2012 (Tee, Ong, 2016, pp. 1-9). They reached the conclusion that the impact of non-cash payments on economic growth, expressed by the relation of Gross Domestic Product to the Consumer Price Index (CPI) might only be observed in the longer period. This means that any policy that promotes non-cash payments does not have an immediate impact on the economy and works only over the longer term.

The latest results on the impact of cashless transactions on economic growth were published in the annual reports of the authors and analysts of the Moody's agency: V. Singh and M. Zandi (Zandi et al., 2016, pp. 1-31). Based on the research on the macroeconomic data of seventy countries in the world in 2011-2015, it was noted that retail payments contributed to the growth of trade and consumption, which in turn supports production and overall economic growth. In the analyzed sample it was pointed out that there was a positive correlation between the penetration and use of payment cards, and economic growth. The increasing use of electronic payments, including especially credit and prepaid debit cards, not only resulted in an increase in consumption by 0,2% in emerging markets and 0,14% in developed countries, but also an increase in GDP by 0,11% and 0,08% respectively, which corresponded to a total of USD 297 billion. The increased use of electronic payments makes the economy more efficient, reduces transaction costs and contributes to improving the flow of goods and services. As a result of the growing popularity of electronic payments, a general increase in employment in the entire seventy surveyed countries by 2,6 million was noticed during the period considered. The largest increases in jobs were recorded in China - an average of 427,000 new jobs a year and in India – 336,000. The empirical studies revealed that the development of electronic payments itself may not be enough to increase the welfare of the country. A developed financial system and a “healthy” economy are needed to ensure the economic and social welfare. With a view to promoting non-cash transactions, state authorities limit the regulations to the necessary minimum, favor the creation of developed financial infrastructure and support consumption growth were recommended. In addition, the adoption of an electronic

transaction had a significant meaning for the transparency of settlements between counterparties and encourages to reduce the fraud that accompanies transactions involving cash (Mieseigha, Ogbodo, 2013, pp. 11-16).

The research results presented above were based on the analysis of the impact of non-cash payments – mostly by cards – on the components of global demand. A slightly different approach in the analyzes of economic growth was applied by researchers – among others A. Jail or M. Idrees, who based their economic growth study on an analysis of supply and on transformations of the production function of Solow or Cobb-Douglas (Jalil, Idrees, 2013, pp. 383-388). They analyzed the scale of the impact of education and technical progress on the creation of national income in various economies.

Even though non-cash payments have a positive impact on business activities, it should also be remembered that they may also create several types of threats. Although technological progress has enabled improvement and innovation in the electronic payment system from a basic ATM card transaction through internet transfer, there are still current problems related to the security of users of these instruments. Phishing emails maybe treated as the part are just some of the shortcomings of non-cash payments (Oyewole et al., 2013). The risk of losing money weakened consumer confidence in making electronic payments. J. Park used economic data on 70 countries from the least developed Bangladesh to the developed United States over the years 2002-2004 proved that the development of non-cash payments contributed corruption, which reduces the quality of private investment, and that in turn leads to a reduction of economic growth (Park, 2012, pp. 907-929). C.N. Ezuwore-Obodoekwe, A.S. Eyisi, S.E. Emengini, A.F. Chukwubuzo discovered, on the example of Nigeria, that the transition from cash to non-cash forms of payment causes the loss of autonomy of that central bank (Ezuwore-Obodoekwe et al., 2014, pp. 30-42). If the central bank loses its ability to control money supply, then inflation in the economy increases (Al-laham, Altarawneh 2009, pp. 339-349). As a result, the central bank's monetary policy instruments become ineffective to control the interest rate and money supply. Moreover, they concluded that the promotion of electronic money significantly reduces the demand for central bank reserves reported by commercial banks, limits the ability of the central bank to control the money supply, increases the speed of money circulation, decreases international monetary control, and changes the money multiplier (Al-Laham et al., 2009, pp. 339-349). Until then, there is no unmistakable evidence of how the adoption of non-cash payments could affect the economy.

The Table 1 summarizes main findings from empirical studies on the impact on cashless payments on economic growth.

Table 1.

Review of current research on the impact on cashless payments on economic growth

Autor(s)	Main findings and/or conclusions
Zandi et al. (2013)	Cashless payments boost private consumption; the increase rise in consumption is found to contribute 0.17 percent to the GDP growth for a group of high-income countries.
Hasan et al. (2012)	A cash less transactions reduced costs connected to traditional paper-based transact thereby facilitating the operating costs for merchants. Subsequently operating costs would result in economies of scale among the merchants, leading to business expansion and greater level of investment in the economy, ineconomic growth.
Kearney, Schneider (2011, 2013)	Cashless transactions, may be beneficial for tax collection by the government and therefore more revenues may lead to an increase in government expenditures.
Hasan et al. (2012)	Electronic retail payments stimulate trade and consumption, resulting in higher economic growth in 27 European. Countries from to 2009. Growth enhancing effect for card payments was the strongest among different payment instruments. Cheque payments were found to have the least macroeconomic impact on growth due to the substitution effect with electronic cards.
Zandi et al. (2013)	That electronic card usage increased private consumption by 0.7 percent and subsequently leads to an increase in GDP growth by 0.17 percent per year across the 56 countries a future 1 percent increment in electronic card usage would result in generate an annual increase in consumption by 0.056 percent and subsequently improve growth by 0.032 percent.
Zandi et al. (2016)	Cashless payment had a positive impact on economic growth for a group of 70 countries from year 2011 to 2015.
Prabheesh, Rahman (2019)	Credit card affected consumption smoothing in Indonesia.

Source: own studies.

3. Research hypotheses and methodology

The panel data was analyzed for CEE and Western European countries and panel models were built using the ordinary least squares method. The original functional form of the model is consistent with that found in literature (Zandi et al., 2016, p. 14; Electronic Payments..., 2013, p. 50; Tee, Ong, 2016, p. 4):

$$realGDPpercapita_{it} = \alpha_1 + \beta_1 credit_transfer_{it} + \beta_2 direct_debits_{it} + \beta_3 card_payments_{it} + \beta_4 e_money_payments_{it} + vit$$

where:

$realGDPpercapita_{it}$ – explained variable, real GDP per capita in the country i and in the period t ,

α_1 – absolute term,

$credit_transfer_{it}$ – value of transactions via credit transfer in the country i and in period t ,

$direct_debits_{it}$ – value of transactions via direct debit in the country i and in period t ,

$card_payments_{it}$ – value of transactions using payment cards in the country i and in period t ,

$money_payments_{it}$ – value of electronic transactions in the country i and in period t ,

$\beta_1, \beta_2, \beta_3, \beta_4$ – structural parameters of the model,

v_{it} – total random error, consisting of a purely random part ε_{it} and the individual effect ui referring to a specific i unit of the panel ($v_{it} = \varepsilon_{it} + ui$) (Kufel, 2007, p. 164).

Statistics such as R^2 , residual standard error and residual sum of squares, F statistics, chi-square test and Hausman test were used to verify the models. Firstly, for each group of countries of the explained variable a general model was built that included all explanatory variables and then a detailed model that contained only explanatory variables that have a statistically significant impact on real GDP per capita.

The study used data for ten countries of Central and Eastern Europe¹ (112 observations) and for eight countries from Western Europe² (77 observations) in the years 2005-2018. The research includes a total of 189 observations. The variables used to verify research hypotheses are described in the Table 2 below.

Table 2.
Description of variables

Specification	Variable	Source	Description of variable
Explained variable	real GDP per capita	Eurostat, Database	real GDP, i.e., nominal GDP/GDP deflator per person (in euro)
Explanatory variables	credit_transfer	EBC Statistical Data Warehouse, SDW EBC	value of transactions via credit transfer (in million euro per one million inhabitants)
	direct_debits	EBC Statistical Data Warehouse, SDW EBC	value of transactions via direct debit (in million euro per one million inhabitants)
	cheques	EBC Statistical Data Warehouse, SDW EBC	value of transactions via checks (in million euro per one million inhabitants)
	card_payments	EBC Statistical Data Warehouse, SDW EBC	value of transactions using a payment card: debit, credit or charge of American Express or Diners (in million euro per one million inhabitants)
	e-money_payments	EBC Statistical Data Warehouse, SDW EBC	value of transactions using electronic money, where electronic money is monetary value stored on an electronic device: server or card (in million euro per one million inhabitants)

Source: own studies.

Real gross domestic product is calculated by dividing gross domestic product (GDP) by its consumer price index (CPI). Real GDP in 2005-2018 was obtained from Eurostat international financial statistics. Real GDP has been used as an indicator of economic growth (Apergis, Payne, 2010, p. 3; Slesman et al., 2015, pp. 214-226; Wang et al., 2016, Cevik et al., 2016, pp. 360-371; Conti, 2014, pp. 199-211). Data on the value of transactions using electronic transfer, direct debit, card payments, checks and electronic payments for 2005-2018 were collected from the European Central Bank, Statistical Data Warehouse.

¹ Slovakia, Bulgaria, Poland, Czech Republic, Hungary, Romania, Lithuania, Latvia, Estonia, Slovenia.

² France, Austria, Belgium, Germany, Netherlands, Luxembourg, Ireland, Great Britain.

4. Result of empirical research and discussion

Empirical analysis was begun by identifying mean, median, minimum, maximum, standard deviation, coefficient of variation and coefficient of skewness for selected variables, Table 3.

Table 3.
Statistical parameters of analyzed variables

Variable	Unit of measure	Mean	Median	Minimum	Maximum	Standard deviation	Coeff. of variation	Coeff. of skewness
Central and Eastern Europe								
credit_transfer	mln euro per one mln inhabitants	159 209,77	142 433,13	9 207,11	1 059 348,79	132 752,69	83,38	3,90
direct_debits	mln euro per one mln inhabitants	3 485,60	215,43	18,23	75 389,30	11 911,12	341,72	4,80
cheques	mln euro per one mln inhabitants	102,52	11,74	0,00	1 196,00	228,76	223,14	3,27
card_payments	mln euro per one mln inhabitants	1 240,79	954,63	50,46	4 843,25	971,71	78,31	1,05
e-money_payments	mln euro per one mln inhabitants	23,57	2,11	0,00	836,37	116,94	496,18	6,86
real GDP per capita	euro per one mln inhabitants	11 221,43	10 800,00	4 200,00	20 200,00	3 785,33	33,73	0,23
Western Europe								
credit_transfer	mln euro per one mln inhabitants	770 531,50	384 627,78	31 432,80	3 032 558,43	726 995,92	94,35	1,42
direct_debits	mln euro per one mln inhabitants	27 652,78	18 854,17	4 275,19	165 537,91	32 357,83	117,01	3,28
cheques	mln euro per one mln inhabitants	21 647,55	5 132,57	41,06	215 672,85	42 677,77	197,15	3,35
card_payments	mln euro per one mln inhabitants	6 594,47	5 757,60	1 771,56	17 973,07	3 681,14	55,82	1,24
e-money_payments	mln euro per one mln inhabitants	12 703,36	18,87	0,63	213 993,50	40 180,45	316,30	3,61
real GDP per capita	euro per capita	40 758,93	35 150,00	29 200,00	84 400,00	15 481,61	37,98	1,97

Source: own studies.

All selected variables for the countries of Central and Eastern Europe and Western Europe are characterized by right-side asymmetry. The highest value of transactions in both groups of countries was made using credit transfers, and the lowest by electronic payments and then checks. The average value of transactions using payment cards, likewise the value of transactions via direct debits, checks or electronic payments, was higher for Western European countries than for Central and Eastern European countries. Only the average value of transactions via credit transfers proved to be higher in the countries of Central and Eastern Europe (159.209,77 million per capita).

The level of correlation of the explained variable and explanatory variables was then verified and the correlation between the explanatory variables (Table 4).

Table 4.
Spearman's correlation coefficients

Variables	Credit_transfer	Direct_debits	Cheques	Card_payments	E-money_payment	Real GDP per capita
CEE countries						
Credit_transfer	1,000000	0,362893	-0,343030	0,448888	0,096235	0,479045
Direct_debits	0,362893	1,000000	-0,185376	0,720079	-0,273752	0,855875
Cheques	-0,343030	-0,185376	1,000000	-0,396216	-0,545034	-0,096099
Card_payments	0,448888	0,720079	-0,396216	1,000000	0,186414	0,797276
E-money_payments	0,096235	-0,273752	-0,545034	0,186414	1,000000	0,007644
Real GDP per capita	0,479045	0,855875	-0,096099	0,797276	0,007644	1,000000
Western European countries						
Credit_transfer	1,000000	0,004050	-0,294649	0,767132	0,892039	0,804357
Direct_debits	0,004050	1,000000	-0,148842	-0,422619	-0,098350	-0,179284
Cheques	-0,294649	-0,148842	1,000000	-0,027105	-0,173201	-0,223632
Card_payments	0,767132	-0,422619	-0,027105	1,000000	0,784736	0,731574
E-money_payments	0,892039	-0,098350	-0,173201	0,784736	1,000000	0,796813
Real GDP per capita	0,804357	-0,179284	-0,223632	0,731574	0,796813	1,000000

* Correlation coefficients marked in bold are relevant for $p < 0,05$.

Source: own studies.

The correlation of the explained variable and the explanatory variables is statistically significant for variables for the countries of Central and Eastern Europe: for the value of transactions using credit transfers, direct debits, and payment cards, while it was insignificant for payments using checks and electronic payments. However, in Western European countries, only payments using credit transfers, direct debits and electronic payments were statistically significant. Spearman's rank correlation coefficient calculated in the group of Central and Eastern European countries for real GDP per capita and transaction value using direct debit or using payment cards with an absolute value of 0,856 and 0,797 respectively, means rather strong linear relation between the analyzed features, because the higher absolute value of the coefficient, the stronger the linear relation, whereas a positive correlation indicates that an increase in one indicator leads to an increase in the other indicator. Similar conclusions might be drawn for the explanatory variables for Western European countries of the value of transactions using credit transfers, payment cards as well as electronic payments and the explained variable – real GDP per capita. In the group of CEE countries there is a strong positive correlation between the value of transactions using direct debit and the value of transactions using payment cards, a correlation coefficient of 0,72, and a significant correlation between the value of transactions using a credit transfer and the value of transactions using payment cards. Furthermore, it is observed that a decrease in the value of transactions using checks causes an increase in the value of transactions using payment cards. However, in the group of Western European countries it may be noticed that as the value of transactions via credit transfers and the value of electronic transactions increases, the value of transactions using payment cards also increases, a correlation coefficient of about 0,78.

Panel models for the CEE and Western European countries were built using the classical least squares method. For each group of countries for explained variable, a general model was presented which included all explanatory variables and a detailed model, which only contained

explanatory variables that had a statistically significant impact on economic growth. The results of estimation for the group of CEE countries are presented in Table 5.

Table 5.

Estimation results – Central and Eastern European countries

Panel LSM estimation using 112 observations						
10 cross-sectional data units included						
Dependent variable (Y:) $\ln(\text{realGDPpercapita})$						
Robust standard errors (robust HAC)						
	coefficient	standard error	z	p-value	relevance*	
const	7,48343	0,409121	18,29	9,68E-75	***	
$\ln(\text{credit_transfer})$	0,101218	0,021244	4,765	1,89E-06	***	
$\ln(\text{direct_debts})$	0,060277	0,005716	10,55	5,31E-26	***	
$\ln(\text{card_payments})$	0,230745	0,019817	11,64	2,47E-31	***	
$\ln(\text{realGDPpercapita}_{t-1})$	0,142319	0,031604	4,503	6,70E-06	***	
Arithmetic means of dependent variable 9,298177	Standard deviation of dependent variable	0,31871				
Residual sum of squares		2,333763	Residual standard error		0,147685	
R ² coefficient of determination: 0,793013		Adjusted R-squared			0,785276	
F (4,9) = 408,1133		p-value for F test:				F=3,66E-10
Logarithm of credibility = 57,85584		Akaike Information Criterion			-105,7117	
Schwarz Bayes criterion: -92,11918		Hannan–Quinn Information Criterion			-100,1968	
rho1 residual autocorrelation: -0,293537		Durbin-Watson statistic			2,259016	
Test for normal distribution of residuals		Null hypothesis: the random component has a normal distribution				
Test statistic: Chi-square (2) = 0,510184		z as p-value = 0,774845				

* Significant variable at a level of significance of 1%.

Source: own studies.

Due to different units of measurement, the dependent and independent variables have been transformed using the logarithm function. Considering the Akaike information criterion, the Schwarz Bayes criterion and the Hannan-Quinn criterion, the best estimated model takes the following form:

The estimated form of the model is as follows:

$$\ln(\text{realGDPpercapita}_{it}) = 7,48 + 0,10 \ln(\text{credit_transfer}_{it}) + 0,06 \ln(\text{direct_debts}_{it}) + 0,23 \ln(\text{card_payments}_{it}) + 0,14 \ln(\text{realGDPpercapita}_{it-1}) + V_{it}$$

Verification of significance of variables

Based on the Student's t statistics, statistical significance was verified for absolute term and for explanatory variables at the level of significance $\alpha = 0,01$. Considering that $p < \alpha = 0,01$, the hypothesis H₀ should be rejected and H₁ should be approved. With a probability of making a mistake of 0,01, the absolute term and explanatory variables: the value of transactions using credit transfers, the value of transactions via direct debit, the value of transactions using payment cards and real GDP per capita delayed are statistically significant. The parameters of the model obtained because of estimates have signs as expected.

The standard error of residuals is: 0,147785, which means that the real values of real GDP per capita deviate from theoretical values by an average of 0,148.79,30% variation was explained by the model. The adjusted coefficient of determination was at a similar level. The F test was also conducted, which determines the overall significance of all parameters, where statistical hypotheses were formulated:

H0: all parameters are irrelevant.

H1: at least one parameter is relevant.

P-value for test F = 3,66e-10. Since $p < \alpha$, it means that H0 should be rejected and H1 should be approved. The logarithm of credibility had a value of 57,85584. In order to verify a hypothesis, at the significance level $\alpha = 0,05$, about the lack of residual autocorrelation, the following hypotheses were formulated:

H0: $\rho = 0$ (no residual autocorrelation).

H1: $\rho < 0$ (negative residual autocorrelation occurs because r is < 0).

The Durbin-Watson test was conducted, and its value of test statistic is 2,259016.

DW test statistic for a 5% significance level was compared with the critical values for $n = 118$ and $k = 4$, where:

dL = 1,6303.

dU = 1,7702.

Because $d > d_u$ then we assume H0, there is no autocorrelation.

Moreover, standard errors resistant to autocorrelation and heteroscedasticity (HAC) were used. A normality of distribution test was also conducted - chi-squared compliance test (χ^2), where:

H0: distribution is a normal distribution.

H1: distribution is not normal.

The critical value of the test: χ^2 with a probability of $\alpha = 0,05$ is 5,99146.

Since the calculated value of the χ^2 test was 0,510, and therefore the condition: $\chi^2 < \chi^2_{0,05}$, where it should be stated that there is no reason to reject the null hypothesis.

A similar approach was used for Western European economies. The research was initially conducted on all variables, and then for variables that showed a correlation between real GDPs per capita, that is the value of transactions using credit transfers, payment cards and electronic payments. The numbers characterizing the sample results of panel estimations by the method of least squares were presented in Table 6.

Table 6.*Estimation results – Central and Western European countries*

Panel LSM estimation using 77 observations						
8 cross-sectional data units included						
Dependent variable (Y:) l_realGDPpercapita						
Robust standard errors (robust HAC)						
	coefficient	standard error	z	p-value	relevance	
Const	6,64785	1,38876	4,787	1,69E-06	***	
l_emoney_payments	0,041436	0,013946	2,971	0,003	***	
l_credit_transfer	0,153132	0,087417	1,752	0,0798	*	
l_card_payments	0,098722	0,035208	2,804	0,005	***	
l_realGDPperca~ 1	0,087999	0,034034	2,586	0,0097	***	
Arithmetic means of dependent variable 10,60424	Standard deviation of dependent variable 0,336437					
Residual sum of squares	2,13198		Residual standard error		0,172078	
R ² coefficient of determination: 0,752166			Adjusted R-squared		0,738397	
F (4, 7) = 888,6306			p-value for F test:		1,51E-09	
Logarithm of credibility: 28,83177			Akaike Information Criterion		-47,66355	
Schwarz Bayes criterion: -35,94452			Hannan–Quinn Information Criterion		-42,97604	
rho1 residual autocorrelation = 0,013433			Durbin-Watson statistic		1,908896	
Test for normal distribution of residuals						
Null hypothesis: the random component has a normal distribution						
Test statistic: Chi-square =	190,094					
z as p-value =	5,27E-42					

Source: own studies.

It was not possible to statistically estimate the correct model for the Western EU countries. The greatest drawback of each estimated model was the incorrect distribution of residues. The model adjustment to empirical data was about 70%. This may be explained by the fact that certain determinants affecting the development of real GDP per capita in the discussed group of countries were not included in the model.

To conclude, it may be stated that the specified factors for the group of CEE countries clearly explain the level of real GDP per capita.

The author's findings indicated a strong impact of payment card transactions in CEE countries real GDP per capita. The other payment instruments such as credit transfer and direct debit had a smaller impact on economic growth with regression coefficients of 0.10 and 0.06, respectively. The author's findings are consistent with I. Hasan et al (2012), O. Slozko and A. Pelo (2014), or Prabheesh and Rahman (2019), who highlighted the strong impact of electronic payments (which include payment cards) on economic growth.

While previous studies on the impact of non-cash forms of payment had referred to all countries in the European Union, our studies focus on division between Central and Eastern and Western European countries, which are characterised by a differentiated development of non-cash transactions.

5. Conclusion

Empirical analysis was begun by identifying mean, median, minimum, maximum, standard deviation, coefficient

An impact on real GDP per capita is effective only in case of CEE countries. While for the economies of the CEE countries non-cash turnover has a considerable influence, for Western European countries not necessarily. The lower use of non-cash forms of payment in CEE countries compared to Western European countries is related both to the delay in economic development, due to the need to undergo a system transformation process, and to cultural and social considerations. The strong disparity in the level of development of non-cash transactions and the lower use of individual instruments within the European Union constitutes a certain obstacle to the free movement of payment services within the Community.

In Western European countries the level of non-cash turnover reached a certain degree of saturation, which does not significantly translate into an increase in real GDP per capita. This is evidenced by the ineffective iterations performed on various functional forms of the econometric model on panel data. The hypothesis in the article that the impact of non-cash payments on economic growth is stronger in Central and Eastern European countries than in Western European countries has been positively verified. The model estimated for the CEE countries indicates that the impact of non-cash payments on economic growth measured in real GDP per capita is positive. The greatest influence on the explained variable has the value of transactions involving payment cards - an increase in the value of transactions using this payment instrument by one percentage point causes real GDP per capita increase by 0,23 percentage point. Moreover, the increase in the value of transactions via credit transfers by one percentage point increases real GDP per capita by 0,10 percentage point. It is also worth mentioning that transactions with direct debits have a positive impact on the explained variable in the CEE countries - real GDP growth by 0,06 percentage point. The explained variable as an explanatory variable has been delayed by one period, which is consistent with the research conducted so far that the effect of the impact of non-cash turnover on the economy requires time. It is worth pointing out that the explanatory variable – payments involving electronic money in the model for the CEE countries, proved statically insignificant.

In Western European countries the average real GDP per capita was found to be higher than in Central and Eastern European countries. The average value of transactions using credit transfers, direct debits, payment cards or electronic money also proved to be higher. Although the countries of Central and Eastern Europe have not yet reached the level of development of Western Europe, but they are making great progress – it is commonly said that what took 40 years in Western Europe, in CEE countries was realized in 10 years. Even though currently Central and Eastern Europe is developing faster compared to Western European countries, it is still perceived as less developed. Its advantage, however, is not a gradual but a step increase,

thanks to which it may quickly catch up with Western European countries. In the CEE countries, the changes are occurring much faster, which means that these countries are moving directly from the past towards the future quicker than Western European countries.

It relatively advantageous position of Poland's results from the openness of consumers to several types of innovations. In Western European countries contactless payments are just beginning to gain popularity thanks to the rapidly growing payment infrastructure. The estimated GDP reactivity because of the increase in the value of transactions with payment cards in the CEE countries is higher than in Western European countries, whilst the average level of the value of transactions was more than five times higher in the analyzed period. Western European countries have more established payment networks, more developed infrastructure – most traders accept cards. Cash payments are still common in the CEE. In more developed economies, where the use of cards has already reached a mature level, the use of cards is progressing at a slower rate. Indeed, the recession slowed down the growth of card use, the most strongly, however, among more developed countries, while among CEE economies it did not matter that much. That explains the fact that the CEE countries may have a greater impact on GDP by increasing the card penetration rate, and therefore - the increase in the value of card transactions. This may be achieved through the development of retail payment infrastructure to match the economies with a higher level of GDP – promoting payment mechanisms, enabling merchants to accept electronic payments.

The impact of accepting non-cash payments on economic growth may only be observed in the longer term. Therefore, activities promoting non-cash payments will not have an immediate impact on the economy. Furthermore, what is more, the impact of non-cash transactions on economic growth may vary depending on the form of making non-cash payments. Whilst the positive relationship is proven, its strength, which is difficult to determine, is not known. Various models used in current studies indicate the positive impact of non-cash turnover on economic growth. We are still exploring the issue, what determines the direction and strength of the impact of non-cash turnover on economic development in various countries. In this respect, the research results are ambiguous.

Following Raya and Vargas (2022), exploring fraud and tax evasion “in terms of the preference of cashless instruments over cash” would have a significant value added. Our empirical studies would include the study could cover a wider set of countries and a longer list of control variables.

Additionally, to convince the public of the positive outcomes of a cashless society, it would be interesting to explain the evolution of fraud and tax evasion in terms of the preference of cashless instruments over cash. Finally, the same study could be replicated in different countries from various stages of cash dominance. By observing the differences between them, we can analyse the determinants of becoming a cashless society of potential economies, a very present concern in international markets. However, this could only be possible in other developed economies where there is availability of data and good financial institutions.

References

1. Al-Laham, M., Al-Tarawneh, H., Abdallat, N. (2009). Development of Electronic Money and Its Impact on the Central Bank Role and Monetary Policy. *Issues in Informing Science and Information Technology*, Vol. 6, pp. 339-349, doi: 10.28945/1063.
2. Alliance, S.C. (2003). *Contactless payment and the retail point of sale: applications, technologies, and transaction models*. Retrieved from: https://www.securetechalliance.org/resources/lib/Contactless_Pmt_Report.pdf, 18.03.2016.
3. Apergis, N., Payne, J.E. (2010). Energy consumption and growth in South America: Evidence from a panel error correction model. *Energy Economics*, Vol. 32, Iss. 6, pp. 1421-1426.
4. Arai, K. (2004). Elimination of competitors: Some economics of payment card associations. *ISER Discussion Paper*, No. 612. Osaka: Osaka University, Institute of Social and Economic Research (ISER), pp. 1-24.
5. Arney, L.E., Lipow, J., Webb, N.J. (2014). The impact of electronic financial payments on crime. *Information Economics and Policy*, Vol. 29(C), pp. 46-57, Elsevier. doi: 10.1016/j.infoecopol.2014.10.002.
6. Arnold, W. (2007). E-Payment-Systeme: Geld für den elektronischen Markt. *Die Bank – Zeitschrift für Bankpolitik und Praxis*, No. 8, pp. 574-581.
7. Bank for International Settlements (2003). *A glossary of terms used in payment and settlement systems*. Retrieved from: http://www.bis.org/cpmi/glossary_030301.pdf, 27.12.2016.
8. Cevik, E.I., Dibooglu, S., Kenc, T. (2016) Financial stress and economic activity in some emerging Asian economies. *Research in International Business and Finance*, Vol. 36, pp. 127-139, doi: 10.1016/j.ribaf.2015.09.017.
9. Cirasino, M., Garcia, J.A. (2008) Measuring Payment System Development, Working Paper. *Financial Infrastructures Series*. Payment Systems Development Group, The World Bank, pp. 1-78.
10. Conti, M. (2014) The Introduction of the Euro and Economic Growth: Some Panel Data Evidence. *Journal of Applied Economics*, No. 17, 2, pp. 199-211, doi: 10.1016/S1514-0326(14)60009-X.
11. *Electronic Payments, E-Commerce, and Economic Activity: Theoretical Review and Evidence for Developed and Emerging Market Economies* (May 2013), Providencia, Santiago, Chile.
12. European Central Bank, Statistical Data Warehouse, SDW EBC. Retrieved from: <https://sdw.ecb.europa.eu/>, 1.03.2020.
13. Eurostat, Database. Retrieved from: <https://ec.europa.eu/eurostat/data/database>, 1.03.2020.

14. Ezuwore-Obodoekwe, C.N., Eyisi, A.S., Emengini, S.E., Chukwubuzo, A.F. (2014). A Critical Analysis of Cashless Banking Policy in Nigeria. *Journal of Business and Management, Vol. 16, Iss. 5, Ver. V*, pp. 30-42.
15. Hasan, I., De Renzis, T., Schmiedel, H. (2012). Retail payments and economic growth. Bank of Finland. *Research Discussion Paper, No. 19*, pp. 1-19.
16. Jalil, A., Idrees, M. (2013). Modeling the impact of education on the economic growth: Evidence from aggregated and disaggregated time series data of Pakistan. *Economic Modelling, Vol. 31(C)*, pp. 383-388, Elsevier doi: 10.1016/j.econmod.2012.11.035.
17. Kearney, A.T., Schneider, F. (2011). *The shadow economy in Europe*. Retrieved from: https://www.atkearney.de/documents/856314/1214702/BIP_The_Shadow_Economy_in_Europe.pdf/cd3277da-74c3-4a35-9ac4-97f7a0e93518, 16.06.2020.
18. Kearney, A.T., Schneider, F. (2013). *The shadow economy in Europe*. Retrieved from: <https://www.atkearney.com/documents/10192/1743816/The+Shadow+Economy+in+Europe+2013.pdf>, 16.06.2020.
19. Kufel, T. (2007). *Ekonometria. Rozwiązywanie problemów z wykorzystaniem programu GRETL*. Warszawa: PWN.
20. Mieseigha, E.G., Ogbodo, U.K. (2013). An empirical analysis of the benefits of cashless economy in Nigeria's economic development. *Journal of Finance and Accounting, Vol. 4, No. 17*, pp. 11-16.
21. NBP, Departament Systemu Płatniczego (2008). Grupa Robocza ds. Programu Rozwoju Obrotu Bezgotówkowego przy Koalicji na Rzecz Obrotu Bezgotówkowego i Mikropłatności. *Obrót bezgotówkowy. Zalety i korzyści wynikające z jego upowszechniani*. Warszawa.
22. ONZ (2019). Retrieved from: <https://unstats.un.org/unsd/methodology/m49/>, 20.09.2019.
23. Oyewole, O.S., Gambo El-Maude, J.G., Abba, M., Onuh, M.E. (2013). Electronic payment system and economic growth: A review of transition to cashless economy in Nigeria. *International Journal of Scientific Engineering and Technology, Vol. 2, Iss. 9*, pp. 913-918.
24. Park J. (2012). Corruption, soundness of the banking sector, and economic growth: A cross-country study. *Journal of International Money Finance, Vol. 31, Iss. 5*, pp. 907-929, doi: 10.1016/j.jimonfin.2011.07.007.
25. Paul, A., Friday, O. (2012). Nigeria's cashless economy: the imperatives. *International Journal of Management & Business Studies, No. 2*, pp. 31-36.
26. Pradhan, R.P., Mallik, G., Tapan, P.B. (2018). Information communication technology (ICT) infrastructure and economic growth: A causality evinced by cross-country panel data. *IIMB Management Review, No. 30*, pp. 91-103, doi: 10.1016/j.iimb.2018.01.001.
27. Raya, J.M., Vargas, C. (2022) How to become a cashless economy and what are the determinants of eliminating cash. *Journal of Applied Economics, Vol. 25, Iss. 1*, pp. 543-562, doi: 10.1080/15140326.2022.2052000.

28. Rogers, E.M. (1995). *Diffusion of innovations*. New York: The Free Press.
29. Slesman, L., Baharumshah, A.Z., Ra'ees, W. (2015) Institutional Infrastructure and Economic Growth in Member Countries of the Organization of Islamic Cooperation (OIC). *Economic Modelling*, No. 51, pp. 214-226, doi: 10.1016/j.econmod.2015.08.008.
30. Slozko, O., Pelo, A. (2014) The Electronic Payments as a Major Factor for Futher Economic Development. *Economics and Sociology*, Vol. 7, No. 3, pp. 130-140, doi: 10.14254/2071-789X.2014/7-3/10.
31. Tee, H.H., Ong, H.B. (2016). Cashless payment and economic growth. *Financial Innovation*, Vol. 2, Iss. 4, pp. 1-9. Heidelberg: Springer. doi: 10.1186/s40854-016-0023-z.
32. Wang, S., Li, Q., Fang, C., Zhou, C. (2016). The relationship between economic growth, energy consumption, and CO2 emissions: Empirical evidence from China. *Sci. Total Environ.*, Vol. 542, Part A, pp. 360-371, doi: 10.1016/j.scitotenv.2015.10.027.
33. Wong, T.L., Lau, W.Y., Yip, T.M. (2020). Cashless Payments and Economic Growth: Evidence from Selected OECD Countries. *Journal of Central Banking Theory and Practice*. Vol. 9, No. s1, pp. 189-213, doi: 10.2478/jcbtp-2020-0028.
34. Zandi, M., Koropecjy, S., Singh, V., Matsiras, P. (2016). *The Impact of Electronic Payments on Economic Growth*. Moodys Analytics. Retrieved from: <https://usa.visa.com/dam/VCOM/download/visa-everywhere/global-impact/impact-of-electronic-payments-on-economic-growth.pdf>, 10.01.2019.
35. Zandi, M., Singh, V., Irving, J. (2013). *The Impact of Electronic Payments on Economic Growth*. Retrieved from: <https://usa.visa.com/content/dam/VCOM/download/corporate/media/moodys-economy-white-paper-feb-2013.pdf>, 26.03.2019.

THE DEMAND FOR COMPETENCE AND QUALIFICATION OF MEDICAL PERSONNEL IN THE LIGHT OF THE RESULTS OF EMPIRICAL STUDIES

Marcin HABERLA

Wroclaw University of Economics and Business; marcin.haberla@ue.wroc.pl, ORCID: 0000-0003-0599-4182

Purpose: The article's primary purpose is to present issues related to the demand for competence and qualification of medical personnel. The specific goal is to identify gaps in healthcare professionals' qualifications and competencies and prepare recommendations/positions for system changes.

Design/methodology/approach: The author based his considerations on Polish and foreign literature on the subject, studying scientific articles and electronic sources. The author used the following professional databases to collect scientific literature: the Library of Science and Google Scholar. The author then performed qualitative (qualitative research – individual in-depth interview) and quantitative (statistical – online survey) analysis based on extracting as much knowledge as possible from the collected quantitative data. Qualitative research is a qualitative technique for obtaining data in which an interview is conducted based on a previously prepared interview scenario. The IDI technique makes it possible to get – in direct interaction with the respondent - data of a qualitative nature, which, although it does not allow (due to lack of representativeness) to generalize it to the entire population under study, provides in-depth information within the framework of a specific research question.

On the other hand, the statistical analysis made it possible to determine the extent to which a given phenomenon occurs, and then indicate the main trends observed in a specific area and environment. As part of the research, more than 1,000 CAWI interviews were conducted with owners of medical facilities (POZ), and medical and non-medical personnel.

Findings: The level of competence of healthcare workers concerns all citizens. The Polish education system is mainly oriented towards professional skills training. Social competencies are acquired by medical graduates only when they begin their professional work. On the other hand, employers require documents confirming professional qualifications when looking for employees. Increasing the competencies and qualifications of the staff of medical institutions will contribute to the continuous development of POZ. It will be the foundation of the entire, efficiently operating healthcare system. Therefore, special attention should be paid to management, finance, personnel development, and the comprehensiveness of care.

Social implications: The market for medical services is developing rapidly in Poland. According to a report by research firm PMR titled: „Private healthcare market in Poland 2022. Market analysis and development forecasts for 2022-2027" (EMIS, 2022), price increases are one of the main challenges for the private healthcare sector. According to PMR, for the whole of 2022, prices for outpatient and other health-related services will increase by about 14 percent compared to 2021, which will, on the one hand, affect the nominal increase in the value of this

market, but will also reduce its fundamental dynamics. On the other hand, the provision of primary healthcare services is carried out by various healthcare providers (entrepreneurs: individuals or legal entities, NGOs, SPZOZs) and professional practices (individuals and groups; doctors, nurses, or midwives). Among healthcare providers, entrepreneurs are the most numerous (83%). Providers contract with the National Health Service for a physician, nurse, and midwife care. According to the Human Capital Balance survey (PARP, 2022), medium and large enterprises continue to invest in developing their employees' competencies, despite the organizational and financial difficulties caused by the COVID-19 pandemic. Work-based learning has remained a widely used means of developing competencies, used particularly frequently in the education, healthcare and social assistance, and industry and mining sectors. Among the most critical problems in the health, the sector is the shortage of personnel, resulting from generational changes, an ineffective system of pre- and postgraduate education, changes in work styles, migration, obstruction of access to certain specialties by interest groups, and an insufficiently effective system of supporting deficit specialties (residencies). A shortage of doctors and nurses has been evident in Poland for years. According to Eurostat data, Poland has the lowest number of practicing physicians per 1,000 residents in the EU (2.4), and the number of nurses (5.1 per 1,000 residents) is also among the lowest in the EU (Figure 10). However, official national estimates are higher - between 3.4 and 4.4 doctors per 1,000 residents (Kowalska-Bobko et al., 2021).

Originality/value: The author addressed the article to health policy and legislation makers on the desired qualifications and competencies in the medical services labor market. Indirect recipients are market entrepreneurs involved in identifying and forecasting qualifications and professional needs in the labor market (Primary Healthcare (PHC) medical facilities - PHC owners, medical and non-medical staff). Parallel audiences are stakeholders involved in the formation of the qualification system of the healthcare sector, including institutions responsible for defining education standards and awarding titles, administrative units running education and qualification institutions, and formal education entities (universities, schools, training institutions). The article's value is to identify gaps in the competencies and qualifications of medical personnel to shape health policy so that these gaps are minimized.

Keywords: competencies, qualifications, healthcare system, medical personnel.

Category of the paper: Research paper.

1. Introduction

Poland's healthcare system has been evaluated negatively for many years, as indicated by periodic surveys. More than half of Poles are dissatisfied with how healthcare is functioning. In turn, just under 50% of those surveyed believe that problems with the availability and quality of benefits obtained through universal health insurance stem from too little spending on healthcare, and the amount allocated for this purpose being used inefficiently.

Poland has taken measures to improve access to healthcare services, primarily by increasing healthcare care expenditures. Contributing to the change in this state of affairs is the 2018 amendment to the law on publicly funded healthcare services, which introduces a gradual increase in healthcare spending, which is expected to reach 6 percent of GDP. There is now

a further increase planned to match 7 percent of GDP by 2027, as announced in the "Polish Deal" policy document. Despite attempts to reform the healthcare system in the 2015-2019 period, significant improvements in the availability of health services are still unnoticed. The shortfall is due not only to inadequate healthcare financing, but also to demographic processes (the inevitable aging of the population). In addition, growing staff shortages and aging healthcare personnel are noticeable. Growing inefficiencies have exacerbated problems in the primary healthcare sector and overextended the most expensive form of care, i.e., hospitalization (Ministry of Health, 2022). Significant imbalances characterize Poland's healthcare system in terms of service provision (infrastructure is mainly concentrated in the hospital sector), inadequate provision of outpatient care, diagnostics, and long-term care, and poor coordination of inpatient care with other types of care.

Poland still has an old and rigid division of healthcare professionals and social roles in care. Many new professions or skills are not described and require new knowledge and work organization. The system lacks intersecting-combining skills/competencies of certain groups of occupations, and undertake activities within the same organization. It is necessary to periodically monitor and modify the existing qualifications and competencies of medical and auxiliary personnel to the current conditions of the health sector. The increasing age of physicians (over 50) hinders the implementation of innovation primarily related to electronic medical records (e-health), and technological, and IT exclusion is a common reason for retirement.

In Polish literature, the concepts of qualification or competence are often used interchangeably, even though the scopes of the two concepts differ to a large extent. In a nutshell, qualifications are entitlements to perform professional tasks; as a rule, they are formal; they can be in the form of school diplomas, qualification courses, certificates, authorizations, and so on. On the other hand, competencies are the knowledge, skills, and attitudes that make it possible to perform tasks in a given field and carry out professional activities.

Also, the emergence of human capital theory contributed to the spread of concepts such as qualifications and competencies, which are indirectly reflected in the text of T.W. Schulz (1987) and J. Orczyk (2009):

- human capital is individual in nature, meaning that it cannot be sold or given to another person; consequently, it is tied to a person regardless of where that person is located,
- the benefits from the use of capital are received personally by the specific individual who owns it, and the life span of human capital does not exceed the life span of the individual,
- the acquisition of human capital is considered to be an investment in oneself, primarily the sacrifice of one's own time and other resources,

- the most effective due to the extension of the period of its use, as well as the lower economic value of time in the years of youth (then you receive a lower salary, and the efficiency of education is also usually higher) is the acquisition of human capital at a younger age is
- human capital is subject to devaluation like other forms of capital.

Matching the competencies and qualifications of potential and current employees with real needs is becoming one of the critical problems of the modern labor market.

2. The concept of competence and qualification

The term "competence" is closely related to the Latin word "competentia," which means "has the right to judge" or "has the right to speak" (Caupin et al., 2006). The term was of great interest to psychologists in the first half of the 20th century, as reflected in a large amount of empirical research in psychology (Shippmann et al., 2000). In contrast, it wasn't until the 1970s that David C. McClelland, a professor of psychology at Harvard University, published a study titled "Testing for Competence Rather Than for Intelligence", which led to widespread application in human resource management (HRM), among other fields.

As J. Orczyk (2009) notes, initially, competencies were formal, indicating the scope of authority to make decisions, to perform specific tasks (Butkiewicz, 1995). Their implementation was often linked to a particular procedure.

Generalizing, competence can be defined as the broadly understood ability to take specific actions, which is conditioned to a large extent by the knowledge, skills, and social competencies acquired in the process of learning (i.e., specific learning outcomes). Thus, competence is more than just a smaller, more extensive set of learning outcomes, because a person's competencies also consist of already acquired experience, predispositions, and aptitudes (Slawinski, 2017).

Commonly, competencies are divided into hard and soft competencies, i.e., professional and psychosocial competencies. However, the Future Competencies Observatory Team proposed a division into three interdependent competency areas according to the typology used by the European Center for the Development of Vocational Training (CEDEFOP) competencies consist of (Strojny et al., 2021):

- cognitive competencies, i.e., theoretical knowledge related to a given professional specialty,
- functional competencies, i.e., practical skills related to a given professional specialty, necessary for the performance of tasks,
- social competence, i.e., attitudes and behavior in interactions and the ability to assimilate knowledge, acquire new competencies, and self-development.

The definition of social competence is defined in the Law of December 22, 2015, on the Integrated Qualification System (Ministry of Education and Science, 2022): (...) *the abilities developed in the course of learning to shape one's development and to participate autonomously and responsibly in professional and social life, taking into account the ethical context of one's conduct.*

On the other hand, S. Slawinski (2017) believes that *in the perspective of personal development and professional career, the so-called key competencies are of great importance. Their importance for success in life is emphasized in the Recommendation of the European Parliament and of the Council of December 18, 2006, on key competencies for lifelong learning. The recommendation lists eight key competencies: communication in the mother tongue, communication in foreign languages, mathematical and basic scientific and technical competence, digital competence, learning to learn, social and civic competence, initiative and entrepreneurship, and cultural awareness and expression.*

Similar to social competencies, qualifications are also defined in the Law of December 22, 2015, on the Integrated Qualifications System. According to the Act, *a qualification is a set of learning outcomes in terms of knowledge, skills and social competencies, acquired in formal education, non-formal education or through informal learning, by the requirements established for a given qualification, the achievement of which has been verified in validation and formally confirmed by an authorized certifier.* In addition, the law categorizes different types/categories of qualifications (Table 1). It is also worth noting that the discrepancy between the colloquial meaning of the word qualifications and its statutory definition is because, according to the Act on the ZSK, qualifications will be, among others, a certificate of completion of elementary school, a certificate of completion of junior high school and a high school diploma. In contrast, in the tradition, certificates of this kind were not associated with qualifications by anyone.

Table 1.
Categories of qualifications

Qualifications	Definition	Example
Full qualification	Qualifications that are awarded exclusively within the educational system upon completion of specific stages of education, as well as first, second-, and third-level qualifications within the meaning of the Act of July 27, 2005. - Law on Higher Education. (Article 2, item 10 of the Act on the ZSK)	<ul style="list-style-type: none"> • Completed elementary school • Completed high school • With passed high school diploma • Bachelor's degree • Master's degree
Partial qualifications (regulated, awarded in the educational and higher education system, from the field of crafts, marketable)	qualifications established by separate regulations, the awarding of which is carried out under the rules outlined in those regulations, excluding qualifications awarded in the educational and higher education systems. (Article 2, item 12 of the Act on the ZSK)	<ul style="list-style-type: none"> • Driver's license cat. A, B, etc. • Operator's license • of machinery and working equipment • Ex: backhoe loaders, loaders, road rollers • Authorizations of the Office of Technical Inspection, e.g.: Lift trucks, HDS, overhead cranes

Cont. table 1.

Partial qualifications regulated	established by law, awarded outside the education and higher education systems. They are necessary from the point of view of the labor market to complement the more basic qualifications acquired in the educational and higher education systems. The requirements for learning outcomes required for regulated qualifications are related to defined types of activities	<ul style="list-style-type: none"> • Driver's license cat. A, B, etc.
Partial qualifications awarded in the education and higher education system	Partial qualifications awarded in the educational system include, among others, qualifications in a profession (confirmed by a certificate) obtained as part of post-secondary schools, and higher education - qualifications awarded after completing postgraduate studies	<ul style="list-style-type: none"> • Licenses of the operator of machinery and working equipment Ex: backhoe loaders, loaders, road rollers
Sub-qualifications from the crafts area	Qualifications confirmed by a journeyman's certificate or master's diploma after their inclusion in the MCC	<ul style="list-style-type: none"> • Gunsmith - master certificate • Gunsmith - journeyman's certificate • Eyeglass optician - master certificate • Eyeglass optician - journeyman certificate
Market sub-qualifications	Qualifications not regulated by law, the granting of which is carried out based on freedom of economic activity	<ul style="list-style-type: none"> • Implementing and coordinating business processes (Lean Office) • Conducting mediation in criminal and misdemeanor cases

Source: own compilation based on: Law of December 22, 2015, on the Integrated Qualifications System.

The types of qualifications operating in Poland, as presented in the table above, make it possible to successfully develop one's career path also outside the formal education system.

Poland has a rich heritage and long tradition in the field of qualifications. Currently, qualifications are awarded within and outside the education and higher education systems. For example, in education, in addition to certificates of completion from various public schools, one can obtain certificates confirming qualification in a profession and different kinds of diplomas confirming professional qualifications. In higher education, on the other hand, examples of qualifications obtained include certificates of completion of first- or second-level studies (bachelor's or master's degree) (Slawinski, 2017).

3. Rationale and methodology of the study

Negative phenomena in the labor market make it a primary and keptizens' employability, i.e., the ability to g and keep a job that satisfies them, and the opportunity for career development. The goal is to make the most of one's qualifications and competence potential, not just to find a job. These types of phenomena also occur in the health sector. With that said,

competencies and qualifications should increase the value. This study aimed quality of services provided.

This study aims to increase knowledge of qualifications and professional needs in the healthcare industry in the sphere of Primary Healthcare (hereafter PHC) entities, and to align the education system with the requirements of employers and the market. The analysis provided knowledge of the competence and critical qualification gaps of medical personnel employed in the healthcare system.

The author used the desk research method. The desk research analysis technique consisted of collecting and analyzing secondary data that already existed and had been prepared by others. Thus, they were not produced by the researcher and did not require fieldwork and, hence the presence of interviewers or moderators. It was an analysis of information obtained from publicly available sources that already existed, requiring only the consolidation and or The collected material was checked for quality and reliability in the first stages of the analysis material was checked for quality and reliability. Only after selecting reliable data was the actual desk research analysis carried out. Among the main advantages of Desk Research are easy to access to materials, the abandonment of t the consequent reduction of survey time, and subsequent reduction of survey time, as well as the relatively low cost due to the lack of need to hire people to collect data. Among the main disadvantages of this motor is that it only allows the use of available data, which is not always sufficient to answer all the research questions posed. For this reason, it serves more often as a supplement to the data collection and exploration of research questions. It is usually combined with other techniques to collect all the necessary research material. In this case, the phased approach to the desk research analysis technique limited the time commitment to analyzing documents and data, which were very often characterized by a large volume. In practice, only selected parts of the paper were helpful to the study's objectives.

The next stage of the research was qualitative research (individual in-depth interview - IDI), which, unlike the questionnaire interview, allowed dynamic modification of the shape of the scenario depending on the specifics of the respondent's nature of the answers given by them, or the introduction of threads into the conversation that wasn't taken into account at the stage of designing the interview scenario. This significantly reduced the risk of omission during the interview of issues the respondent's point of view of the respondent, the specifics of the situation of the organization they represented, etc.

The final stage of the primary research was quantitative research (CAWI online interview). The CAWI technique, in this case, consisted of the respondent filling out an online version of the questionnaire himself, which was provided to him in the form of an online link, redirecting him to the prepared questions. The respondent answered the questions one by one, and the correctness of the completion was supervised by software. After answering all the questions, the data were sent to the database immediately in coded form.

The territorial scope of the survey covered the entire country, divided into 16 provinces. In each province, the survey covered the following:

- Regional associations of health employers.
- Medical establishments are operating in a given province.

Thanks to this, the results received a diversified sample in terms of the place of activity/function of medical establishments, which contributed to increasing the representativeness of the results of the conducted analysis.

Participants in the study included:

- representatives of the Federation of Health Employers,
- representatives of Regional Associations of Health Employers,
- owners of medical establishments (POZ),
- medical and non-medical staff.

4. Qualitative and quantitative research conclusions

According to qualitative research, employers consider such competencies as the communication skills of a particular doctor or nurse, and their approach to the patient when hiring employees. Also essential is teamwork in adapting to the work environment and problem-solving, significant experience, willingness for prudent development, and, increasingly, knowledge of a foreign language. It is crucial in the case of a registrar or medical assistant that such a person has a university degree, also related to medicine. For nurses, it is essential to have a community and family nursing course, school nursing with qualifications, an ECG course, a spirometry course, and a vaccination course. The study strongly emphasized that there are difficulties in finding well-qualified medical regist. These medical assistants would be prepared not only in soft skills/competencies, but also in triage, among others.

On the other hand, when it comes to the demand for professional qualifications of medical personnel, additional capabilities such as specialization in family medicine, permission to perform immunizations, and computer skills are essential. There were also opinions that in the case of physicians, especially their shortage in the labor market, specialization and license to practice are sufficient. In the survey, respondents also noted the high community demand and school nurses with extensive work experience.

Summarizing the findings on demand for competencies of medical personnel, it can be concluded that:

- among the most sought-after competencies is the ability to communicate with patients and build lasting relationships with them. This will help build trust in family medicine doctors with patients in the future, employers see high ambition and willingness to developers as one of the qualities that can indicate that an employee is determined to improve their qualifications and do their job better;
- in some of the surveyed establishments, the importance of competence plays a secondary role, because there is such a large generation gap and shortages in the labor market that professional qualifications are becoming the most important;
- for those working in registration, patience, and forbearance towards the patient are very important;
- assertiveness is also gaining importance, as patients have an increasingly demanding attitude and try to force many services that are not justified;
- over the next 3-5 years, as now, soft competencies, behavior towards the patient, and reacting in difficult situations in contact with the patient will gain in importance;
- leading competencies will be communicated, assertiveness, and empathy of both medical and nursing staff.

Also during the quantitative survey, respondents were asked to provide answers regarding the need for competencies and qualifications of medical personnel. Respondents were asked what types of skills/competencies they did not have or did not have sufficiently that they needed support. Respondents indicated:

- IT skills, in terms of working with computers (63.38%),
- responsibility and resistance to stress (49.24%),
- foreign language skills (46.56%),
- skills in operating internal information systems (44.26%),
- use of modern means of information and communication (42.07%),
- readiness to expand and supplement acquired knowledge and skills (41.68%).

Respondents indicated such skills as handling a patient/customer with a claim, being rude, aggressive, stress-resistant, and assertiresistantonse to others. The data is presented in Table 2.

Table 2.
Type of skills/competencies that require training support

Answer	%	Number
social competence (sensitivity, respect for others)	40,25%	421
cooperation skills	45,22%	473
communication skills and ease of establishing contacts	46,18%	483
technical skills	28,11%	294
IT skills, in terms of working with computers	63,38%	663

Cont. table 2.

Skills in operating internal information systems	44,26%	463
customer service skills	32,79%	343
knowledge of foreign languages	46,56%	487
openness to changes and innovations	38,05%	398
readiness to expand and supplement the acquired knowledge and skills	41,68%	436
guided by the principles of ethics in the implementation of professional tasks	15,77%	165
creativity	27,82%	291
personal culture and interpersonal skills	28,49%	298
responsibility and resistance to stress	49,24%	515
use of modern means of information and communication	42,07%	440
ability to cooperate in the implementation of projects	21,22%	222
other, what	1,91%	20
do not know	1,53%	16

Source: own elaboration based on quantitative research.

Respondents were also asked the question of the impact of lack of skills/competence on the quality of services provided. In their opinion, the lack of skills/competencies affects the quality of services provided by:

- poor work organization (67%),
- failure to inform the patient (58%),
- lack of satisfaction with the visit (49%),
- longer waiting time for an appointment (46%),
- poor assessment of the patient's health (18%).

In response to others, respondents indicated: staff frustration, doctor absenteeism, lack of job satisfaction, and professional burnout. The data is presented in Figure 1.

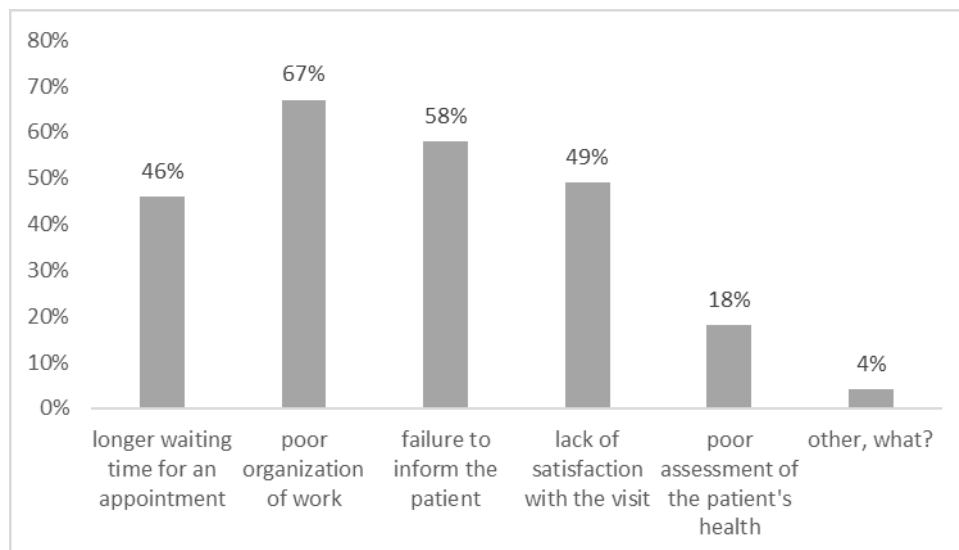


Figure 1. Impact of lack of skills/competence on quality of services provided.

Source: own elaboration based on quantitative research.

Respondents were also asked whether the number of forms of training offered on the market and their topics were sufficient. More than half of the respondents (53%) believe that the number of training forms provided on the market and their issues is insufficient. 35% of respondents take the opposite view. In addition, 51% of respondents thought there were barriers

to accessing forms of education. These relate to lack of time, lack of funding, and lack of staff (no one to replace the employee).

In the next part of the survey, respondents were asked about the most standard forms/mode of qualification improvement. In their opinion, the most common forms/modes of qualification upgrading include:

- group workshops (56%),
- professional courses (52%),
- online classes (46%),
- individual training (39%),
- postgraduate studies (18%),
- studies (7%).

In response to others, respondents indicated: conferences, reading medical work, recurrent training, post-secondary schools, online courses, webinars, short online lectures of a few minutes (if possible), training in small groups, and close to home/work. The data is presented in Figure 2.

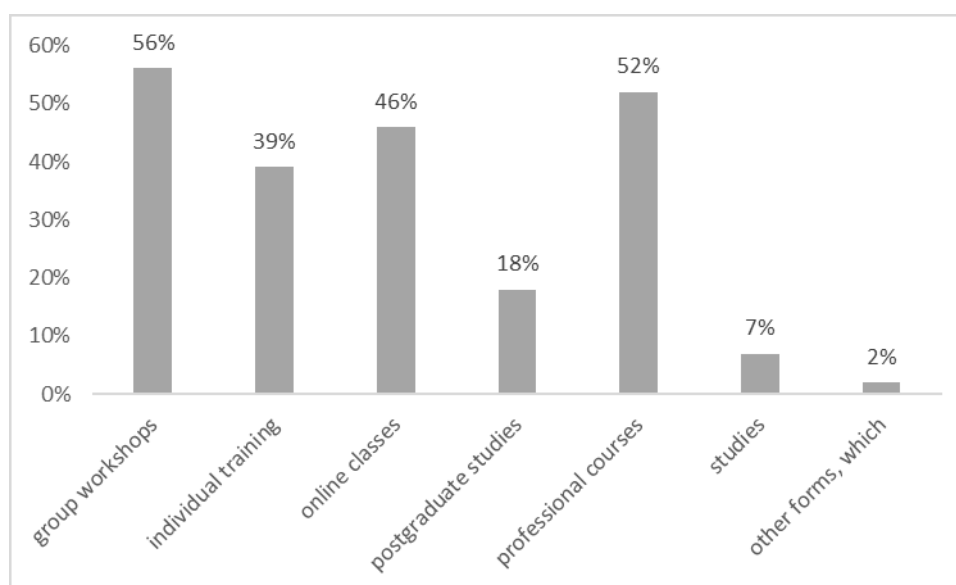


Figure 2. Most expected form/mode of qualification improvement.

Source: own elaboration based on quantitative research.

5. Conclusions and recommendations

Healthcare financing in Poland is at one of the lowest levels in Europe. In 2020, Poland spent 4.8% of its GDP on healthcare (with year-on-year growth of 7.3% in GDP alone), which puts us at the gray end. Other countries spent proportionally: Lithuania and Latvia: 5.2% each, Estonia 5.1%, Belgium 8.8%, France 10%, Germany 11.2%. From this, it follows that any effort to increase healthcare spending is essential.

Interest in medical education has been at a similar level for many years. Still, one should not forget about the candidate base that can start training yearly (number of high school graduates + about 10% of candidates from previous years). With the number of candidates relatively constant for Poland and the number of universities authorized to educate in the medical field increasing, individually for the universities, a decrease in the number of candidates may be recorded (and this is happening). This is fostered by an irrational and rigged recruitment system that simultaneously adds up the number of candidates at all universities without considering that candidates apply for admission at several or even a dozen universities. Being admitted to one of them, they drop out of the next ones, creating a vacancy.

In light of the research, a significant change would be the introduction of mandatory training for the POZ team and management in communication, conflict resolution, assertiveness, stress management, professional burnout, and emotion management. It is equally important to improve teamwork, cultural competence, IT skills (including remote working), and digital cyber security competencies. Upgrading skills is part of the idea of lifelong learning. In this aspect, it is of utmost importance that it is the legislator/organizer of the healthcare system that should take care of the possibility of improving these competencies and qualifications, creating appropriate conditions (time-wise) for cadres to participate in training.

In addition to identifying funding sources, it would be necessary to develop a system for monitoring this obligation, accreditation for training institutions, validation of results, and a method for supporting alternative work organizations. This refers to the organization of substitution of a doctor or other employee at work while they are participating in the mandatory training, especially in small medical entities and professional practices (e.g., one doctor + two nurses + one registrar).

The implemented activities should also go in the direction of financing and organizing qualification courses for nurses and midwives in the interpretation of ECG and ultrasound, as well as the creation, available from any medical entity, of the possibility of teletransmitting the image to a reference center for evaluation. This way, examinations performed at the primary care level and AOS could be interpreted and analyzed by physicians of the appropriate specialty. A specialist's consultation would guarantee the person acting it (PCP, nurse, midwife) the security of a therapeutic decision.

The changes in the labor market and organizations, including medical entities, resulted in the need to define the areas in which medical institutions must seek opportunities for further development and improvement of their organizational efficiency. Looking at both the needs of private and public medical entities, one gets the impression that, if not now, then shortly, the qualifications and competencies of their employees will be an advantage for these entities. The challenge facing medical facilities will be to develop and improve the qualifications and competencies of their employees in line with the needs of the organization and customers/patients.

References

1. Butkiewicz, M. (1995). *Model polskich standardów kwalifikacji zawodowych*. Warszawa, p. 30.
2. Caupinet et al. (2006). *ICB – IPMA Competence Baseline, version 3.0*. International Project Management Association, p. 9.
3. EMIS (n.d.). *Rynek prywatnej opieki zdrowotnej w Polsce 2022. Analiza rynku i prognozy rozwoju na lata 2022-2027*. Retrieved from https://www.emis.com/php/search/doc?pc=PL&doc_dtyp=1&lang=en&dcid=757701532&range=365&indu_local_class=induell&similar=hide&show_translated_articles=1&coverage=all&title=0&rpp=100&sort_by=relevance&display=1&search_selected_tab=all&search_log_id=e779bda2-ae1-4f27-9089-606b4c8afdf1&search_log_event_id=a53831d4-d495-43be-926e-71df65b49523&get_translated_articles=1&isSerp=false&profile_type=0&keyword=Private+healthcare+market+in+Poland&query_entry=quick&numresult=4, 20.08.2022.
4. Kowalska-Bobko, I. et al. (2021). *Sustainability and resilience in the Polish health system*. Retrieved from https://www3.weforum.org/docs/WEF_PHSSR_Poland_Report.pdf, 21.08.2022.
5. Ministerstwo Edukacji i Nauki (nd). *Ustawa z dnia 22 grudnia 2015 r. o Zintegrowanym Systemie Kwalifikacji*. Retrieved from D20160064.pdf (sejm.gov.pl), 21.08.2022.
6. Ministerstwo Zdrowia (n.d.). *Zdrowa przyszłość. Ramy strategiczne rozwoju systemu ochrony zdrowia na lata 2021-2027, z perspektywą do 2030 r.* Retrieved from <https://pracodawcy.pl/wp-content/uploads/2021/06/Zdrowa-Przyszlos%CC%81c%CC%81.-Ramy-strategiczne-rozwoju-systemu-ochrony-zdrowia-na-lata-2021-2027-z-perspektywa%CC%A8-do-2030-r..pdf>, 21.08.2022.
7. Orczyk, J. (2009). Wokół pojęć kwalifikacji i kompetencji. *Zarządzanie zasobami ludzkimi*, 3-4, pp. 19-32.
8. PARP (n.d.). *Bilans Kapitału Ludzkiego. Raport podsumowujący wyniki badań 2019-2020*. Retrieved from https://www.parp.gov.pl/storage/publications/pdf/RAPORT_wersja_ostateczna_korekta_220121.pdf, 22.08.2022.
9. Schulz, T.W. (1987). Education and Population Quality. *Economics of Education. Research and Studies*. Pergamon Press, p. 12.
10. Shippmann, J.S., Ash, R.A., Batjtsta, M., Carr, L., Eyde, L.D., Hesketh, B., ... Sanchez, J.I. (2000). The practice of competency modeling. *Personnel Psychology*, 53(3), pp. 703-740.
11. Sławiński, S. (2017). *Mała encyklopedia ZSK*, pp. 24-26.
12. Strojny, P., Nowak, P., Hetmańczyk, M., Malaka, J., Skrzek, K. (2021). *Standardy kształcenia kompetencji przyszłości*, pp. 8-9.

UAV TECHNOLOGY TO SUPPORT MANAGEMENT DECISION- MAKING IN THE INDUSTRY

Martin HOLUBČÍK^{1*}, Gabriel KOMAN², Milan KUBINA³

¹ Department of Management Theories, Faculty of Management Science and Informatics, University of Žilina;
martin.holubcik@uniza.sk, ORCID: 0000-0002-5200-2441

² Department of Management Theories, Faculty of Management Science and Informatics, University of Žilina;
gabriel.koman@uniza.sk, ORCID: 0000-0001-7562-5476

³ Department of Management Theories, Faculty of Management Science and Informatics, University of Žilina;
milan.kubina@uniza.sk, ORCID: 0000-0002-0214-3836

* Correspondence author

Purpose: The aim of this article is to define and approach the concept of UAV and its use in industry and decision support in business.

Design/methodology/approach: The methodology of the article consisted of comprehensive analysis of the theoretical concept of UAV technology within the case study framework.

Findings: Result of this analysis provides an evaluation of the state for implementation as support for decision-making and management of companies that will use this trend in the future.

Practical implications: With the progress of science and technology, the individual components of this technology have gradually evolved and become more and more accessible. UAV technology represents great potential in the production processes of factories or smaller factories.

Social implications: UAV (Unnamed Aerial Vehicles) technology has been evolving for decades. However, its civilian use and industrial use have only come in recent years. UAV technology represents great potential in manufacturing processes, support other technological trends, such as IoT, 5G, AI, Factory 4.0.

Originality/value: The presented paper provide not only practical but also theoretical conclusion to management of production processes of factories or smaller factories.

Keywords: management, decision making, UAV technology.

Category of the paper: Research paper. Case study.

1. Introduction

UAV technology can help a large number of businesses. With the gradual advancement of science and technology, it is slowly reaching every sector. The possibilities of using UAV devices are expanding every day. It is thanks to this expansion that there is room for further use. This chapter focuses on the current possibilities of using UAV technology.

The mentioned technology offers many possibilities for use in several spheres. Drones currently have the greatest use for military purposes. However, in addition to military purposes, UAV technology has potential in personal life, humanitarian aid, rescue services, businesses and much more. Until recently, companies used drones mainly for video production and photography, especially for marketing purposes, but there are many other possibilities of UAV technology that represent potential for companies in almost every industry. From agriculture to Internet access, drones are a multi-purpose tool that offers the potential to transform some of the most important ways in which humankind works (CALU, 2021).

As already mentioned, UAV technology has a wide range of uses. Thanks to its capabilities, it is used in many industries. In addition to the military, drones are often associated with other industries.

Farmers use drones to collect data on their crops and then use them to improve their yields. UAV technology is widely used in the agricultural industry. In 2018, more than 30% of farms used UAV technology. However, this percentage increases every year. This testifies to the usefulness and possibilities of this technology. Drones in agriculture save costs by being able to identify failing plants in time and carry out crop inventories. Thanks to the mapping and analysis of agricultural land, it is possible to choose the right places for planting new plants. UAV technologies are relatively widespread in agriculture and the possibilities of their use are constantly expanding (Radoglou et al., 2020).

Environmental protection is one of the sectors in which UAV technologies are widely used. One of the main ways drones help protect is by providing detailed vegetation maps that help monitor forest work and map water to better understand how water moves in the area. Drones have also been invented to shoot seeds out of the air, which could aid in reforestation at carved sites (Dronegenuity, 2021).

Mining companies use drones to obtain data on mining activities in real time. Thanks to surface surveys, it is possible to plan and optimize explosion designs in the initial stages of mining. Thanks to drones, maps of mines and tunnels are also created during subsurface mining. These maps lead to increased security and can also help companies find ore that would not otherwise be found (Wingtra, 2021).

In oil and gas extraction, UAV technologies are mainly involved in security operations. In this type of mining, drones help increase workplace safety by providing inspectors with a tool to gather high-quality visual data inside assets that are critical to the oil refining process, such as FCC tanks and units, and risers (Force Technology, 2021).

Drones are used in the chemical industry to improve internal inspections by replacing inspectors in the collection of visual data. These are data that are collected mainly in large objects used in chemical processes (Flyability, 2021).

As part of electricity generation, UAVs help with workplace safety and process control. This control is dangerous for employees and for that reason it is appropriate to use UAV technology. In power generation, drones also help inspectors reach areas that would otherwise be difficult to access. Drones can also help nuclear power plants by replacing inspectors in collecting visual data on key assets such as reactors. As a result, inspectors do not have to risk their health during routine inspections (Flyability, 2021).

Construction companies and architects use UAV technologies to increase the efficiency and safety of individual construction processes. Mapping and surveying work on construction sites can be quite time consuming if you need to do this work manually. Drones help accelerate these efforts and allow construction companies to provide real-time progress maps and surveys that can help them plan projects as well as improve ongoing projects, leading to significant savings (Ayemba, 2021).

Logistics is one of the most well-known industries in which UAV technologies are used. Drone delivery to the consumer does not yet have to multiply anywhere in the world, but it is a great benefit for commercial drones. The best-known company that actively uses UAV technologies to deliver goods to consumers is Amazon. In 2019, Amazon began testing its Prime Air service. It is a delivery service where a fleet of drones delivers goods to consumers. Several companies focused on the sale and transport of goods have begun to respond to this trend. Wing and UPS have obtained approval from Amazon. However, their logistics solutions are only in preparation and testing. However, Prime Air currently only runs in certain locations. The disadvantage of delivery via drones is mainly short range. Larger parcels also fail to transport these drones efficiently, and for this reason this form of goods transport is still very limited (Song et al., 2018; Hasanalian, Abdelkefi, 2017).

Online food ordering and delivery allow fast casual restaurants to reduce their physical location and reduce real estate costs, but delivery costs still reduce profits. Some restaurants try to use drones for faster and cheaper delivery. Domino entered into a partnership with the Flirtey startup in November 2016 to make the first commercial delivery of pizza using drones (TNW, 2021).

The use of drones in warehouses has been increasing in recent years. Large warehouses focus on increasing efficiency by investing in automation and robotics. However, it is not easy, as the cost of warehousing operations represents 30% of the total logistics cost. Furthermore, it is difficult to obtain a skilled workforce, the growing demand for customer service and the

growth of e-commerce have intensified the need to increase the efficiency of warehousing operations (Falco et al., 2019).

Indoor drones help inspectors enter the city's sewer systems to collect visual data. This data can be used to identify the source of the problem or to evaluate the condition of the infrastructure as part of the regular maintenance process (Flyability, 2021).

Drones have also been used in recent years by law enforcement agencies, fire brigades and search and rescue services. Police use drones to help them better understand the situation and map densely populated areas, firefighters use drones to collect thermal data to determine where they should focus their efforts, and search and rescue workers use thermal and visual data from drones to find people missing in the wild (Silvagni et al., 2016).

For years, high-end drones have been used to take aerial photographs for films instead of helicopters, which are more expensive and cumbersome to work with.

Insurance companies always deal with damage, especially after big storms. Drones help insurance companies deal with roof damage complaints much faster by allowing setters to collect visual data from the sky instead of climbing ladders. Insurance companies also use drones to reconstruct accidents, on the basis of which it is possible to simulate how a car accident occurred so that the validity of car-related insurance claims can be verified (Flyability, 2021).

However, UAV technologies are gradually entering every industry. (Filipowicz, 2021; Gumińska, Kłos, 2020; Zawierucha, 2020) The scope of drones in these sectors will expand more and more. There will be more sectors that will use these technologies. Of course, the industries listed above are not all where UAV technologies are actively used. However, these are the sectors where these technologies are most commonly used and known for. At present, new uses for UAVs are increasing every day, which is why it is difficult to monitor their overall development across all sectors (Mahmoud, 2021).

Drones open up new opportunities and increase efficiency in industries. They have proven to be incredibly powerful and versatile industrial tools capable of completing a wide range of applications. Industry professionals are increasingly using drones to improve and optimize industrial processes, as well as to increase operational efficiency. Drones can be used during various phases of the company's life cycle. With almost unlimited visibility, data collection and analysis capabilities, automated drones are valuable to several industries. Drones are uniquely qualified to capture aeronautical data for consistent use in large industrial facilities, enabling fast and seamless data collection to support informed business decision-making processes.

UAV technological trend is currently gradually developing into new industries. The aim of the work was to define and approach the concept of UAV and its use in industry and decision support in the company from several perspectives based on the analysis of the current environment, the current state and a case study.

The purpose of this article is to make a comprehensive analysis of the theoretical concept of UAV technology within the framework of an orientational analysis of resources and a selected case study. Subsequently, as a result of this analysis, it provides an evaluation of the state for implementation as support for decision-making and management of companies that will use this trend in the future.

The article consists of a theoretical part of a comparison of the current findings of the authors from the subject area of research. subsequently, we will focus on explaining the methodology in which we clarify the approaches to the method of data processing mentioned in the text. after these introductory sections, we discuss specific issues within the framework of the scan results. these results consist of two parts: in the first, we deal with a case study in the selected area, and in the second, we connect the results with the decisions of managers in managing these changes in companies. This is followed by a discussion in which we address the potential of UAV technology for businesses, as well as the benefits of implementing it in a business. The last part of the article is the conclusion, in which we formulate the main result of our text, the limitations of the investigated issue and a view of future research in the given area.

2. Methodology

However, the main source of information was scientific databases, providers and users of UAV technologies. Processing information helps to better understand the discussed issue. Methods used to work with information were used for data collection and processing.

Methods used to work with information were used for data collection and processing. The methods used include: Analysis - this method was used in the processing of relevant articles and other resources in order to better understand the issues discussed. these articles were selected based on keywords: UAV technology, UAV, UAV Options, Use of UAV in the company. Synthesis - this method was used to combine relevant information from different relevant sources such as articles, research paper, case studies, reports from organizations and technical reports. Comparison - by comparing information from several sources, it was possible to better understand the issue and select the most relevant information. This was contained in the results of the examination of the theory and the practical part in the result section. Implementation and design - this method was used especially when looking at the technological trend in the future and at the same time in formulating ideas in the discussion and conclusion part of this work.

3. Results

This chapter focuses on a case study that was created based on real use cases of UAV technology in the industry. The case study was selected for a better understanding of the issues discussed. The real use of UAV technologies has been going on in companies for several years. The real results of the implementation of this issue may affect its subsequent development, as it is a relatively new technological trend in companies. The case study was selected to better understand how UAVs work.

3.1. Autonomous drones intended for the construction sector

The first case study deals with Sundt, which, thanks to Skydio's UAV technology, has been able to streamline its production and control processes, making the company more successful and suitable for government contracts. The case study dates from 2021, from author Delephine (2021).

Sundt, one of the largest construction companies in the Southwest, specializes in a number of construction projects, including transportation, commercial buildings, industry and renewable energy. Drones began to be used in 2013, when a project manager brought a personal drone to the construction site to help with a project that had difficulty documenting construction progress. Using images and videos taken by a drone, he demonstrated progress on the web to his clients, which improved work performance and customer satisfaction. Despite the advantages that this drone proved, there was still great skepticism in the company, and it was not until 2018 that the use of drones began to increase in Sundta.

Reducing the time between the first use case and the scaled uptake of drones is a common challenge for most drone programs, which is often due to the perception of drones as toys and the long time it takes for pilots to be trained. Sundt pointed out that once drones are in place and in operation, almost every stage of the process can benefit from the use of drones, from business development and research to project management and documentation.

But even as companies begin to perceive the value of implementing drones in industries such as construction, they still need to be fought. Most drones need an operator to fly. Safe piloting of a drone requires skill, especially when the user is flying around a construction site with an ever-changing landscape of moving machinery. In order for pilots to have the skills needed to maneuver safely on site, it is necessary to undergo a large amount of training, which takes time. This is one of the many reasons why companies like Skydio consider autonomous flights to be the only way for truly scalable operations. Companies like Sundt are already aware of how Skydio is improving its workflows and enabling it to significantly expand its operations.

One of the initial benefits of using Skydio drones in commercial applications is the speed with which pilots start up. This reduces the time required to run drone programs. Sundt was able to significantly reduce the time needed to train its pilots. Training new pilots on the Skydio

drone has reduced training time by almost half. By halving this time, businesses can implement drones and expect the results to be delivered much sooner.

Delaying flight approval is costly. It takes the pilot time and resources and slows down any production dependent on this data. Even when the drone is ready to fly, the setup time for most manual drones used in construction is 5 to 10 minutes, while Sundt can prepare UAVs with Skydio in 30 seconds to a minute. Thanks to the fast setup time, the Skydio drone is a tool that can be deployed immediately.

Most drones usually require a lot of preparation and calibration, Sundt said. When the time is crucial, whether it is on the construction site or bad weather needs to be predicted, these minutes are absolutely crucial. The workplace is constantly flowing and changing, the ability to capture the moment is essential. The confidence that operators can fly and capture data instantly changes how and when drones can be deployed on a construction site, increasing their value and opening up new use cases.

In addition to these time savings, Skydio AI and computer vision have also made a significant difference in where Sundt can fly. Most drones rely on GPS and magnetometers for navigation. There are often materials on construction sites that interfere with these navigation systems. Because Skydio navigation is based on artificial intelligence and computer vision, it can fly close to objects that would not normally be accessible by manual drones, which rely on GPS navigation and magnetometers. Powerful computer vision and artificial intelligence also allow Skydio drones to get closer than anyone who flies manually would feel comfortable.

The first thing Skydio had to do was overcome our dependence on GPS and magnetometers. To achieve this, they had to come up with a sophisticated vision system. Skydio operates 12 deep networks at the same time, which require a powerful chip. Therefore, it uses NVIDIA Tegra TX2, which is much more powerful than chips used by other drones on the market. This allows the drone to process large amounts of data. From hardware to software, the base is autonomous and allows you to fly in ways that operators would not otherwise be able to do. For example, Skydio can avoid obstacles that are not even visible in the camera record because it is programmed to make rational conclusions about space.

Thanks to Skydio, Sundt has been awarded a contract to work with high-pressure and high-temperature systems. The ability to fly safely in harsh spaces can save workers' lives. With Skydio, Sundt can get to some very tight, claustrophobic and dangerous areas where it is dangerous to send people. Sundt inspects high-pressure and high-temperature systems. If a company uses drones for these inspections, it does not risk injury or death to its employees. Thanks to human inspections, the construction industry has been able to reduce the accident rate over the years, but mortality has remained the same. When something explodes in these environments, workers often do not survive. Because Skydio can fly to these areas, which would not be possible with other drones, and capture important data, this mortality can be effectively reduced. The drone costs about \$ 1000, but human life is priceless.

The AI built into the Skydio drone is unmatched by any other drone that Sundt has considered. A drone is basically a flying computer. Thanks to the ability to zoom in at a short distance, it has better accuracy, which allows you to create better 3D maps. Because Skydio has partnered with DroneDeploy, the processing times for ortho-mosaic maps or 3D models are shorter than any other drone on the market. This helps speed up the process from drone flying to providing information to the project team, which is appreciated by many Sundt project managers.

Because Skydio is made in America, it allowed Sundt to pursue well-paying government projects that would otherwise be rejected due to Chinese-made drones, such as the DJI. This was a key factor that led Sundt to take advantage of Skydio's technology. Sundt is working on federal work and federal projects, but the United States Department has determined that Chinese-made drones are no longer an option for government procurement. If the company had a Chinese-made drone in its fleet, it would not get the contract. Sundt also pointed out that the support of domestic suppliers had a significant impact on their business operations. Being in the same time zone allowed them to resolve issues faster than foreign customer support and come up with more timely solutions.

Skydio drones have greatly streamlined the operation of Sundt's drones, saving them time and money, while opening up additional revenue opportunities. This talks about how much Skydio is set to change the paradigm in the construction industry. In addition to construction, Skydio's drone capabilities are promising for many industries looking to expand their drone programs. By capturing important and high-quality data in demanding environments and enabling faster drone departures, Skydio is set up to disrupt multiple industries in many ways. (Delepine, 2021)

3.2. Use of UAV to support business decision-making

Decision-making is one of the basic processes of a company and is one of the most important components. Therefore, in order for a company to be successful, it is necessary for the company to operate as efficiently as possible. This chapter focuses on how the UAV technology trend supports business decision-making.

UAV technology represents great potential for companies. This potential can also be used to support decision-making in the company. Thanks to real-time data acquisition and processing, companies have the opportunity to streamline decision-making processes, which has a positive impact on the company's results.

Every industry-focused company faces challenging situations where data acquisition may not be easy. Thanks to UAV technologies, this issue may be a thing of the past. After choosing an efficient technological solution, data collection can be accelerated and streamlined. Drone solutions offer ideal temporal and spatial bridging, so that data reaches decision-makers in near real time. However, UAV technology can pre-process individual data, saving time and costs for

in-house data processing. The processed data then form information that is essential for decision-making in the company (Niles, 2019).

However, UAV technology not only simplifies data collection and processing, but also helps to disseminate it effectively. The platform used by drones has the ability to share data between all stakeholders. This prevents misinformation or low awareness in the company. Thanks to the sharing of this data, all employees can be informed about the current state and other procedures, which significantly increases the efficiency of the company (Equinox's Drones, 2021).

In conjunction with other technological trends, UAV technology also helps with the simulation of models that are the result of decision-making processes. Thanks to sensor data, drones can create a digital version, or even a digital twin, which can then be used to simulate new processes. Creating simulations not only simplifies business processes and saves money, but also helps to anticipate unexpected risks that may arise (Swami, 2020; Pollak et al., 2019; Blaskova et al., 2022).

UAV technology bridges reality with management and decision-making processes anywhere, and provides valuable insights that prevent time and costs from being exceeded at every stage of a company's asset lifecycle. Drone-based solutions are critical to business planning, building and maintaining critical economic assets, such as large-scale transportation infrastructure, mines, clean energy, farms and more. They also help streamline the planning process for these digital twin sectors, reduce overhead management costs during construction through near-real-time monitoring, and extend asset life cycles through preventive maintenance (Jankal, 2014; Ferenc et al., 2017).

4. Discussion: potential of the technological trend UAV

As mentioned in the previous chapter, the advantages of UAV technology outweigh its disadvantages. However, it is important that the technological solution is implemented correctly and used as efficiently as possible to achieve the full potential of the technology. This begs the question, what is the potential of the UAV's technological trend?

In general, it can be argued that the potential of this technology depends on the industry in which the technology is implemented. For example, for farmers, this technology has a different potential than for rescue services. The main benefits discussed in the previous chapter represent the potential for businesses. However, the potential of this technology can be formulated and introduced much more generally, taking into account all sectors and businesses,

Thanks to the possibility of connecting drones with any compatible sensors, it brings great potential in data collection. Being able to collect data that was previously difficult or inaccessible can give a business a new perspective that can determine a company's future

development (Swami, 2020). In addition, the versatility of drones allows companies to develop products and services that would once seem impossible. For example, the British company Animal Dynamics has developed a miniature "dragonfly drone" weighing less than 50 g. This small drone is capable of operating in strong winds, which is useful for tracking in remote locations and complex search and rescue missions (Cohn et al., 2021).

Drones have considerable potential to affect marketing function. Current use ranges from small-scale applications in which drones carry advertising banners at public events, through potentially extensive use to provide basic customer service, to the collection of large amounts of information (Flyability, 2021).

UAV technologies change business models by providing alternatives to traditional processes or channel partners. For example, the delivery of consignments via drones is gaining attention, which makes it possible for drones to become an agent and contact point for the customer. This may be especially true for consumers living in hard-to-reach areas, as drones do not have to travel using traditional infrastructure. Drones therefore allow merchants to reach or communicate with customer segments that were previously unreachable. Drones are also integrated into warehousing operations and retail settings. Walmart, for example, has filed a patent for the use of drones to move products between departments. Using drones in this way affects operating costs and benefits customers (Song et al., 2018).

One of the most direct ways drones affect business models is the provision of products and services. For example, Uber is working on the development of human-carrying drones, and the personal drones of the Chinese company EHang are already being tested. These new offers could fundamentally change mobility, including prices, transport structures and standards (Ehang, 2021).

As a distributed technology that can be quickly and flexibly reconfigured and increasingly repaired, it is likely that drones can enhance resilience or the ability to maintain functions and structures. Given today's societal challenges, research is particularly needed to shed light on how drones affect the resilience of business models. For example, drones have the potential as a safe and resilient way to deliver products during the COVID-19 pandemic (Dronegenuity, 2021).

As urbanization continues, cities need to adapt to larger populations and chronic congestion. Urban planning is becoming increasingly important for cities, but it requires a thorough understanding of metropolitan rhythms and flows. Using drones, urban planners are able to better understand their environment and implement data-based enhancements (Mahmoud, 2021).

However, there is great potential for linking UAV technologies with other technological trends. At present, UAV technologies can already cooperate with digital twin technology. This collaboration is based on the fact that a digital twin is created using data from UAV technology sensors, which is used to create simulations. However, the greatest potential is the connection of UAV technologies with the technological trend of the Internet of Things.

Although these technologies overlap in many ways, they are not identical. However, the interconnection of these technologies could yield autonomous drones that would be able to solve problems without operators. The integration of UAVs with IoT networks is a new direction for research and industry. The IoT concept allows things to be connected anywhere and at any time via any network in order to provide any service. This characteristic of IoT allows UAVs to become an integral part of the IoT infrastructure. In UAV-based IoT (UIoT), UAVs can be used for various purposes, such as UAV trajectory planning, IoT ground data collection, data sampling and reconstruction, energy efficient device search. The use of drones can improve various aspects of smart cities, such as data collection, privacy and security, public safety, disaster management, energy consumption and quality of life. In UIoT, UAVs generally collect data from terrestrial sensors and devices through peer-to-peer connections. Therefore, there is no need to transfer data to neighboring nodes, which can reduce power consumption (Lagkas et al., 2018).

The key challenge for 5G and over 5G (B5G) is to ensure ubiquitous connectivity to different types of devices. Unmanned aerial vehicles (UAVs) are expected to be an important part of the upcoming wireless networks, which can potentially facilitate wireless broadcasting and support high-speed transmissions (Comsoc, 2021).

The potential of this technology is really huge. Businesses are provided with benefits that help consolidate their place in the market. The disadvantages that come with this technology hardly jeopardize its potential. The possibilities of use in companies are really large and they are constantly increasing. With the advancement of science and technology, this potential will continue to expand. Whether the companies currently have the maximum potential of UAV technology is questionable, but the use of this technology gives companies a huge competitive advantage, which is crucial for the future direction. The connection of this technology with other technological trends brings a huge potential for further digitization. Such connections lead to the perfect concept of smart city, or even factory 4.0.

4.1. Benefits of implementation in the company

The wide possibilities of modern drones, which are created by connecting devices with new sensors, offer companies advantages. These benefits are crucial for many businesses. Gradual implementation in several competing companies will force other companies to use this technology to maintain their position in the market. One of the factors that determines a company's position in the market is its efficiency. In this case, the efficiency of the company can be increased through the following benefits resulting from the implementation of UAV technology in the company.

The use of drones has great advantages. Drones can enable retailers and other businesses to deliver products and services faster than ever before. Drones offer a more efficient and environmentally friendly way of making small one-off deliveries compared to traditional

delivery vehicles. They can also reduce the amount of manpower and special equipment needed (Mahmoud, 2021).

UAVs are used in many cases due to their advances in security. With their remote control capabilities, drones monitor positions, inform about possible dangers and draw attention to threatening conditions such as oil and gas refineries, pipelines, light sources, etc. Not only that, drone technology is used in the military even during high-risk periods. Their features allow them to obtain real-time data to create and maintain a secure environment. The advantage of greater security can be used in every sector, whether it is agriculture or military purposes.

As the usability of drones increases, so do their prices. UAVs are no longer just for the military, the legal authorities or the elite. As UAVs take over several manpower, vehicles and operating activities in commercial use, many costs remain.

Thanks to their high-resolution cameras equipped with state-of-the-art sensors, UAVs can capture aerial images, aerial videos and collect large amounts of accurate data. The obtained data are transformed into detailed 3D maps and 3D models for complete analysis. 3D mapping is especially important for detecting cracks, damage or other dangerous elements in disaster-stricken areas. Drones, which are paired with high-definition images or 4K video, are known for streaming major events such as entertainment, personal, political, and global affairs. However, high-quality aerial images and 3D models represent a great advantage for every industry (Equinox's Drones, 2021).

UAVs use GPS in their software, so they can be programmed and precisely guided to specific locations. For example, in precision agriculture, drone is used to perform many agricultural duties, such as pesticide spraying, weed identification, crop health monitoring, crop damage, crop evaluation, field soil analysis, irrigation monitoring, etc. This feature of accuracy using GPS saves farmers time and money. However, it is an advantage for all industries, as it is the accuracy of the equipment that increases the efficiency of the company (Mahmoud, 2021).

Thanks to UAVs, obtaining efficient data from hard-to-reach places is a huge advantage for all professional companies in the industry. It is the most suitable alternative to overcome the limitations of traditional methods concerning the safety of workers, especially in hazardous situations, such as radiation monitoring, control of high-voltage lines. Drones also provide more cost-effective access to inspections of these sites (Lagkas et al., 2018, Beninger, Robson, 2020).

Because drones have different technical parameters, several of them can provide controls at high or low altitudes. The versatility of these features allows companies to easily customize the tools for their projects. Drones are suitable for both routine and emergency scenarios, the construction industry respects these advantages, especially developers of buildings for roof inspections. Drones can perform various tasks, such as taking high-quality photos, videos, thermal images, and so on. These data are then immediately transmitted and processed, in contrast to the time-consuming conventional method.

Multiple drone data collection options could inspire widespread changes in data collection strategies, especially if these changes lead to cost savings, increased security and improved analysis. Savings need to be made, for example, in inventory analysis, thermal imaging of pipelines and railways, three-dimensional claims modeling and building imaging. For many companies, drones could offer potential either by optimizing current processes or by offering new growth opportunities. For many companies, drones are fast becoming another part to consider when developing digitization strategies. Thanks to cloud services and Big Data technology, drone data collection capabilities have the potential to radically change the competitive dynamics of the information environment (Thibau, Aode, 2016; Equinox's Drones, 2021).

5. Conclusion

The technological trend of UAVs has been evolving for decades, but its use in industries has only been possible in recent years. This use is the result of lower technology prices and the expansion of opportunities offered by this trend. UAV technologies provide a really wide range of uses. Based on the analysis of this technological trend, it can be seen that this technology has a really great potential. The future direction of UAV technology also brings a number of opportunities for businesses. The advantages of this trend far outweigh its disadvantages. This is also evidenced by the industries in which these technologies are used. With the gradual development of science and technology, drones can be expected to reach all sectors and replace workers who are exposed to danger in their work. Among the industries in which this technology is currently lacking, it is possible to include especially manufacturing companies. Whether in factories or smaller factories, UAV technology represents great potential in manufacturing processes. UAV technologies support other technological trends, such as IoT, 5G, AI, Factory 4.0 and the like. Although these technologies are currently incompatible, a revolution in science and technology can be expected once they are interconnected.

The implementation of each new technology comes with certain limitations. Despite the really wide range of advantages, it is important to consider the limitations that can have a negative impact on the company. UAVs can quickly fall into manipulation and invade the privacy of a group or individual. Although many wish to use drones to maintain security, this could undermine numerous individual freedoms on behalf of public security. Other limitations include the following.

Security is an essential element that needs to be prioritized when operating drone technology. UAVs equipped with high-quality sensors detect possible collisions and safely bypass them, which is an important feature. These drone capacities must be similar to those of manned aircraft navigators. It is commendable to hire professional drone service providers who

can operate an aircraft drone without crashing it. Drones operated in densely populated areas have an increased risk of impact or damage to the ground, mainly due to system failure or hacking (Mahmoud, 2021).

One of the major limitations of the growth of drone technology is its vulnerability. Hackers can quickly attack the drone's central control system and become its operator. The primary control system contains important data. Hackers may obtain private information, damage or disclose data to unauthorized third parties (CALU, 2021).

Unlike traditional aircraft, drones are more vulnerable to weather conditions. For example, if climatic conditions are unfavorable, the UAV will not maneuver appropriately or collect reliable data or images. However, there are drones that are more stable and successfully withstand gusts of wind, but their price is higher.

Drones are susceptible to attacks by wild animals and are sometimes dangerous to nature. It is possible that when a drone operator flies in a natural area with a significant number of wild animals, it collapses on a tree or conflicts with a vulnerable animal. Large birds such as eagles regularly attack drones operating in their area (Insurance business, 2019).

The biggest limitations that can result from the implementation of UAV technology in the company is the legislative restrictions. The use of unmanned aerial systems has expanded, but the law is still evolving as it is a new technology in the industry. The specific procedures established for small drones also apply to commercial and recreational uses, but are still unclear in several respects. Rules to regulate the movement of drones and protect property from unauthorized interference are still being prepared in several countries. Thus, UAV technology operates in many companies in the gray zone. There are many ambiguities between government regulations and state or city laws governing the management of airspace, which may cause drone operators to violate rules they are unaware of (Insurance business, 2019).

However, the individual limitations mentioned in this subchapter are not so fundamental as to outweigh the advantages of that technology. If the legislation and position of the company allow it, it is appropriate to use this technology. That is why companies are increasingly using these technologies. Many disadvantages of science and technology will then disappear. Of course, these are not all limitations, but they are the most important ones that should have the greatest impact on decisions about the implementation of UAV technology in the company.

Looking at the technological trend in the future. Give a business a new perspective that can determine a company's future development.

With the progress of science and technology, the individual components of the mentioned technology gradually developed and became more and more available.

In recent years, UAV technology has begun to expand into industries. It is therefore conceivable that this technology will spread to several industries in the future. With the progress of science and technology, new sensors will be created that will be compatible with UAV devices. It is thanks to this connection that the possibilities of UAV devices will expand considerably.

By expanding the portfolio of UAV technologies, drones will gradually become more and more familiar to companies. Over time, businesses in several industries will use UAV technologies.

However, businesses will need to determine whether they will operate their own drones or outsource them. Factors such as the investment horizon, the need for data security, and the desired speed of development will influence this choice. A business could opt for in-house drone operations and data analysis if they are concerned about ownership issues or security. In this case, the business is willing to invest significant funds up front and wants to take a "learn by doing" approach. For example, French rail operator SNCF uses an in-house drone program to increase safety and maintenance through network surveillance.

Acknowledgements

This publication was realized with support of the Operational Programme Integrated Infrastructure in frame of the project: Intelligent systems for UAV real-time operation and data processing, code ITMS2014+: 313011V422 and co-financed by the European Regional Development Found.

References

1. 911 Security (2021). *What is a Drone?* Retrieved from: <https://www.911security.com/blog/what-is-a-drone>.
2. Airobotics (2021). *Automated Drone Applications For Industrial Purposes*. Retrieved from: <https://www.airoboticsdrones.com/applications/>.
3. Ayemba (2021). *Utilizing drone technology in construction*. Retrieved from: <https://constructionreviewonline.com/machinery-equipment/drones-in-construction/>.
4. Beninger, S., Robson, K. (2020). The disruptive potential of drones. *Marketing Letters*, 31, 315-319.
5. Blaskova, M., Tumova, D., Miciak, M. (2022). Taxonomy of Factors Involved in Decision-Making to Sustain Organization Members' Creativity. *Administrative Sciences*, 12(1), 39.
6. CALU (2021). *The Future Of Drones*. Retrieved from: <https://www.calu.edu/academics/undergraduate/associate/drone-technology/future-drone-technology-and-uses.aspx>.
7. CB Insights (2020). *38 Ways Drones Will Impact Society*. Retrieved from: <https://www.cbinsights.com/research/drone-impact-society-uav/>.
8. CBJ (2017). *Agsky Technologies*. Retrieved from: <https://www.cbj.ca/agsky-technologies/>.

9. Cohn, P., Green, A., Langstaff, M., Roller, M. (2017). *Commercial drones are here: The future of unmanned aerial systems*. Retrieved from: <https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/commercial-drones-are-here-the-future-of-unmanned-aerial-systems>.
10. Comsoc (2021). *UAV Communications in 5G and Beyond Networks*. Retrieved from: <https://www.comsoc.org/publications/journals/ieee-jsac/cfp/uav-communications-5g-and-beyond-networks>.
11. Delepine (2021). *Autonomous Drones for Construction: A Case Study*. Retrieved from: <https://medium.com/skydio/autonomous-drones-for-construction-a-case-study-b06d5c4f3d1b>.
12. Dronegenuity (2021). *Drones Will Help Save The Environment*. Retrieved from: <https://www.dronegenuity.com/ways-drones-help-save-the-environment/>.
13. Ehang (2021). *UAM*. Retrieved from: <https://www.ehang.com/uam/>.
14. Equinox's Drones (2021). *10 Major Pros & Cons of Unmanned Aerial Vehicle (UAV) Drones*. Retrieved from: <https://www.equinoxdrones.com/blog/10-major-pros-cons-of-unmanned-aerial-vehicle-uav-drones>.
15. Falco, D.A., Narducci, F., Petrosino, A. (2019). *An UAV Autonomous Warehouse Inventorying by Deep Learning*. International Conference on Image Analysis and Processing. ICIAP 2019: Image Analysis and Processing – ICIAP 2019, 443-453.
16. FEDS (2020). *Surveying the largest limestone quarry in a day*. Retrieved from: <https://www.feds.ae/blog/surveying-the-largest-limestone-quarry-in-a-day>.
17. Ferenc, P., Varmus, M., Vodak, J. (2017). Stakeholders in the various field and relations between them. *Procedia Engineering*, 192, 166-170.
18. Filipowicz, A. (2021). Conceptualisation of using technical debt to measure the innovation level of new product – selected issues. *Organization And Management Series*, 153, 89-101.
19. Flyability (2021). *Commercial drones: industries that use drones, deliverables, and our list of the top models on the market*. Retrieved from: <https://www.flyability.com/commercial-drones>.
20. Force Technology (2021). *Drone inspection of offshore oil and gas constructions*. Retrieved from: <https://forcetechnology.com/en/services/drone-inspection-offshore-oil-gas-constructions>.
21. Gumińska, J., Klos, M. (2020). Economic aspects of pretreatment technologies before reverse osmosis. *Organization And Management Series*, 145, 119-131.
22. Hasanalian, M., Abdelkefi, A. (2017). Classifications, applications, and design challenges of drones: A review. *Progress in Aerospace Sciences*, 91, 99-131.
23. Insurance Business (2019). *Commercial drones – what are the benefits, risks and legal restrictions?* Retrieved from: <https://www.insurancebusinessmag.com/uk/news/breaking-news/commercial-drones--what-are-the-benefits-risks-and-legal-restrictions-172665.aspx>.
24. Jankal, R. (2014). The role of innovation in the assessment of the excellence of enterprise subjects. *Procedia Social and Behavioral Sciences*, 109, 541-545.

25. Kueabix (2021). *The Future Of Drones In The Supply Chain*. Retrieved from: <https://www.kueabix.com/the-future-of-drones-in-the-supply-chain/>.
26. Lagkas, T., Bibi, S., Argyriou, V., Sarigiannidis, P.G. (2018). UAV IoT Framework Views and Challenges: Towards Protecting Drones as “Things”. *Sensors*, 18(11).
27. Mahmoud (2021). *Unmanned Aerial Vehicles*. Retrieved from: <https://www.sciencedirect.com/topics/engineering/unmanned-aerial-vehicles>.
28. Niles (2019). *Applying Drones for Better Decision Making*. Retrieved from: <https://colab.build/insights/applying-drones-for-better-decision-making/>.
29. Pollak, F., Soviar, J., Svetozarovova, N. (2019). *Selected approaches to sustainable development of corporate reputation - empirical study of online reputation management of subjects from the field of supply chain management*. 8TH Carpathian Logistics Congress (CLC 2018). Prague, 324-329.
30. Radoglou-Grammatikis, P., Sarigiannidis, P., Lagkas, T., Moscholios, R. (2020). A compilation of UAV applications for precision agriculture. *Computer Networks*, 172, 107148.
31. senseFly (2017). *Precision ag profile: AgSky Technologies*. Retrieved from: <https://www.sensefly.com/fr/case-study/precision-ag-profile-ag-sky-technologies/>.
32. Silvagni, M., Tonoli, A., Zenerino, E., Chiaberge, M. (2016). Multipurpose UAV for search and rescue operations in mountain avalanche events. *Geomatics, Natural Hazards and Risk*, 8(1), 1-16.
33. Song, B.D., Park, K., Kim, J. (2018). Persistent UAV delivery logistics: MILP formulation and efficient heuristic. *Computers & Industrial Engineering*, 120, 418-428.
34. Swamy (2020). *Drone solutions for better decision-making*. Retrieved from: <https://www.geospatialworld.net/article/drone-decision-making/>.
35. Thibault, G., Aode, G. (2016). Companies Are Turning Drones into a Competitive Advantage. *Harvard Business review. IT management*.
36. TNW (2021). *Domino's delivers pizza by drone to Dutch beach — but it was just a trial*. Retrieved from: <https://thenextweb.com/news/dominos-delivers-pizza-drone-dutch-beach-but-it-was-just-a-trial-sad>.
37. Transport Office (2019). *Aircraft capable of flying without a pilot*. Retrieved from: <http://letectvo.nsat.sk/letova-prevadzka/lietadla-sposobile-lietat-bez-pilota/>.
38. Vyas, K. (2020). *A Brief History of Drones: The Remote Controlled Unmanned Aerial Vehicles (UAVs)*. Retrieved from: <https://interestingengineering.com/a-brief-history-of-drones-the-remote-controlled-unmanned-aerial-vehicles-uavs>.
39. Wingtra (2021). *Mining and aggregates*. Retrieved from: <https://wingtra.com/drone-mapping-applications/mining-and-aggregates/>.
40. Zawierucha, K. (2020). The development of the modern world in the aspect of new technologies. *Organization And Management Series*, 145, 661-674.

FACTORS AFFECTING OCCUPATIONAL WELL-BEING OF PUBLIC ADMINISTRATION EMPLOYEES IN POLAND

Marta JUCHNOWICZ^{1*}, Hanna KINOWSKA²

¹ Wyższa Szkoła Bankowa w Warszawie; profmartajuchnowicz@gmail.com, ORCID: 0000-0002-7506-55761

² Szkoła Główna Handlowa w Warszawie; hanna.kinowska@sgh.waw.pl, ORCID: 0000-0002-7936-97373

* Correspondence author

Purpose: This article identifies the factors affecting occupational well-being and determines their significance for people employed in public administration institutions in Poland between 2020-2021.

Methodology: The present analysis is based on the authors' proprietary empirical research conducted in 2021 by the CAWI method on a representative sample of 202 public sector employees. The authors assessed their research's outcome by means of a hierarchical cluster analysis, Ward's method as well as one-way ANOVA test.

Findings: The study has revealed that the most important factors determining the occupational well-being of employees in public administration institutions are job security and appealing work content. By contrast, the factor which turned out to least affect their well-being was a good rapport with their supervisor. The research has found that the power of the impact of individual factors varies according to gender and the type of contract under which occupational tasks are performed.

Research limitations/implications: The study captures the variables of occupational well-being of public administration employees in a static perspective. The determinants in question are prone to time and change. Further research is recommended to place them in a long-term perspective. The study focused on Polish employees exclusively. In order to gain more standardized results, the research should be extended to a wider range of regions and countries. The research identified the determinants of well-being through employees' self-judgements. For a complete picture, other sources of evaluation should also be taken into account.

Originality/value: The article fosters understanding of the underlying determinants of occupational well-being of public administration employees. The results are significant for the informed management of employees and provide practical tips to facilitate employee motivation.

Keywords: occupational well-being, employee well-being, public administration, cluster analysis.

1. Introduction

Over the last two years, we have observed a resurgent interest in the concept of employee well-being in the literature, as well as in management practice. This is a natural consequence of the challenges arising from the uncertainty caused by various distressing circumstances. As a result of the pandemic, more than 40 per cent of employees experienced a decline in well-being and three quarters suffered from stress (Nationale-Nederlanden, 2021).

Up to 80% (71% in Poland) of organizations operating globally declare that employee well-being is important or very important to their success (Deloitte, 2020). An in-depth analysis reveals definition problems. Still, there is no explicit definition of employee well-being (Diener et al., 1999; Forgeard et al., 2011; Keyes et al., 2002; Seligman, 2011; Simone, 2014; Zheng et al., 2015). Employee well-being is a complex multidisciplinary concept. Therefore, it is necessary to specify the essence of the matter. Recognition of the variables that influence the level of well-being is of particular theoretical and practical importance. In addition to this, there is a cognitive gap in the literature in terms of recognizing the factors which determine, i.e. enhance or reduce the occupational well-being of the public administration employees, during such a specific period as the years 2020-2021.

Therefore, the article focuses mainly on identifying these factors and on assessing their importance for the Polish public sector workers between 2020 and 2021. To achieve the purpose, the authors have formulated the four specific objectives, namely:

- to define the nature of occupational wellbeing,
- to identify the key determinants of occupational well-being of public administration employees in Poland between the years 2020-2021,
- to establish the hierarchy of specific factors determining the professional well-being of public administration employees,
- to assess to what extent the well-being determinants vary.

The analysis discussed in this article is based on the authors' proprietary empirical research conducted in 2021 by the CAWI method on a representative sample of 202 public sector employees.

2. The nature of occupational well-being

Contemporary management literature and practice have devoted considerable attention to the issues of well-being in recent years. This concept, understood as a general mental and physical state experienced by a person, is multidimensional in nature, and therefore the interpretation of its essence poses serious challenges (Tabor-Błażewicz, 2021). And yet, it is

essential to identify both the components and the determinants of a person's well-being. Research indicates that psychological well-being is the most significant factor affecting the sense of well-being in the work process (Johnson et al., 2018). Therefore, conceptualizing employee psychological well-being from a eudaimonistic perspective, focused on human potential, seems closest to management and quality sciences (Czaplinski, 2012; Ryan, Deci, 2001). Eudaimonic well-being embraces six core aspects: positive attitude towards oneself (self-acceptance), positive interpersonal relationships, a sense of freedom, autonomy, a sense of purpose in life and opportunities to personal growth (Ryff, 2013). The above-mentioned aspects indicate that employee well-being is shaped by work-related factors. It is therefore appropriate to specify the scope of the concept of employee well-being. The authors propose to restrict the crux of the concept to occupational well-being, understood as a mental and physical state experienced by a person in relation to their performance of occupational tasks or functions. This proposal has practical relevance, as it will allow employers and managers to orient their efforts towards factors within their control that directly affect employees' occupational well-being.

As the research shows, the assessment of occupational well-being is partly determined by personal characteristics of an employee, which are relatively permanent, fixed individual dispositions. Consequently, opinions among employees on the type and strength of factors influencing occupational well-being vary. Therefore, individualized analyses and occupational well-being programs addressing the specifics of occupational activities and the main characteristics of employees are desirable. The need for such analyses is confirmed by the contemporary labor market conditions, described as a market of experiences, in which employees, in addition to fair pay, expect personalized values as well as individual experiences and sensations (Lipka, 2022).

3. The importance of exploring the factors of occupational well-being

Without understanding of the key determinants of well-being, organizational managers are confused about how they could respond to any deterioration in occupational well-being in their teams (Ilska, Kołodziej-Zalewska, 2018). And yet, there is a profound rationale for the investment in well-being. 95% of HR executives agree that job burnout affects employee retention rates negatively (Deloitte, 2022b). A study by Limeade and Quantum Workplace found that employees with high levels of well-being are more engaged in the work they enjoy and therefore are more likely to recommend their employer to others (Peterson, 2022). Over the past four decades, behavioural science research has highlighted the competitive advantage that a sense of employee well-being generates for companies (Lester et al., 2022). According to this year's Deloitte survey, 94% of respondents agreed that well-being affects company performance

to some extent. Respondents claimed it improved customer service standards, financial results, reputation, innovation and adaptability (Deloitte, 2022a). Other studies have found that employee well-being, and its opposite, i.e. the sense of unhappiness, are contagious, and can be shared by people functioning within the same social group (Lester et al., 2022). This can exert consequences for employees' sense of belonging and thus their level of stability.

The body of literature presents various sets of factors affecting employees' occupational well-being, embracing multiple dimensions: quality of life, sense of work, likelihood of job burnout, severe fatigue, work-life integrity, suicidal ideation, e.g. the Employee Well-Being Index (eWBI) (Dyrbye et al., 2016). The authors have chosen to apply a framework developed by the Gallup Institute (Gallup-Healthways, 2017) based on a multi-year study, which considers five core factors:

- a) purpose - a sense of satisfaction, a sense of influence and meaning of one's performance,
- b) social: a good work atmosphere, friendly and supportive relationships with others,
- c) financial: security, financial stability,
- d) community: a sense of belonging to a larger group, being proud to work in a particular place,
- e) physical health - good health, physical activity (Gallup-Healthways, 2017).

4. Research methodology

The survey was conducted by the CAWI method in January 2021. It involved two hundred and two respondents working in public sector institutions, predominantly male (53%), with a university education (69%), employed in medium-sized organizations (employing 50-249 people) (38%), on a contract basis (86%), in non-managerial positions (70%).

The specific characteristics of the research sample are presented in Table 1.

Table 1.
Structure of the survey sample (in %)

Sex	Female	47
	Male	53
Age	18-29	12
	30-39	19
	40-49	36
	above 50	33
Education	Vocational	2
	Secondary	29
	Higher	69
Form of Employment	Employment contract	86
	Civil law contract	8
	Proprietorship	6

Cont. Table 1.

Company Size	Up to 50 employees	23
	50-249 employees	38
	250-500 employees	14
	Over 500 employees	25
Position	Non-managerial	70
	Managerial	30

N = 202.

Source: own study.

To meet the main and specific objectives, three research questions were formulated:

1. What key factors affect the occupational well-being of public administration employees in Poland between 2020 and 2021?
2. How significant are the particular determinants of occupational well-being of public administration employees?
3. What is the variation in the factors affecting the occupational well-being of public administration employees?

The survey contained a total of 22 questions concerning respondents' opinions on specific aspects of employees' occupational well-being, engagement and assessment of pay equity¹. Respondents rated statements on a 5-point Likert scale, where 1 represented 'strongly disagree' and 5, 'strongly agree'. To explore occupational well-being, fourteen questions based on the 'Gallup-Healthways, Well-being 5 Index' tool were used (Gallup-Healthways, 2017). In order to diagnose the key factors, ten questions in the survey were analysed. Three additional questions were used to characterise the selected factors of occupational well-being. This was followed by an analysis of the hierarchy of determinants of well-being from the respondents' viewpoint.

Respondents were asked to rank the following factors from the most important (1st place) to the least important (8th place): interesting job, employment security, prestige of the job, sense of fair remuneration, personal growth opportunities, friendly atmosphere at work, work-life balance and good rapport with the supervisor.

The first stage of the analyses focused on the calculation of descriptive statistics. Then, a hierarchical cluster analysis was applied using Ward's method with the square of the Euclidean distance. On the basis this, homogeneous groups of employees were identified according to their ratings of the determinants of occupational well-being. The results were analyzed with a one-way ANOVA test. The tests confirmed statistical significance in the variation of means.

The calculations were performed with the SPSS statistics package version 27.

¹ Research carried out as part of the project 'Sprawiedliwość wynagrodzenia' No. 2016/21/ B/HS4/02992, funded by the National Science Centre.

5. Research findings

5.1. Key factors determining the occupational well-being of public administration employees in Poland in the years 2020-2021

The survey found that public administration employees rated their occupational well-being relatively well. Such a statement is mandated by the fact that in all statements, positive ratings exceeded those which were negative (Table 2).

The highest rated factor was the feeling that their work is of purpose, with as many as 76% of respondents confirming a belief in the sense of work. Slightly fewer respondents (65%) felt satisfaction with their work. Respondents also rated the team atmosphere highly (74% of respondents). In contrast, far fewer (only 59%) rated the working relationship with their supervisor positively. At the same time, 29% of those who responded to the survey had no opinion on this, which is twice as many as on the team atmosphere. The opinions on the sense of work and team atmosphere correspond with the assessment of the sense of pride in work. 69% of employees are proud of the work they perform. Meanwhile, it appears that just as they are critical about work rapport with their superior, they distrust the supervisor and their work colleagues either. Fewer than a half (58%) have a sense of trust and 28% have no opinion on this issue.

The lowest rating among employees is for determinants related to finances, i.e. the conviction that salaries are appropriate to the work performed (only 39% of respondents confirm this statement), and that salaries for different positions are appropriately diversified (42%). At the same time, as many as 32% of respondents do not have an opinion on this, which testifies the lack of transparency in pay diversity.

Health-related factors, especially in terms of feeling intellectually and emotionally exhausted, were also critically assessed by respondents. 46% of respondents confirmed that they felt them and only 30% denied it, while 24% have no opinion on this.

Table 2.
Employee well-being analysis (in %)

Well-being aspect	Statement	Definitely no	Rather not	Difficult to say	Rather yes	Definitely yes	Negative rating	Positive rating
Purpose	My work gives me satisfaction	3%	6%	25%	41%	24%	10%	65%
	I believe my work is of purpose	2%	3%	18%	47%	29%	5%	76%
Social	There is a nice and friendly atmosphere in my team	2%	8%	15%	49%	25%	11%	74%
	My rapport with my superior is very good	4%	8%	29%	37%	22%	12%	59%

Cont. table 2.

Financial	My pay is adequate for my job	13%	25%	23%	25%	14%	38%	39%
	The pay for different positions at my workplace is well varied	9%	16%	32%	28%	14%	25%	43%
Community	I am proud of the work I do	2%	7%	21%	37%	32%	10%	69%
	I have trust in my colleagues and supervisor	2%	12%	28%	39%	19%	14%	57%
Health	My health and fitness are adequate for the job I do	1%	6%	22%	51%	19%	7%	71%
	I feel intellectually and emotionally worn-out by my work	11%	19%	24%	31%	15%	30%	46%

Source: own study.

Based on the results of the survey, it can be concluded that the majority of the surveyed public administration employees admitted that they enjoy their work - as many as 79% of the respondents agreed with the statement and only 7% gave a negative answer (Table 3). The majority (60%) of respondents were optimistic about what the future holds. Nearly two-thirds of the respondents declared having a work-life balance.

Table 3.

Selected determinants of employees' occupational well-being (in %)

Statement	Definitely no	Rather not	Difficult to say	Rather yes	Definitely yes	Negative rating	Positive rating
I have a work-life life	2%	9%	24%	44%	20%	11%	64%
I look to the future with hope and enthusiasm	4%	13%	23%	43%	17%	17%	60%
I enjoy my job	2%	5%	13%	44%	35%	7%	79%

Source: own study.

The above opinions allow to optimistically assess the occupational well-being of public administration employees and to conclude that there is a good basis for influencing the well-being of employees. In order to do so, identification of the determinants of occupational well-being and their importance is needed.

5.2. Hierarchy of individual factors determining the occupational well-being of public administration employees

The research indicates that the most important factor determining the occupational well-being of public administration employees is job security (Table 4). It was ranked as the most important in the hierarchy, among the eight factors analysed, by more than a third of respondents.

Table 4.

Hierarchy of factors determining the occupational well-being of public administration employees

Factor	Average rank	Standard deviation	Factor ranked first (% of respondents)	Factor ranked last (% of respondents)
interesting job	3.5	2.2	26%	6%
job security	3.1	2.1	36%	4%
sense of fair pay	5.4	2.2	10%	7%
opportunity for personal development/growth	4.1	2.1	5%	16%
friendly atmosphere at work	5.3	2.0	9%	10%
prestige of the job	4.3	2.2	6%	23%
work-life balance	4.9	2.1	5%	12%

Source: own study.

Engaging work content came in at the second place. This factor was the most important for 26% of respondents. The importance of the next two factors, i.e. the opportunity for personal development and the prestige of the job, ranked in the middle of the scale and was similar. It is noteworthy that, in the opinion of the surveyed employees, three factors had little influence on the level of occupational well-being, namely: a friendly atmosphere at work, a sense of fair pay and a good rapport with the supervisor. The last one, i.e. rapport with the supervisor, is, according to the respondents, the least important of the eight factors analyzed.

5.3. Variability of factors determining the professional well-being of public administration employees

The hierarchy of factors determining occupational well-being established in the study represented the sentiments of the public administration employees surveyed as a whole. Therefore, further analysis was necessary to identify relatively homogeneous groups of employees in terms of factors determining occupational well-being.

For this purpose, a cluster analysis was performed. Using a one-way ANOVA test, the variables differentiating the distinguished groups were identified. To characterise them, selected personal characteristics (i.e. age, gender, education, post, type of contract) and organizational characteristics (i.e. company size) were adopted. It turns out that the characteristics differentiating public administration employees' opinions on their occupational well-being were only gender and the type of contract under which their occupational tasks are performed (for these variables statistical significance was obtained from tests of mean variables). By contrast, age, education, post, size of the company were not significant in differentiating the employees' sentiments.

The description of the distinguished clusters was preceded by an analysis of the structure of each cluster (Table 5). Cluster one was dominated by women (58%) and those employed under a contract of employment (94%). Cluster two was dominated by men (65%). Employment contracts also predominated here (78%), but a relatively large proportion of this group were sole proprietors (12%). In cluster three, the majority were men (58%) and employed on an employment contract. A relatively high proportion represented those employed under a Civil Law contract (11%).

Table 5.
Structural characteristics of the clusters

	Cluster I	Cluster II	Cluster III
Gender			
Female	58%	35%	42%
Male	42%	65%	58%
Type of contract			
Employment contract	94%	78%	82%
Civil Law contract	5%	10%	11%
Self-employment	1%	12%	7%

Source: own study.

By means of cluster analysis, three relatively homogeneous groups of workers were identified (Table 6) in terms of factors determining occupational well-being.

Table 6.
Clusters of factors determining occupational well-being

Factor	Skupienie I (N = 344)		Skupienie II (N = 423)		Skupienie III (N = 233)	
	mean rank	standard deviation	mean rank	standard deviation	mean rank	standard deviation
engaging job	4.6	2.2	2.7	2.1	2.6	1.6
job security	1.9	1.1	5.4	1.9	2.7	1.9
prestige of the job	6.7	1.5	6.0	2.1	3.6	1.7
sense of fair pay	3.2	1.7	3.4	2.0	5.6	1.7
opportunity for personal development	6.2	1.6	4.8	2.0	4.5	2.1
friendly atmosphere at work	3.6	1.7	4.4	2.5	5.2	2.1
work-life balance	5.2	1.8	4.0	2.1	5.2	2.3
good rapport with superiors	4.7	2.1	5.2	1.9	6.6	1.5

Source: own study.

Cluster one was represented by women, with employment contracts. What matters for the sense of occupational well-being is job security. A sense of fair pay and a friendly atmosphere at work also matter. The prestige of the job and the opportunity for personal development are of minor importance.

The second cluster included men, among whom a relatively high proportion were self-employed. The occupational well-being of these individuals was shaped primarily by the content of their work and their sense of fair pay. The prestige of their work was not important to them.

The third identified group was dominated by men, a relatively large proportion of whom were employed under Civil Law contracts. The content of their work and job security had a positive impact on their professional well-being. On the other hand, evaluation of the fairness of remuneration and, above all, good rapport with the supervisor did not play a role.

6. Summary

The positive and negative consequences of employees' occupational well-being prove that it is expedient to analyze the determinants in detail. As the research shows, the most important determinants of employees' occupational well-being in public administration institutions are job security and engaging work content. In contrast, their well-being is least influenced by good rapport with their supervisor. The research has shown that the power of the impact of individual factors varies according to gender and the type of contract under which occupational tasks are performed. Therefore, it is possible to distinguish three clusters of employees, with different perceptions of the psychological and physical conditions linked to the performance of professional tasks or functions, among employees of public administration institutions.

The above results suggest practical implications. The actions of employers and managers aimed at shaping the occupational well-being of employees require an individualised approach, which thus implies the need to create a comprehensive scheme of actions, incorporated into the system of human capital management in the company. Measures of an action-oriented, interventionist nature, for example successive bonus benefits and policies focused on health and material conditions do not fully meet these prerequisites.

References

1. Czaplński, J. (2012). Ekonomia szczęścia i psychologia bogactwa. *Nauka*, 1, 51-88.
2. Deloitte (2020). *Raport: Trendy HR 2020 | Polska Global Human Capital Trends 2020: Firmy odpowiedzialne w praktyce*. <https://www2.deloitte.com/pl/pl/pages/human-capital/articles/raport-trendy-hr-2020.html>.
3. Deloitte (2022a). *Od fali odejść do fali zmian Czy jesteśmy gotowi na nowe podejście do pracy?* <https://www2.deloitte.com/pl/pl/pages/human-capital/articles/employee-experience/Od-fali-odejsc-do-fali-zmian.html>
4. Deloitte (2022b). *Trendy: Dobre samopoczucie pracowników Well-being, dobrostan, równowaga*. <https://www2.deloitte.com/pl/pl/pages/human-capital/articles/trendy-dobre-samopoczucie-pracownikow.html>.
5. Diener, E., Suh, E.M., Lucas, R.E., Smith, H.L. (1999). SWB: Three decades of progress. *Psychological Bulletin*, 125(2), 276-302.

6. Dyrbye, L.N., Satele, D., Shanafelt, T. (2016). Ability of a 9-Item Well-Being Index to Identify Distress and Stratify Quality of Life in US Workers. *Journal of Occupational and Environmental Medicine*, 58(8), 810-817. <https://doi.org/10.1097/JOM.00000000000000798>.
7. Forgeard, M.J.C., Jayawickreme, E., Kern, M.L., Seligman, M.E.P. (2011). Doing the Right Thing: Measuring Well-Being for Public Policy. *International Journal of Wellbeing*, 1(1), 79-106. <https://doi.org/10.5502/ijw.v1i1.15>.
8. Gallup-Healthways (2017). *Well-Being, 5, Toolkit*. <http://static1.squarespace.com/static/55badabde4b0315175afa387/t/5679899ac647ad4d61528831/1450805658499/Workplace+Well-Being+5+FAQS.pdf>.
9. Ilska, M., Kołodziej-Zalewska, A. (2018). Dobrostan hedonistyczny i eudajmonistyczny w sytuacjach kryzysów normatywnych (Hedonic and Eudaimonic Well-Being in Situations of Normative and Non-Normative Crises). *Zeszyty Naukowe Politechniki Śląskiej*, 123, 155-184.
10. Johnson, S., Robertson, I.T., Cooper, C.L. (2018). *Well-being: Productivity and happiness at work*. Springer-Verlag.
11. Keyes, C.L.M., Shmotkin, D., Ryff, C.D. (2002). Optimizing Well-Being. *Journal of Personality and Social Psychology*, 82(6), 1007-1022. <https://doi.org/10.1037/0022-3514.82.6.1007>.
12. Lester, P.B., Diener, E., Seligman, M.E.P. (2022). Najlepsi pracownicy mają supermoc: są szczęśliwi. *Mit Sloan Management Review*, 14, 95-99.
13. Lipka, A. (2022). *Employee Experience. Zarządzanie kapitałem ludzkim w kategoriach rynku doznań*. PWE.
14. Nationale-Nederlanden (2021). *Dobrostan psychiczny w pracy*.
15. Peterson, M. (2022). *What well-being benefits do employees want to stay engaged at work*. Limeade. <https://www.limeade.com/resources/blog/research-finds-employees-engaged-employer-cares-well/>.
16. Ryan, R.M., Deci, E.L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141-166. <https://doi.org/10.1146/annurev.psych.52.1.141>.
17. Ryff, C.D. (2013). Eudaimonic well-being and health: Mapping consequences of self-realization. In: A.S. Waterman (Ed.), *The best within us: Positive psychology perspectives on eudaimonia* (pp. 77-98). American Psychological Association. <https://doi.org/10.1037/14092-005>.
18. Seligman, M.E.P. (2011). *Flourish: A Visionary New Understanding of Happiness and well-being*. Nicholas Brealey Publishing.
19. Simone, S. De. (2014). Conceptualizing wellbeing in the workplace. *International Journal of Business and Social Science*, 5(12), 118-122. https://ijbssnet.com/journals/vol_5_no_12_november_2014/14.pdf.

20. Tabor-Błażewicz, J. (2021). *Dobrostan pracowników. Koncepcje, zadania, wyniki badań*. SGH Oficyna Wydawnicza.
21. Zheng, X., Zhu, W., Zhao, H., Zhang, C. (2015). Employee well-being in organizations: Theoretical model, scale development, and cross-cultural validation. *Journal of Organizational Behavior*, 36, 621-644. <https://doi.org/10.1002/job.1990>.

INCREASING EFFECTIVENESS OF MANAGEMENT IN FOODSERVICE SECTOR THROUGH DYNAMIC DELIVERY PRICING MODEL

Angelika KANTOR^{1*}, Jakub KUBICZEK²

¹ Department of Consumer Research, University of Economics in Katowice; angelika.kantor@edu.uekat.pl,
ORCID: 0000-0002-3775-731X

² Department of Economic and Financial Analysis, University of Economics in Katowice;
jakub.kubiczek@edu.uekat.pl, ORCID: 0000-0003-4599-4814

* Correspondence author

Purpose: Due to the COVID-19 pandemic, the foodservice sector's activities have not only been limited but have also experienced a change – increase in demand for online order and delivery of food. Thus, improving the cost-effectiveness of food delivery is not so much as recommended, as it is necessary.

Design/methodology/approach: The aim of this study is to propose a dynamic model of delivery valuation. Using SWOT analysis, the significance of delivery presents itself as a factor influencing competitiveness. An IDI with suppliers allowed for the identification of weaknesses in the current delivery price models. Subsequently, a dynamic price model, based on the possibility of usage of publicly accessible data, was proposed.

Findings: Fixed delivery costs can reduce revenues and generate losses in the event of a high fluctuation in fuel prices. Therefore, it is crucial to properly evaluate delivery costs, taking into account not only the distance, but also other variables. The key factors of delivery costs include: one-time cost for the courier's course, distance, opportunity cost of a given delivery expressed as the possibility of making another delivery defined as delivery time. It should be emphasized that it ought to be determined by the volume of traffic at a given moment.

Originality/value: The proposed model provides solutions for the foodservice industry, allowing for optimization of delivery costs. The implementation of the dynamic model in a new market sector can be described as an innovation, which could help not only entrepreneurs, but also customers.

Keywords: foodservice sector, online order, food delivery, dynamic pricing model.

Category of the paper: Research paper.

1. Introduction

The environment has always determined the organizational situation (Gollay et al., 2016), but it is the information and communication technology (ICT) and the associated social effects that have made the virtual world the basis of contemporary relations, business and commercial alike (Ejemeyovwi et al., 2021). ICT as a tool creates great opportunities that grow in relation to the number of users (Sobczyk, 2018).

As a crucial component of technological evolution, digitization has the potential to significantly accelerate development (Miśkiewicz, Wolniak, 2020; Pollák et al., 2021). By more effectively adjusting a business to market conditions and discovering potential areas for new business ventures, the use of ICT tools enhances the decision-making process (Olszak, 2016). Therefore, it can be said that the use of ICT contributes to an enterprise's success (Gajdzik, Wolniak, 2022; Olszak, 2021). Every year, the number of Internet companies related to entertainment, food delivery, shopping, education, and remote work solutions grows significantly (Donthu, Gustafsson, 2020).

This is due to the fact that in the modern world most people communicate using the Internet, while also using it to obtain information and make purchases (Kieźel, 2010, p. 242). The consumer, by means of having access to the Internet, quickly and easily identifies his own needs, looks for rational and alternative solutions, purchases products that he has a preference for, which at the same time meet his expectations (Smyczek, 2012, p. 264).

The upward trend in Internet usage has been sped up by the COVID-19 pandemic as governments in efforts to slow the spread of the virus have focused on reducing transmissions by restricting movement and access to certain sectors of the economy. One of these sectors has been the foodservice industry, which had to adapt to the newly-imposed restrictions. To reach the consumer with its product, it was necessary to optimize operations as well as to look for alternatives (Ziętara, 2022). During the COVID-19 pandemic, entrepreneurs had to quickly introduce the possibility of order delivery, while others had to prepare for an increase in the intensity of deliveries. Some of them even ceased their standard brick-and-mortar operations, fulfilling only take-out or delivery orders (Badowski, 2020). Along with the increase in the number of deliveries made by the foodservice sector, the problem of pricing the delivery is becoming more and more visible. As a result, the issue of the valuation of the cost of food supplies is more and more often discussed in the literature (MacKay, Svartbäck, Ekholm, 2022).

The delivery price is fixed or calculated based on distance. Considering distance as the sole variable for estimating the cost of delivery does not optimize the price, because in the event of increased traffic, the driver needs more time to reach the destination. Consequently, he is unable to make alternative deliveries and loses time for based on which he is compensated. Therefore, it is reasonable to look for alternative methods of evaluating delivery costs.

Deliveries are the basis of Internet activity; therefore, the pricing model is important since it determines the amount of profits in a significant manner (Asdemir, Jacob, Krishnan, 2009). Dynamic pricing models are furthermore seen as fairer as compared to fixed pricing (Narahari, Raju, Ravikumar, Shah, 2005). In addition, they are able to react to changing market conditions, and in the case of deliveries, they immediately consider information about the volume of traffic (MacKay, Svartbäck, Ekholm, 2022). Dynamic pricing models have been in use for decades (McAfee, Te Velde, 2007) - they are used in the sale of airline tickets (Burger, Fuchs, 2005) or stadium seats (Kemper, Breuer, 2016). The catering sector is different from e-commerce. First of all, food is usually consumed as soon as it is delivered. In addition, there is no maximum number of orders for the entire day, yet delivery is a limitation to that. After it is no longer available, restaurateurs disable the option of ordering food with delivery. It should be emphasized that the exhaustion of the pool of the available supply does not increase its price, which is in stark contrast to the case of purchasing online tickets (Shukla et al., 2019).

The aim of the study is to put forward a proposal for a dynamic delivery pricing model that takes into account the real-time traffic volume and uses commonly available information technology (IT) tools. Therefore, the purpose of this study is of a theoretical nature, based on a case study of the foodservice sector. In order to achieve this, the following research questions were posed:

1. Are the currently used valuation methods optimal? If not, what are the reason?
2. What affects the delivery cost? What should be the specification of the delivery pricing model?
3. What are the strengths and weaknesses of the analyzed enterprises in the foodservice industry? What are the opportunities and threats?

2. The foodservice industry situation caused by the COVID-19 pandemic

The epidemiological emergency, which began at the beginning of 2020, forced enterprises to adapt to new conditions. The functioning of all industries in Poland was influenced by regulations imposed by the Minister of Health on March 13, 2020, which came to force the following day (i.e. March 14, 2020), introducing a state of epidemiological emergency. Enterprises were forced to reduce their activities overnight. The extensive duration of the pandemic and recurring restrictions meant that some sectors required government assistance to continue their operations and adapt to the new market conditions (Kubiczek, Derej, 2021). According to the data from the Central Register and Information on Economic Activity (2020), about 60,000 enterprises decided to suspend or wind up their business.

The introduced restrictions had the greatest impact on the small and medium-sized enterprise sector (Lves et al., 2020). The greatest risk is cash flow which is the result of limited and low-level income or reduction in its entirety, with the presence of constant expenses (Lu, Wu, Peng, Lu, 2020). The discussed situation was especially visible in the foodservice industry around the world (Spanulescu, Gheorghiu, 2020). The reason for that was not only government-imposed restrictions, but also the changes in conditions of functioning of the demand side.

Decision-making is a complex process, the key element of which is the situational context. The choice of a given variant may be made under the conditions of certainty, uncertainty, or risk (Holska, 2016). An extraordinary situation is decision making under the conditions of a pandemic, where concern for health is the determining factor.

The desire to distance people from each other and reduce the risk of infection has made the online shopping of food products a global trend (Guo et al., 2021). It has been proven that the desire to feel safe in case of mounting infections increased the likelihood of using the Internet to buy food products (Gao et al., 2020). Furthermore, the introduced restrictions limited consumption in gastronomic establishments, thus forcing the use of their services with personal pickup or the option of delivery to a specified address (Harms et al., 2021). It should be emphasized that the monthslong, repeated lockdown strengthened the preference for online food purchases and the use of take-away food services (Guo et al., 2021; Wang et al., 2020; Ziętara, 2022). The combination of restrictions limiting the activities of gastronomic establishments along with changes in consumer behavior resulted in a synergistic effect in the transformation of the demand for food products, increasing the demand for deliveries (Hadasik, Kubiczek, 2022).

Therefore, the COVID-19 pandemic has significantly changed the functioning of the foodservice sector in Poland (Grochowicz, 2020). Some of the companies have changed the model of their operation, and new restaurants have been created that carry out take-away or delivery orders (Badowski, 2020). The result is a significant increase in competition in the foodservice industry with this competition now, in addition to such factors as price volatility, dependence of revenues on arbitrary factors, as well as inconsistent and ever-changing tax law, a threat to maintaining and developing the business (Kantor, 2021). Therefore, there exists a need to, among other actions, gain customer loyalty and build relationships with them (Kantor, 2021).

During the COVID-19 pandemic, the main issue in the operation of the foodservice industry was to provide existing customers with the possibility of using the restaurants' services. In response to the introduced restrictions, as well as in order to maintain safety of the consumer, enterprises from the sector in question introduced several changes in their operations, such as enabling contactless payments, particularly card payments (Iwańczuk-Kaliska et al., 2021), or extending the possibility of ordering via the Internet, including the implementation of deliveries (Ziętara, 2022). However, the newly-entrenched consumers preferences and the

delivery system adapted to them make it impossible to return to previous solutions (Lu et al., 2020). Therefore, one should focus on the optimization of the current system by looking for new and more effective solutions, including the delivery pricing model.

3. Methods

The commencement of the conceptualization of the process of the dynamic delivery pricing model was preceded by a SWOT analysis, which was to define the delivery as a competitive factor in the foodservice services sector. The obtained results constitute the background for the further part of the study.

The objective scope of the study was the foodservice sector, while the subjective scope was the evaluation of delivery costs. The research method used was a case study. However, to optimize the structure of the proposed model, a triangulation was used, taking into account quantitative and qualitative data. The quantitative data was both secondary (the situation of the foodservice sector) and primary (delivery costs for individual premises). Qualitative data was obtained by conducting in-depth interviews with delivery couriers in the city of Sosnowiec. Individual In-depth Interviews (IDIs) were carried out on from April 28 until May 3, 2022, and 4 drivers from 3 restaurants took part in them. The aim of the individual in-depth interviews was to identify weaknesses of the currently used delivery models and factors influencing the pricing of delivery. The questions in the IDIs concerned the current delivery model and valuation costs, as well as perceived problems with the current model. In addition, drivers were asked to evaluate the delivery system functioning up to that point, both in terms of the effectiveness of deliveries (route optimization) as well as costs.

In the study, the cost of delivery c will be treated as an endogenous variable, while α will be the constant term defining the basic cost of delivery for all deliveries.

The general specification of the delivery cost pricing model can be written as follows:

$$c = \alpha + X \quad (1)$$

where X – vector of variables affecting the delivery cost.

The course of the research process was as follows:

1. Noticing the problem of the stability of delivery costs.
2. Defining delivery as a competitive factor – SWOT analysis.
3. Verification of the effectiveness of the use of fixed delivery costs – conducting IDIs.
4. Identification of the causes of ineffectiveness.
5. Determining the determinants of delivery cost.
6. A proposal for a dynamic delivery pricing model.

4. Methods

4.1. Delivery as a competitive factor

Businesses in the foodservice sector should assess their strengths and weaknesses and concentrate on the characteristics of the environment in order to adjust to the competitive environment. It is possible to use a SWOT analysis for this purpose. The basic form of this analysis is utilized in this study to highlight potential challenges and possible threats in the area of delivery in the foodservice sector. The analysis is presented in Table 1.

Table 1.

SWOT analysis for the surveyed enterprises from the foodservice industry

Strengths	Weaknesses
<ul style="list-style-type: none"> • long period of cooperation with couriers (trust) • knowledge of the city's topography by drivers • long range of deliveries • diversification of means of transportation (cars and bicycles) 	<ul style="list-style-type: none"> • organizational problems • ignorance of current trends • ineffective delivery pricing • long delivery time • employee dissatisfaction • expensive to maintain vehicles (outdated models)
Opportunities	Threats
<ul style="list-style-type: none"> • development of modern technologies and information systems • ability to reach new customers 	<ul style="list-style-type: none"> • price volatility (including fuel, take-out packaging, electricity) • changing regulations and laws (suppliers on scooters) • increased competition in the market

Source: own study.

The couriers are part of the strengths in the area of delivery. Long-term cooperation can result in increased trust. Such a courier can carry out the courses faster, because during the course he focuses fully on the work and knows the topography of the city well. The long range of deliveries makes it possible to reach customers within the city and even neighboring cities. Delivery times can be improved by using a variety of delivery vehicles, e.g. cars and bikes. Couriers on bikes, who won't be slowed down by traffic, can perform better in densely populated areas. Customers who value environmentally friendly solutions can also positively view this delivery technique.

Issues with management are among the weaknesses, such as difficulties operating various platforms in the field of foodservice at the same time, and the lack of optimization of the drivers' routes. City-wide deliveries and deliveries to neighboring cities can cause long delivery times and thus customer dissatisfaction. Delivering minimum-value orders to remote parts of cities may be considered counterproductive. It may turn out that there are solutions on the market that can improve the procurement and delivery process. However, managers or owners are not familiar with contemporary trends. Vehicles used by restaurants may be ineffective and expensive to maintain. If the supplier has his own vehicle, the employer covers the necessary expenses, and with certain car models, these can be very high. As a result of the aforementioned problems, general dissatisfaction for employees may arise.

Among the distinguished opportunities in the area of deliveries, the development of modern technologies was noted, which means the possibility of using new, dedicated applications for foodservices. Cooperation with food delivery platforms such as Pyszne.pl can help attract new customers. New solutions and the possibility of using ICT systems can improve the delivery process and determine the optimal delivery cost. Enterprises can use couriers working for established brands such as Uber Eats, Glovo.

As threats indicated were the volatility of prices related to the execution of the delivery, where particular attention should be paid to the increase in the prices of fuel and electricity as well as disposable packaging. The volatility of regulations and laws relates both to the growing costs of maintaining a business and the modernization of regulations in the context of modern technologies that can be used by an enterprise. Although modern technologies may allow to gain new customers, only with proper use of their potential, a significant increase in competitiveness could be achieved.

In summary, considering each column of the SWOT matrix (Table 1) proves the importance of delivery as a factor that influences competitiveness. It is necessary to include ICT in business, since it can be a source of increasing efficiency, e.g. order fulfillment for regular customers, and on the other hand, it allows to attract new customers. Furthermore, proven suppliers who know the topography of the city are able to deliver the order using cars and bicycles. Thanks to this, it is possible to build a positive image of the company, and, thus, attract new customers. A fast and efficient method of delivery could build a competitive position on the market, especially when new companies appear. Contracting bicycle couriers may prove efficient given the rising costs of fuel. Then management issues, such as excessive number of deliveries or mistaken orders, may create a negative public perception. Moreover, inappropriate use of ICT can limit the exploitation of the opportunities that technology brings. The highlighted delivery weaknesses may increase the risk associated with the threats. Vehicles that are expensive to maintain can increase the financial burden on enterprises. Setting a fixed price with high volatility of its determining factors may generate costs greater than the revenues from the delivery.

4.2. Identification of variables determining delivery costs – IDI results

The defined research area determined the course of the research process, as well as the approach to each of its stages. The identified problem, expressed as the ineffectiveness of the current delivery cost system, was subjected to a deeper analysis with the use of IDIs. In table 2 the respondents' statements were presented along with the identified weakness in the current approach to the calculation of delivery costs.

Table 2.*Identification of weaknesses in the current delivery cost model*

Driver	Statement	Identified weakness
M (64 y/o)	"The price of delivery is independent of the time I spend on commuting - during rush hours it is the same as off-peak hours, and I waste more time"	Price based only on distance, not traffic
M (19 y/o)	"In our company, it is annoying that the deliveries are made in sequence, sometimes I could take something next door, but another driver gets it" "I could do two close runs instead of one far run. Besides, for two close ones I would earn more, because what is counted is the individual run" "Sometimes there is such a traffic that we lack drivers and other times two go to the same place at the same time"	No route optimization Opportunity cost for short versus long deliveries
M (37 y/o)	"I don't like going to the city center, because it happens that I get stuck in a traffic jam and the next deliveries are already waiting for me" "It happened that someone ordered over the phone and did not pick up the order later"	Traffic No order verification
F (34 y/o)	"The waiting time for the customer, sometimes 15 minutes after the order has been placed, is a problem. In that time I could make a different delivery"	Time spent on delivery

Source: own study.

The main problems were identified as a derivative of not taking into account the volume of traffic when carrying out a delivery. Furthermore, it should be noted that with the help of the traffic flow, the opportunity cost can be determined similarly to the route efficiency for a given provider. The next step was to determine the variables that are currently included in the valuation of delivery costs (Table 3).

Table 3*Identification of the variables affecting the cost of delivery*

Driver	Statement	Delivery cost factor identified
M (64 y/o)	"I do not know how the prices are set, but for the same amount I go to the end of Dąbrowa Górnicza and further parts of Sosnowiec, it takes much more time"	Fixed cost (α)
M (19 y/o)	"We have 3 price zones for deliveries which depend only on the distance" "The price does not depend on the form of payment, it is faster when someone prepays the order, because then I only hand it over and go on"	Distance Payment method
M (37 y/o)	"We don't include packaging costs in the delivery cost, as others do. We include it in the price of the items from the card" "The only thing is whether someone has to place a minimum-amount order or we will increase the cost of delivery"	Additional aspects related to delivery The entrepreneur's profit from the delivery
F (34 y/o)	"Sometimes it happens that I go once to the same place and it takes 10 minutes, and once for 20 - but the cost for the buyer is the same"	Fixed cost (α)

Source: own study.

4.3. A proposal for a shipping cost pricing model

A delivery cost based only on distance can be written as follows:

$$c_s = \begin{cases} c_{s_1} & \text{when } 0 < s < s_1 \\ c_{s_2} & \text{when } s_1 < s < s_2 \\ \dots & \\ c_{s_n} & \text{when } s > s_n \end{cases} \quad (2)$$

The answers of the respondents confirm that the presented approach is ineffective. In addition, IDIs allowed for the identification of factors determining the cost of delivery and classification into two groups:

- fixed (e.g. driver's remuneration for each trip, defined delivery zone),
- variable (e.g. traffic volume, number of packages).

Therefore, the proposal for the deconstruction of the model (1) will contain aspects independent of the order expressed as α and factors of the variables X. It should be noted that some of the X variables can be expressed as a combination of other factors, e.g. using the formula for delivery time:

$$t = \frac{s}{v} \quad (3)$$

where:

t – delivery time,

s – route,

v – average delivery speed.

It is worth emphasizing that s is constant, so t depends on the average speed of delivery, which is mainly influenced by the traffic volume (tv). In addition, the smoothness of driving translates into fuel consumption (m), which can also be estimated using the traffic volume. The distance and traffic intensity also affect the possibility of alternative deliveries, e.g. three shorter ones instead of a longer one. The opportunity cost of delivery will be denoted by the variable a . Using the dynamic approach makes it necessary to express c_s as a function:

$$c = \alpha + f(m|tv, t_s|tv, a|t_s) \quad (4)$$

In addition to the fixed cost (α) for delivery, independent of the delivery characteristics, e.g. packaging prices, the model takes into account the traffic volume, which allows for the estimation of delivery costs, fuel consumption depending on the traffic situation, time for delivery, and therefore also the opportunity cost for other supplies. Therefore, the concept of a dynamic delivery cost pricing model makes it necessary to determine the volume of traffic as it affects many aspects related to it. Utilizing contemporary technologies, such as cell phone signal analysis, might be useful when estimating the volume of traffic.

5. Conclusions

Delivery is a key aspect of the business activity in the foodservice sector and can be seen as a factor of the company's competitiveness, which was confirmed by the SWOT analysis performed. Delivery may be an opportunity to attract new customers, as well as to fulfill orders from regular customers. However, numerous errors in their implementation, such as delivering later than expected or mistaking orders pose a threat to the business. Fixed delivery costs can reduce revenues and generate losses in the event of a high fluctuation in fuel prices. Therefore, it is crucial to properly evaluate delivery costs, taking into account not only the distance, but also other variables. This is particularly important as the COVID-19 pandemic has changed consumer behavior, increasing e.g. the number of deliveries.

The current delivery cost models are based on the average cost of delivery, which, as the suppliers themselves note, does not lead to optimization. This is due to the basic observation that delivery conditions are never constant but rather highly volatile. For example, it may turn out that for close deliveries the cost would be lower than assumed, and for long-distance deliveries in the event of transport congestion, it would be very high. These problems can be solved using a dynamic model of delivery costs pricing.

Although determining the cost of a specific delivery is a complex process, as indicated by the persons directly involved in deliveries, the key factors of delivery costs include: one-time cost for the courier's course, distance, opportunity cost of a given delivery expressed as the possibility of making another delivery, defined as delivery time. It should be emphasized that it ought to be determined by the volume of traffic at a given moment. Considering the traffic volume is necessary in order to optimize the delivery price, and its determination can be done using ICT, although simple solutions, such as Google Maps, are also available. It should be noted that the impact of the individual components of the cost of delivery should be presented transparently to the customer.

Despite the diversification of data sources, the used methods, and due diligence, it was not possible to eliminate the shortcomings of the study. The primary limitation of the study, as in the case of all conceptual research, is proposing a theoretical model that has not been empirically verified. Therefore, it is, in a way, an initial framework for further research and development, especially when optimizing the structure and parameters of the model. A considerable issue is, although in line with the assumptions of the methodology, the small number of cases which the considerations are based on. Including more cases may reveal other problems and additional ways of considering other factors affecting the height of the shipping cost.

Nevertheless, though the study was theoretical, it was based on a real problem, providing many practical applications. The proposed model provides solutions for the foodservice industry, allowing for the optimization of delivery costs. The considered model in the study is

not a particular novelty, as the dynamic price models currently in use are implemented in the valuation of transportation services, including UBER and BOLT. The implementation of a dynamic model in a new market sector can be described as an innovation, which could help not only entrepreneurs, but also customers. An extension of the considerations presented in this study would be the application of the proposed approach in practice. Therefore, future research may focus on the implementation of the model and its empirical verification.

References

1. Asdemir, K., Jacob, V.S., Krishnan, R. (2009). Dynamic pricing of multiple home delivery options. *European Journal of Operational Research*, 196(1), 246-257. <https://doi.org/10.1016/j.ejor.2008.03.005>.
2. Badowski, M. (2020). Nowy trend i sposób na prowadzenie restauracji w czasie pandemii. „Teraz każda restauracja która jeszcze operuje jest dark kitchen”. Retrieved from <https://strefabiznesu.pl/nowy-trend-i-sposob-na-prowadzenie-restauracji-w-czasie-pandemii-teraz-kazda-restauracja-ktora-jeszcze-operuje-jest-dark-kitchen/ar/c3-14951008>, 18.06.2022.
3. Burger, B., Fuchs, M. (2005). Dynamic pricing—A future airline business model. *Journal of Revenue and Pricing Management*, 4(1), 39-53.
4. Donthu, N., Gustafsson, A. (2020). Effects of COVID-19 on business and research. *Journal of Business Research*, 117, 284-289. <https://doi.org/10.1016/j.jbusres.2020.06.008>.
5. Ejemeyovwi, J.O., Osabuohien, E.S., Bowale, E.I.K. (2021). ICT adoption, innovation and financial development in a digital world: empirical analysis from Africa. *Transnational Corporations Review*, 13(1), 16-31. <https://doi.org/10.1080/19186444.2020.1851124>.
6. Gajdzik, B., Wolniak, R. (2022). Influence of Industry 4.0 Projects on Business Operations: Literature and Empirical Pilot Studies Based on Case Studies in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 44. <https://doi.org/10.3390/joitmc8010044>.
7. Gao, X., Shi, X., Guo, H., Liu, Y. (2020). To buy or not buy food online: The impact of the COVID-19 epidemic on the adoption of e-commerce in China. *PLOS ONE*, 15(8), e0237900. <https://doi.org/10.1371/journal.pone.0237900>.
8. Gollay, I.N., Gollay, A.V., Shindina, T.A., Salimonenko, E.N., Chuvashova, A.D. (2016). Priority areas of analysis of the external environment of a company-innovator depending on a type of introduced innovations. *Polish Journal of Management Studies*, 13(2), 58-68. <https://doi.org/10.17512/pjms.2016.13.2.06>.

9. Grochowicz, M. (2020). Sytuacja branży gastronomicznej w pierwszych miesiącach trwania pandemii COVID-19 na przykładzie Krakowa. *Urban Development Issues*, 67, 5-16. <https://doi.org/10.2478/udi-2020-0029>.
10. Guo, H., Liu, Y., Shi, X., Chen, K. Z. (2021). The role of e-commerce in the urban food system under COVID-19: lessons from China. *China Agricultural Economic Review*, 13(2), 436-455. <https://doi.org/10.1108/CAER-06-2020-0146>.
11. Hadasik, B., Kubiczek, J. (2022). E-commerce market environment formed by COVID-19 pandemic – a strategic analysis. *Forum Scientiae Oeconomia*.
12. Harms, R., Alfert, C., Cheng, C.F., Kraus, S. (2021). Effectuation and causation configurations for business model innovation: Addressing COVID-19 in the gastronomy industry. *International Journal of Hospitality Management*, 95, 102896. <https://doi.org/10.1016/j.ijhm.2021.102896>.
13. Holska, A. (2016). Teorie podejmowania decyzji. In: K. Klincewicz (Ed.), *Zarządzanie, organizacje i organizowanie – przegląd perspektyw teoretycznych* (pp. 239-252). Warszawa: Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego.
14. Iwańczuk-Kaliska, A., Marszałek, P., Schmidt, K., Warchlewska, A. (2021). *Ocena zmian na rynku płatności w Polsce* (Sygn. Wib Pab 10/2021).
15. Kantor, A. (2021). Ryzyko działalności gospodarczej w branży gastronomicznej w kontekście COVID-19. In: *Współczesne uwarunkowania zarządzania organizacjami w kontekście młodych naukowców* (pp. 102-116). Wydawnictwo Naukowe Akademia WSB.
16. Kemper, C., Breuer, C. (2016). How efficient is dynamic pricing for sport events? Designing a dynamic pricing model for Bayern Munich. *International Journal of Sport Finance*, 11(1), 4-25.
17. Kieźel, E. (Ed.). (2010). *Konsument i jego zachowania na rynku europejskim*. PWE.
18. Kubiczek, J., Derej, W. (2021). Financial performance of businesses in the COVID19 pandemic conditions—comparative study. *Polish Journal of Management Studies*, 24(1), 183-201. <https://doi.org/10.17512/pjms.2021.24.1.11>.
19. Lu, Y., Wu, J., Peng, J., Lu, L. (2020). The perceived impact of the Covid-19 epidemic: evidence from a sample of 4807 SMEs in Sichuan Province, China. *Environmental Hazards*. <https://doi.org/10.1080/17477891.2020.1763902>.
20. MacKay, A., Svartbäck, D., Ekholm, A.G. (2022). *Dynamic Pricing and Demand Volatility: Evidence from Restaurant Food Delivery*. Available at SSRN 4164271.
21. McAfee, R.P., Te Velde, V. (2007). *Dynamic Pricing in the Airline Industry*. Working Paper, Pasadena: California Institute of Technology.
22. Miśkiewicz, R., Wolniak, R. (2020). Practical Application of the Industry 4.0 Concept in a Steel Company. *Sustainability*, 12(14), 5776. <https://doi.org/10.3390/su12145776>.
23. Narahari, Y., Raju, C.V.L., Ravikumar, K., Shah, S. (2005). Dynamic pricing models for electronic business. *Sadhana*, 30(2), 231-256.

24. Olszak, C.M. (2016). Toward better understanding and use of business intelligence in organizations. *Information Systems Management*, 33(2), 105-123. <https://doi.org/10.1080/10580530.2016.1155946>.
25. Olszak, C.M. (2021). *Business Intelligence and Big data. Drivers of organizational success*. Taylor & Francis Group.
26. Pollák, F., Konečný, M., Ščeulovs, D. (2021). Innovations in the Management of ECommerce: Analysis of Customer Interactions during the COVID-19 Pandemic. *Sustainability*, 13(14), 7986. <https://doi.org/10.3390/su13147986>.
27. Rozporządzenie Ministra Zdrowia z dnia 13 marca 2020 r. w sprawie ogłoszenia na obszarze Rzeczypospolitej Polskiej stanu zagrożenia epidemicznego (Journal Of Laws, item 433 and 441).
28. Shukla, N., Kolbeinsson, A., Otwell, K., Marla, L., Yellepeddi, K. (2019). *Dynamic pricing for airline ancillaries with customer context*. Proceedings of the 25th ACM SIGKDD International Conference on knowledge discovery & data mining, pp. 2174-2182. <https://doi.org/10.1145/3292500.3330746>.
29. Smyczek, S. (2012). *Consumer behavior on international market*. Placet.
30. Sobczyk, G. (2018). Zachowania konsumentów wobec nowych trendów konsumpcji – wyniki badań. *Annales Universitatis Mariae Curie-Skłodowska, Sectio H Oeconomia*, 52(1), 171-180. <https://doi.org/10.17951/h.2018.52.1.171>.
31. Spanulescu, I., Gheorghiu, A. (2020). The impact of Coronavirus Covid-19 on world economy – an econophysics approach and model. *Hyperion International Journal of Econophysics New Economy*, 13(1), 7-19.
32. Wang, Y., Hong, A., Li, X., Gao, J. (2020). Marketing innovations during a global crisis: a study of China firms' response to COVID-19. *Journal of Business Research*, 116(May), 214-220. <https://doi.org/10.1016/j.jbusres.2020.05.029>.
33. Ziętara, H. (2022). Logistics Support as a Key Success Factor in Gastronomy. *International Journal of Social and Business Sciences*, 16(4), 192-198.

CRAFT DEVELOPMENT IN LEARNING ORGANIZATION (LO): ECONOMIC APPROACH

Elżbieta KARAŚ¹, Katarzyna ŁUKANISZYN-DOMASZEWSKA^{2*}

¹ Opole University of Technology, Faculty of Economics and Management, Department of Enterprise Management, E-Business and Electronic Economy; e.karas@po.edu.pl, ORCID: 0000-0002-2211-6173

² Opole University of Technology, Faculty of Economics and Management, Department of Regional Policy and Labour Market, k.lukaniszyn-domaszewska@po.edu.pl, ORCID: 0000-0002-2165-5095

* Correspondence author

Purpose: The aim of the study is to show that the craft is a form of learning organization, which in its activity takes into account the aspect of continuous training of employees and improvement of all functional areas.

Design/methodology/approach: The main approach and subject of the analysis was the level of knowledge and general theoretical and state-legal findings of the information available in the literature about the craft sector and the possibilities of developing and supporting enterprises in the SME sector. The basic research method was the use of desk research, and on the basis of the information collected in this way, an analysis of the possibilities and impact of support programs for the craft sector in Poland was conducted.

Findings: The article presents the idea of a learning organization from the aspect of craft enterprise development, the process of knowledge building, and the assumptions and principles of using the Polish Craft Incubator Program. The main result of this study is to illustrate the situation with regard to craft enterprises and the possibilities of their development in the current socio-economic conditions.

Research limitations/implications: The data and conclusions were drawn up on the basis of an overall assessment (analysis of secondary sources) and not on the basis of facts (primary studies). The prepared applications should be a prerequisite for further research in the field of crafts in Poland.

Practical implications: An additional practical result is to indicate the possibility of using the Polish Craft Incubator program as a source of obtaining financial resources in the learning process.

Originality/value: The value of the paper is to increase the awareness of owners of craft enterprises, by showing them the possibility of using new organizational concepts and government programs. The article has primarily educational value and is a general concept of stimulating creative action towards building learning organizations. The content of the article is addressed to craftsmen and all cooperating entities operating in the field of supporting crafts.

Keywords: Learning organization, learning orientation, organizational learning, economic development, sustainable craft.

Category of the paper: General review.

1. Introduction –the concept of a learning organization

In today's economy, craft companies have a great opportunity to gain new markets for the products and services they provide. There is a novel trend towards the individualization of customer needs, which is an opportunity for craft enterprises as more flexible market entities in terms of structures and management from global corporations. The adaptation to environmental conditions, technological changes, new customer needs, requirements of employed employees forces companies to change the way they operate on the market - craft companies react much faster to changes of this kind. They are focused on raising qualifications, developing skills, implementing innovative ideas, stimulating creativity to meet the individual needs of customers.

Therefore, it is important to create the right conditions for employees to show a desire to innovate, acquire knowledge, to want to influence the development of the company through knowledge, skills and motivation. This is related to the learning processes of individual employees as well as the entire organization.

In this respect, the continuity of the "craft experience" and the centuries-old model of acquiring qualifications based on professional preparation in the form of "learning through work" and a process of continuous learning are important (Polish Craft Incubator Program, 2022).

The craft is the key element of cultural heritage, the artefact of the master's consciousness, found expression in the transmission of knowledge, skills and craft culture to the next generation of craftsmen. Education in craftsmanship is based on both the trust in the master and on the social commitment of the master. The master's commitment is primarily used by young people who gain qualifications in craftsmanship (Bielawska, 2016).

In order to strengthen the position of craft, it is therefore necessary to cooperate, communicate and be open to change, building a culture that is characterized by the fact that (Zimniewicz, 2009):

- is open to experiments and new experiences,
- encourages responsible decision-making,
- is ready to accept mistakes and constantly learn.

Consequently, from the perspective of a craft organization, the learning process and learning orientation are very important. As learning is a fundamental tool in the organization, learning orientation forms a foundation for explorative learning and is about the direction and intensity of learning (Alerasoul et al., 2022).

The aim of the paper is to show that the craft is a form of learning organization, which in its activity takes into account the aspect of continuous training of employees and improvement of all functional areas. The pursuit of masterful execution of the task is the priority of each subject and the essence of the craft profession. Currently, support programs that teach and

develop various craft areas are coordinated by the government program Polish Craft Incubator. The article presents the idea of a learning organization from the aspect of craft enterprise development, the process of knowledge building and the assumptions and principles of using the Polish Craft Incubator Program.

2. Learning organization, learning orientation, organizational learning – theoretical approach

A learning organization is one that builds its advantage on the basis of unique knowledge and special competencies and is able to push the boundaries in value creation to a more perfect degree than traditional companies do (Malara, 2007). In this approach, learning processes are treated as key processes of the organization (Malone, 2002) and are intended to enable building and maintaining a competitive advantage in the market. This approach is very appropriate to the importance of craft in the modern world. The concept from 1988 is still valid and contains the most important statements (Mikuta et al., 2002), namely:

- learning is a fundamental value in the organization,
- all members of the organization participate in the learning process,
- the learning process is planned and organized,
- the organization knows not only how to learn, but also how to innovate,
- learning should be continuous and conscious.

Since learning is a fundamental tool in the organization, learning orientation forms a basis for exploratory learning (i.e., proactive, generative, or two-track) and concerns the direction and intensity of learning (Alerasoul et al., 2022). Direction appears to be influenced by the presence of a shared vision within the organization, as is learning intensity, defined as the motivation determined by commitment and open-mindedness toward knowledge creation and use (Sinkula et al., 1997).

In addition, the learning orientation represents a set of values that affect the extent to which an organization is satisfied with the theories (Argyris, Schön, 1997), mental models, and dominant logics it uses, which may or may not have a basis in the marketplace (Baker, Sinkula, 1999).

Thus, the learning orientation can be viewed as a dimension of strategic alignment that provides a foundation for both internal knowledge creation and external knowledge generation, e. g. from market, technology, competition, or socio and economic system (Calantone et al., 2002).

The aim of the learning orientation is to transfer the learned knowledge to the workplace and create capabilities that are both effective and efficient (Song, Chermack, 2008).

Basically, organisation should have the culture that fosters the organizational learning climate in order to facilitate the path for the intuiting of individuals and team members, and the interpreting and integrating of information (Cook, Yanow, 1993). In this way an organizational culture is characterised by crucial values (Bui, Baruch, 2010) such as a long-term vision, corporate-level systemic thinking, interactive communication, trust, respect and diversity encouragement, teamwork, collaboration, personal empowerment, tolerance of ambiguity, uncertainty and errors, and continuous improvement (Alerasoul et al., 2022).

On the other hand, the innovative organization can be developed from the foundation of the educational organization. To create a truly innovative organization, people should share the same vision of innovation. They should work closely together and find synergies in teams, as the team is stronger than the total (Ng, Pak Tee, 2004).

Generally, scholars have proposed a variety of definitions of learning organizations. Table 1 shows selected definitions of learning organizations.

Table 1
Selected definitions of learning organizations

Author	Definition
P. Senge	A learning organization is a place where people are constantly expanding and developing their abilities to achieve the desired results, where people are constantly learning how to learn together, and a place where people are constantly discovering that they are creating reality and how they can create it.
M. Pedler, K. Aspinwall	A learning organization is a company that facilitates learning for all its members and is constantly transforming.
W.M. Grudzewski, I.K. Hejduk	An intelligent organization is a learning and self-improvement organization in which people at all levels individually and collectively are constantly working to achieve the results and knowledge they really care about.
A. Zaliwski	An organization that acquires and implements knowledge into organizational structures, products, processes, and practices (and wherever possible).
Cz. Sikorski	A maximally flexible organization in which routine, habits and stereotypes do not replace dynamic reality
K. Perechuda	The learning organization and its essence boils down to continuous investment in human resources oriented to the internalization of internal knowledge.
D.A. Garvin	A learning organization is an organization proficient in the implementation of the tasks of creating, acquiring and transferring knowledge, and in modifying its behavior in response to new knowledge and experience
B. Wawrzyniak	A learning organization means the renewal of the enterprise, the internationalization of the board, changes in technology and technology, increasing social responsibility.

Source: Karaś E., Piasecka-Głuszak A., *Nowy wymiar organizacji – organizacja ucząca się a organizacja inteligentna*, Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu, No. 3(41), 2014, p. 3.

Within this view of organizational learning, the research examines, among other things, how organizations learn from direct experiences, how organizations learn from the experiences of others, and how organizations develop conceptual frameworks or paradigms for interpreting those experiences (Levitt, March, 1988).

Organizational learning (OL) is critical to organizational survival and has led to a considerable number of conceptual and empirical studies (Alerasoul et al., 2022). A clear definition of learning has proven difficult over the years. Organizational theorists have long been concerned with learning. Most scholars view organizational learning as a process that

unfolds over time and associate it with acquiring knowledge and improving performance. However, they differ on other important issues.

The concept of LO focuses on learning as a tool, a lever, and a philosophy for sustainable change and renewal in organizations in a rapidly changing world (Bui, Baruch, 2010).

Organizational learning means the process of improving actions through better knowledge and understanding. It is argued that behaviour change is required for learning to occur. Some scholars cite information processing as the mechanism by which learning occurs. Others suggest shared cognitions, organizational routines, and even memory. And some suggest that organizational learning is common, while others believe that erroneous, self-serving interpretations are the norm (Stata, 1991).

Moreover, OL as a dynamic capability plays an important role in the acquisition and transfer of relevant knowledge, strategic flexibility, competitive strategy implementation, and innovation performance of organizations (Hung et al., 2011).

The learning organization can be defined both in terms of the outcomes that can be used to judge whether the organization has learned or not, and the process that the organization must change to embed learning (Watkins, Marsick, 1992).

In general, a learning organization is one that is able to create, acquire, and transfer knowledge and change its behaviour to incorporate new knowledge and insights.

This definition assumes a simple truth: New ideas are essential to learning. Sometimes they arise *de novo*, through flashes of inspiration or creativity; sometimes they come from outside the organization or are shared by knowledgeable insiders. Regardless of where they come from, these ideas are the catalyst for organizational improvement. But they alone cannot create a learning organization.

In general, learning organizations master five major activities: systematic problem solving, experimentation with new approaches, learning from their own experience and the past, learning from the experiences and best practices of others, and rapid and efficient transfer of knowledge within the organization. Each of these areas goes hand in hand with a particular mindset, set of tools, and patterns of behaviour. One such example appears to be the craftsmanship.

One of the studies to characterize the learning organization was made during the fourteenth seminar of the European Advisory Committee of the CEIES, which distinguishes several indicators to characterize the learning organization of the twenty-first century (Tabor, 20002):

- it can be a company, an association, a college, a school, a city, a nation, or any other small or large group of people who feel the need to improve themselves through learning,
- the learning organization invests in its future through the education and training of its members,
- creates opportunities and incentives for skill development for all members in all positions,

- shares with them the vision of tomorrow and encourages them to face challenges, change and participate in development,
- connects work with learning,
- mobilizes talent by focusing on learning and planning education and training,
- gives all members the opportunity to broaden their horizons in line with their own preferred learning styles,
- uses modern technologies in education,
- actively responds to the broader needs of the environment and communities in which it operates, and encourages its members to do so.

It should be noted that all the factors listed are important for the development of the craft and its potential. Continuous learning in the crafts is the basic method of acquiring skills and professional qualifications. In this process, craft organizations such as guilds, chambers of crafts and the Polish Craft Association play an important role.

The aim of craft vocational training is to provide young people with the practical skills and theoretical knowledge they need for responsible work, both as employees and in the context of self-employment. Craft vocational training for young workers involves school-based and out-of-school occupations and is linked to vocational training that ends with the award of a journeyman's certificate. Therefore, one of the most important tasks of craft organizations is to teach the profession. This process includes the following stages: acquisition of knowledge, then dissemination and sharing of knowledge, and its use.

The main subject of the concept of a learning organization is a person. In the case of craftsmanship it is a master of craft as well as individual employees who acquire knowledge in the organization, which leads to the formation of organizational memory. In this way, through the learning process, craftsmen are looking for new solutions to improve the functioning of the company on the market. As a result, craft enterprises are characterized by an increase in creativity, development of products and services, more effective customer service, dynamization of changes and implementation of innovations. They build a whole specific culture and continuity of craft heritage. In this way, they create key values in the region.

Craft has been stereotyped for years through the prism of rare, unique or disappearing professions such as: blacksmith, shoemaker, watchmaker, hatter or goldsmith-jeweller. Mass production with the help of new technologies has supplanted extraordinary craftsmanship made using qualified own work with the use of craft qualifications professional. Some craft professions are disappearing, but new ones are also being created according to the needs of society and the economy.

In order to strengthen the organization of economic self-government of crafts in the field of human and social capital and institutional potential, the Ministry of Economic Development and Technology established the Polish Craft Incubator. Its main goal is to strengthen the organization of the economic self-government of crafts in terms of human and social capital,

as well as institutional potential in order to implement statutory activities, including the development of entrepreneurship and dual education. The Government Program for Supporting the Development of Craft Organizations for 2020-2030 implements one of the basic assumptions of the National Institute of Freedom – Civil Society Development Centre, which is the coordination of cooperation between central administration bodies and non-governmental organizations.

The program aims at emphasizing the strategic role of craftsmanship in Poland, as well as the importance of its support provided by Polish authorities. This article analyses the content of the program in terms of strengthening the organization of the economic self-government of the craft.

At the turn of 2019 and 2020, there was a noticeable increase in interest in crafts and its local government structures by the Ministry of Development, Labour and Technology. In mid-2020, the Ministry appointed a team to work on the draft law on crafts and dual education.

Craftsmanship remains an industry that is important in the context of activities carried out by the Ministry of Labour Development and Technology. This is evidenced by the creation of a dedicated unit in the form of the Department of Crafts in the Department of Dialogue and Social Partnership, whose main task is to take action to improve the conditions for craft activities.

This department is engaged in the development of a draft of a new law, for which the name "Act on Crafts and Dual Education in Crafts" was adopted. It was also responsible for coordinating work related to the preparation and implementation of the government support program for craft organizations for the years 2021-2030 under the name "Polish Craft Incubator". Its task was also to coordinate work related to the preparation and implementation of the government program to support craft organizations for the years 2021-2030 under the name "Polish Craft Incubator".

In addition, the Ministry has established a team to work on the draft law on crafts and dual education. The team is an ad hoc body supporting the work of the ministry on the development of a draft of a new law on crafts and dual education in order to develop dual education through the introduction of systemic regulations regarding vocational training in the workplace.

3. The Polish Craft Incubator Program

Craftsmanship is an important link in the economic structure, it is a model for initiating and taking actions that contribute to the development of the competitiveness of small and medium-sized enterprises. For this purpose, the government program of the Polish Craft Incubator was created.

The government program called "Polish Craft Incubator" concerns craft organizations and assumes support for their development as strategic partners of the state in the development of entrepreneurship and professional dual education. The program emphasizes the strategic role of crafts in Poland and the importance that Poland attributes to its development. The need to adopt the program is due to the fact that at the moment there is no government document strictly devoted to the promotion of crafts and dual education as well.

The main objective of the program is to support the organization of economic self-government of crafts, which will have a positive impact on the development of their human and social capital and institutional potential. Financial resources from the program will help to achieve the statutory objectives of craft organizations and will have a positive impact on the development of their entrepreneurship and dual education.

Dual education, or alternating education, should be treated as a natural investment in the future, in order to build a new base of future professionals who will power the potential of companies. Craft apprenticeship is an example of the classic dual vocational training system. It combines learning from a craftsman in the work process. Learning in crafts is a well-known and common method of acquiring skills and professional qualifications. In this process, an important role is played by craft organizations such as guilds, chambers of crafts and the Polish Craft Association.

The aim of learning in crafts is to obtain by the young person practical skills and theoretical knowledge necessary for the responsible exercise of the profession (Polish Craft Incubator Program, 2022) model of obtaining qualifications based on professional preparation in the form of "learning through work". This type of skills profile is widely used in the labour market, which is confirmed by the results of research indicating that craft skills are used in both creative and other sectors of the economy (Craft Council, 2022).

The program consists of operational tasks aimed at supporting the current activities of economic self-government:

- Task 1. Institutional and infrastructural support for craft organizations.
- Task 2. Development and promotion of dual education in crafts.

According to task 1, namely the institutional and infrastructural support for craft organizations, the statutory tasks of the economic self-government of crafts include conducting educational activities for members. The task provides for the financing of technical resources, including IT resources for the statutory activities of craft organizations related to the administration of apprenticeship in crafts, carried out on the basis of a dual education system, supervision over its course and the implementation of professional examinations and vocational training of adults.

In turn, as part of task 2, i.e. the development and promotion of dual education in crafts, support for competitions concerning craft professions is provided, as an activity aimed at familiarizing children and young people with the offer of learning and working in crafts. The aim of the competitions is to shape a positive image of professional work and promote

knowledge about the labour market, and their particular value is the early promotion of education in professions and respect for professional work.

In order to meet the needs of primary school graduates regarding the choice of educational paths by increasing the prestige of the offer of vocational training in craftsmanship, the task includes the possibility of financing prizes by craft organizations as part of both competitions for professions for children and youth addressed to kindergartens and primary schools and vocational competitions for young people studying in craft enterprises.

Moreover, as part of the competition announced by the government program "Polish Craft Incubator" edition 2021, two paths were provided - only task 1 was carried out (National Institute of Freedom – Civil Society Development Centre, 2022):

- Path 1. Development of the infrastructural potential of craft organizations.
- Path 2. Development of organizational potential of crafts and building local partnership.

The first path provided for the financing of technical resources for the statutory activities of craft organizations related to the administration of apprenticeship in crafts, implemented on the basis of a dual education system, supervision over its course and the implementation of professional examinations and vocational training of adults. The maximum grant amount in each of the two paths was PLN 20 000.

The second path provided support for organizations local partnerships with craft organizations and campaigns fundraising craft organizations. This task was important because of the need to increase the involvement of craft communities in cooperation with external entities, i.e. related to career counselling.

It is worth noting that the following craft organizations could apply for a grant under the competition (National Institute of Freedom – Civil Society Development Centre, 2022):

- Polish Craft Association.
- Chambers of Crafts and Entrepreneurship.
- Features of crafts and entrepreneurship, registered in the register of associations of the National Court Register.

In total, the funds allocated for grants in the first edition amounted to PLN 4 800 000 of which the following paths were allocated for the implementation of individual paths:

- PLN 2 400 000 – Path 1. Development of the organization's infrastructure potential craftsmanship.
- PLN 2 400 000 – Path 2. Development of the organizational potential of craftsmanship and building local partnerships.

In general, a total of 487 bids were submitted in the competition. Three of them received a negative formal assessment, the others were sent for substantive assessment.

As part of path 1: „Development of the infrastructure potential of craft organizations” generally 135 offers received funding, whereas as part of path 2: „Development of the organizational potential of crafts and building local partnerships” the amount of 139 offers received funding.

On May 2022, a new call for proposals as part of the second edition of the competition began. The call ended on 20 June 2022. Projects may be implemented from 1 June 2022 to 31 December 2023. In the second edition of the competition, two tasks are carried out. As part of the second edition of the competition, the maximum amount of the grant is (National Institute of Freedom – Civil Society Development Centre, 2022):

- Task 1. Institutional and infrastructural support for craft organizations: PLN 30 000 per year (PLN 60 000 for the entire task).
- Task 2. Development and promotion of dual education in crafts: PLN 60 000 per year (PLN 120 000 for the whole task).

It is very important that the second edition of the competition will implement task 2, i.e.: Development and promotion of dual education in craftsmanship. In the first edition of the competition, this task was not implemented.

Indeed, the priority for the European Union is to help young people enter the market. working and staying on it and in acquiring and developing skills that will allow them in the future to find a job. It turns out that countries where attractive vocational education and training systems exist, especially those with stable apprenticeship systems and extensive opportunities for learning through practice (e.g. Germany or Austria), perform better in facilitating the transition from education to employment and maintaining low levels of youth unemployment.

The dual system of vocational training in crafts prepares a young employee to immediately take up work after graduating from a stage I sectoral vocational school, because in this system the juvenile employee gains theoretical knowledge, practical skills and professional experience at the same time.

4. Key economic benefits of the Polish Craft Incubator Program

From an economic perspective, there are many benefits of the Polish Craft Incubator Program, especially those resulting from dual education, mainly:

- maintaining relatively low unemployment among young people,
- increase in the level of education of young people and acquired competences (in the context of knowledge, experience and skills),
- adjusting the educational offer of schools and continuing education institutions to the needs of entrepreneurs,
- shaping an effective vocational training system that prepares young people for a specific profession and at the same time provides the basis for acquiring new qualifications or specializations,
- the existence of a systemic solution that facilitates the employment of graduates of vocational schools and continuing education institutions,

- making the labour market more flexible,
- undertaking cooperation between entrepreneurs and educational institutions in the field of defining directions and forms of vocational education in accordance with the current demand on the labour market,
- creating a civil society (functioning of local partnerships and activity of medium-order structures – economic self-government of enterprises) and increasing the level of social capital.

The added value resulting from the idea of implementing the concept of a learning organization in the craft environment is building social and intellectual capital in the region. The subject of introducing the Polish Craft Incubator Program and concept is man, his potential and experience. There are individual employees who acquire information in the organization, which leads to the creation of specific organizational knowledge. In this way, through the learning process, they are looking for new solutions to improve the functioning of the organization on the market.

As a result, these organizations are characterized by increased productivity, development of products and services, more effective customer service, dynamization of changes and implementation of market innovations.

On the other hand, the economic policy of the government takes into account the need to develop local enterprises. Consequently, government programs, such as Polish Craft Incubator, are needed, because in the face of economic changes in recent years, only small and medium-sized companies have a chance for quickly adaptation to the expectations of local customers. The government's support policy in this area is extremely important.

There is no doubt, that it is a long-term process, but now is the best time to combine tradition with modernity - and the assumptions of the concept of learning organizations can be very useful in the process of these changes.

5. Conclusions

The main effect of this paper was to illustrate the situation with regard to craft enterprises and the possibilities of their development in the current socio-economic conditions. An additional practical result is to indicate the possibility of using the Polish Craft Incubator program as a source of obtaining financial resources in the learning process.

The value of the paper is to increase the awareness of owners of craft enterprises, by showing them the possibility of using new organizational concepts and government programs. The article has primarily educational value and is a general concept of stimulating creative action towards building learning organizations.

Generally, craft companies as learning organizations, adapt to the factors of the immediate environment, constantly acquire new competences and skills. They are based on knowledge and experience that build the organizational identity of the company and determine the quick adaptation to economic changes. Craft companies, therefore, are organizations that notably influence the development of the small and medium-sized enterprise sector and play a key role for the sustainable economic development of the region.

In addition, emerging craft businesses seek greater financial and environmental sustainability. Emerging craft enterprises are important in balancing the processes associated with globalization, especially in the area of environmental protection. In this way, crafts can contribute to the transition to a circular economy that avoids waste, keeps materials and objects in use, and regenerates natural systems.

Craft offers not only a way of making, but also a way of thinking - one that is collaborative, inclusive, and responsive to the changing natural environment. It seems essential in the context of moving away from our current production model of "take, make, and waste" to a more circular model (Crafts Council, 2022). Traditional forms of knowledge and practice should therefore also be central to the debate about the planet and climate change.

Yet crafts people's knowledge is often pushed back in favour of technological solutions and the priorities of global corporations. For this reason, it is so important to support and protect emerging craft businesses, even in the context of globalization.

In general, all these changes can be translated into sustainable development of the region, especially in economic, social, educational and environmental terms. This, in turn, favours the improvement of the economic situation in the long term through economic synergy effects, taking into account the cooperation of various market entities in the region.

References

1. Alerasoul, S.A., Afeltra, G., Hakala, H., Minelli, E., Strozzi, F. (2022). Organizational learning, learning organisation, and learning orientation: An integrative review and framework. *Human Resource Management Review*, Vol. 32, Iss. 3, 100854, ISSN 1053-4822, doi.org/10.1016/j.hrmr.2021.100854.
2. Baker, W.E., Sinkula, J.M. (1999). The synergistic effect of market orientation and learning orientation on organizational performance. *Journal of the Academy of Marketing Science*, 27(4), 411-427.
3. Bielawska, A. (2016). Realizacja idei społecznej odpowiedzialności biznesu w rzemiośle. *Research Papers of Wrocław University of Economics*, No. 436, pp. 48-54, DOI: 10.15611/pn.2016.436.05.

4. Bui, H., Baruch, Y. (2010). Creating learning organizations: A systems perspective. *The Learning Organization.*, 17(3), 208-227.
5. Calantone, R.J., Cavusgil, S.T., Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, 31(6), 515-524.
6. Cook, S.D.N., Yanow, D. (1993). Culture and organizational learning. *Journal of Management Inquiry*, 2(4), 373-390.
7. Craft Council, <https://www.craftscouncil.org.uk/>, 24.08.22.
8. Crafts Council, <https://www.craftscouncil.org.uk/stories/craft-skills-and-knowledge-should-be-at-the-heart-of-the-debate-about-our-relationship-to-the-planet-says-sustainability-champion-katie-treggiden>, 24.08.22.
9. Hakala, H. (2011). Strategic orientations in management literature: Three approaches to understanding the interaction between market, technology, entrepreneurial and learning orientations. *International Journal of Management Reviews*, 13(2), 199-217.
10. Hakala, H., O'Shea, G., Farny, S., Luoto, S. (2020). Re-storying the business, innovation and entrepreneurial ecosystem concepts: The model-narrative review method. *International Journal of Management Reviews*, 22(1), 10-32.
11. Huber, G.P. (1991). Organizational Learning: The Contributing Processes and the Literatures. *Organization Science*, February, DOI: 10.1287/orsc.2.1.88.
12. Hung, R.Y.Y., Lien, B.Y.-H., Yang, B., Wu, C.-M., Kuo, Y.-M. (2011). Impact of TQM and organizational learning on innovation performance in the high-tech industry. *International Business Review*, 20(2), 213-225.
13. Karaś, E., Piasecka-Głuszak, A. (2014). *Nowy wymiar organizacji – organizacja ucząca się a organizacja inteligentna. Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu, No. 3(41)*, p. 3.
14. Levitt, B., March, J.G. (1988). *Annual Review of Sociology, Vol. 14*, pp. 319-340.
15. Malara, Z. (2007). *Przedsiębiorstwo w globalnej gospodarce. Wyzwania współczesności*. Warszawa: PWN, p. 131.
16. Malone, M.S. (2002). *Kapitał intelektualny*. Warszawa: PWN, pp. 111-123.
17. *Measuring lifelong learning*. Materiały z 14 seminarium CEIES Włochy, 25-26 czerwca 2001 r. Luksemburg: Office for Official Publications of the European Communities, 2002, epp.eurostat.ec.eu.
18. Mikuta, B., Pietruszka-Ortyl, A., Potocki, A. (2002). *Zarządzanie przedsiębiorstwem XXI wieku*. Warszawa: Difin 2002, pp. 10-11.
19. National Institute of Freedom – Civil Society Development Centre, <https://niw.gov.pl/nasze-programy/polski-inkubator-rzemiosla/edycja-2021/>, 24.08.22.
20. Ng, Pak Tee. (2004). The Learning Organisation and the Innovative Organisation. 1 Jan, pp. 93-100.
21. Polish Craft Incubator Program, <https://niw.gov.pl/nasze-programy/polski-inkubator-rzemiosla/>, 24.08.22.

22. Santos-Vijande, M.L., Lopez-Sanchez, J.A., Trespalacios, J.A. (2012). How organizational learning affects a firm's flexibility, competitive strategy, and performance. *Journal of Business Research*, 65(8), 1079-1089.
23. Sanz-Valle, R., Naranjo-Valencia, J.C., Jim'enez-Jim'enez, D., Perez-Caballero, L. (2011). Linking organizational learning with technical innovation and organizational culture. *Journal of Knowledge Management*, 15(6), 997-1015.
24. Sinkula, J.M., Baker, W.E., Noordewier, T. (1997). A framework for market-based organizational learning: Linking values, knowledge, and behavior. *Journal of the Academy of Marketing Science*, 25(4), 305-318.
25. Song, J.H., Chermack, T.J. (2008). A theoretical approach to the organizational knowledge formation process: Integrating the concepts of individual learning and learning organization culture. *Human Resource Development Review*, 7(4), 424-442.
26. Stata, R. (1989). Organizational Learning—The Key to Management Innovation. *Sloan Management Review*, Spring.
27. Tabor, J., *Rozwój organizacji uczącej się a zarządzanie talentami*, <http://www.e-mentor.edu.pl/artykul/index/numer/24/id/538>.
28. Watkins, K.E., Marsick, V.J. (1992) Building the learning organisation: a new role for human resource developers. *Studies in Continuing Education*, 14(2), 115-129, DOI: 10.1080/0158037920140203.

AUTOMATION OF WAREHOUSE RESOURCE PLANNING PROCESS BY USING A CLOUD DEMAND FORECASTING TOOL

Mariusz KMIECIK

Silesian University of Technology; mariusz.kmiecik@polsl.pl, ORCID: 0000-0003-2015-1132

Purpose: Research paper is an extension of the concept connected with demand forecasting function acquisition by logistics operators in the whole distribution network (concept is considered among others in the following papers: (Kmiecik, 2021a, 2021b, 2020)). The concept of centralized forecasting assumes that a logistics operator, whose attributes coincide with the features selected through analysis of forecasting-able entities in the distribution networks and flagship enterprises, is able to take over the forecasting function for the whole distribution network. Paper, which is based on the mentioned concept, shows one of the first stages of its implementation. This stage is the implementation of the forecasting tool in the logistics operator's actions to support his operational activities. Currently, the logistics operator doesn't conduct the forecasting activity, but there are attempts aimed at implementation of forecasting tool and increasing the offered services' added value level. Operational activity, which will be first to be supported, is the process of planning the warehouse resources. Mentioned resources concern the human and internal transportation resources, which are needed for fulfilling the processes connected with SKU (Stock Keeping Units) releasing from the warehouse. The main paper purpose to examine the concept the of automated cloud-based resource planning process at the selected 3PL entity which provides logistics services to wide range of manufacturers in the distribution network using the computer simulation model with comparison with the current resource planning process.

Design/methodology/approach: Following research paper based on analysis the survey results and analyzing the simulation results. In the survey were tested the warehouse managers which are responsible for resource planning process. The analysis provides the general requirements of managers about resource planning process supported by automated cloud-based demand forecasting solution and information about expected forecasting tool accuracy. In the paper there were also created two simulation models based on BPMN 2.0 standard. First model reflects the current shape of resource planning process and was created to compare to the second, improved model. Improved model includes the examining of automated cloud-based resource planning solution.

Findings: The main expectations of 3PL operational managers about usage the demand forecasting tool is to support of warehouse resource planning. They also state that the expected accuracy of such a tool is the weekly MAPE not greater than 5%. The main benefits of proposed solution are the time decreasing, increasing the level of automation, showing the main areas when the agile point of view should be implemented and show the perspective of resource possibility of usage in the different activities (beside the resource planning process).

Originality/value: Automation and fully cloud integration will allow to reduce the process time more than 60% (in total and in average one process time). There are also some disadvantages of proposed solution which could be reduced by using other trends connected with Industry 4.0 development and by developing the collaborative strategies of the particular nodes of distribution networks.

Keywords: logistics operator; distribution network; warehouse management; demand forecasting; BPMN 2.0 model.

Category of the paper: research paper.

1. Introduction

Internal logistics is commonly state as the key of the business (Krajovic et al., 2018), for ensure the quick and faster supplies, for price stabilization and bulk breaking there is a necessity of using a proper warehouse infrastructure (Pandain, 2019) and efficient usage of warehouse resources. Nowadays, the third-party logistics service providers (3PL) needs to be more and more competitive. There is a huge amount of enterprises and the trend of logistics services outsourcing grows continually. Especially in Poland, where the logistics sector has got a very high share in tonne-kilometers in European Union in 2019 (16,4%) (Koliński, Werner-Lewandowska, 2021). The third-party logistics service providers need to be more competitive, To achieve high level of competitiveness, some me researches mentioned that the innovation openminded and aimed to value added creation is the most necessary thing (Chu et al., 2018).

One of the competitive advantages of enterprise is the need of creation a value by using resources properly (Aremu et al., 2018). Other of such a value added services could be, according to the author's opinion, extension of standard offered services by demand for products forecasting. This conception is called as centralized forecasting. The concept of centralized forecasting assumes that a logistics operator, whose attributes coincide with the features selected through analysis of forecasting-able entities in the distribution networks and flagship enterprises, is able to take over the forecasting function for the whole distribution network. Mentioned concept connected with demand forecasting function acquisition by logistics operators in the whole distribution network is considered, among others, in the following papers: Kmiecik, 2021a, 2021b and 2020. Proposed concept requires using the demand forecasting tool in the form of integrated with WMS (Warehouse Management System) IT tool. The future role of information technologies in supporting the management and control of logistics practices has been largely demonstrated (Ageron et al., 2018). Also, a lot of research and market trends expose the huge meaning of modern forecasting technologies like machine learning. Currently, there is a many usage of machine learning forecasting algorithms which considers a lot of prediction factors. Usually using a machine learning algorithm gives the better result just using a different forecasting method based only on historical data – it was confirmed by a lot of researches like Dou et al., 2021 and Spiliotis et al., 2020.

Usage of modern technologies by 3PL is a natural answer to current fourth industry revolution (Industry 4.0). In literature there were distinguished the basis of concept connected with logistics operators adjusted to Industry 4.0 reality. The Operator 4.0 has been defined as “a smart and skilled operator who performs not only cooperative work with robots but also work aided by machines as and if needed by means of human cyber-physical systems, advanced human-machine interaction technologies and adaptive automation towards human-automation symbiosis work systems” (Cimini et al., 2020). Nowadays, 3PL are striving with the issues of processes automation and usage of technological advanced solutions. Using automated processes offers a magnitude of benefits like better processes accuracy, consistency, reliability, costs reducing (Devarajan, 2018). A properly constructed information exchange system and the willingness to exchange information between different enterprises is the basis of an efficiently functioning enterprise network. A properly created information exchange system is also recognized by some authors as one of the key elements of the coordination of entire supply chains (Arshinder et al., 2008). Digital technologies and computer technologies that support the flows in networks are extremely important. We can distinguish, for example, electronic exchanges, which allow you to easily coordinate some transport activities (Karaenko et al., 2019). To automated the processes 3PL usually use the RPA (Robotic Process Automation) which could automate, among others, collection and processing the planning or demand data (Devarajan, 2018). It is really important especially when 3PL is enabled in building the distribution omnichannels strategies or improving processes according to e-commerce requirements. There are a lot of differences between traditional and e-logistics. For example, the 3PL should adapt processes from bulk to bulk & parcel shipment types or should be ready for less predictable orders flows (Erceg, Sekuloska, 2019). In this case the process automation could also help. The main differences and advantages of automated work is shown in table 1.

Table 1.

Differences about manually and automated warehousing work

Warehousing issue	Manually work	Automated work
Delay in procurement	2-3 hours	30-35 minutes
Delay in dispatched	1-2 hours	10-20 minutes
Errors committed in billing, procuring and dispatching	60%	10% due to network problems

Source: (Pandain, 2019).

Automated work in the warehouses, if it is planned and implemented properly, has a lot of benefits. On the other hand more manually work could for example (Barczak et al., 2020): extend the duration of the processes and time of making decisions, lower the managers' efficiency level and lower the level of process efficiency, increase the consumption of resources and increase costs or inhabit the stream of flows and reduce quality. Fully automation could be also one of the factors to improve demand planning processes, because the quality in demand planning processes should be measured (among others like forecasts errors, inventory level, customer's service level and customer services performer on time) by process time (Szozda, Werbińska-Wojciechowska, 2013). This time could be reduced by process automation. One of the important elements to consider in contemporary considerations on coordination is the active

inclusion of technological solutions in human activities and the ability to coordinate also the operation of these solutions. (Wang et al., 2020). Currently, the assumptions related to the creation and implementation of EDI (Electronic Data Interchange) are still important, but this is not only the only requirement for a well-designed information flow system. The broadly understood digitization pushes retailers and other enterprises operating in the network to adapt their business models to, for example, the modern conditions of multi-, cross- and omnichannels functioning (Rai et al., 2018).

Proper automation requires proper technology. One of such a technology, which provides also a huge amount of calculation power, data and information acquisition in the real time and possibility of integration and collaborative work is cloud technology. The usage of cloud-based solutions and the level of adoption of such solution affects positively on supply chain (Shee et al., 2018). Nowadays, there is even an upcoming proposition of new Supply Chain Management (SCM) strategy called Cloud-based Supply Chain Management (C-SCM) (this conception is showed among others in Giannakis et al., 2019). C-SCM shows the trends connected with cloud tools usage in whole supply chain flows. One of the biggest cloud-based systems advantages from the perspective of management is on-demand services, broad network access, resource pooling, rapid elasticity and measured services (Giannakis et al., 2019). One of the concepts that is increasingly exploited both in terms of science and practice is the Digital Twin concept. This concept is based on a very strong digitization of activities and the possibility of creating an accurate computer model of the company's activity. Digital Twin, as some authors say, can also derive information from the demand forecasting system adopted by the company (dos Santos et al., 2020; Wright, Davidson, 2020), which gives grounds to think about the implementation of Digital Twin solutions as an additional element of demand management. Because of that is one of the main direction of processes and systems development in the 3PL activity.

Following research paper combines the conception of centralised demand forecasting, usage of demand forecasting tool by 3PL with the current meaning of process automation and usage of cloud technology (figure 1).

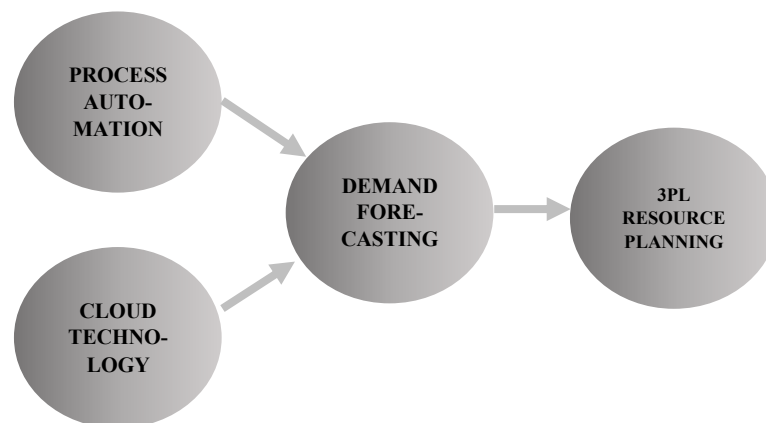


Figure 1. Research paper main areas.

2. Main research steps

Research paper focuses on the issue of resource planning processes in the example of selected logistics operator which could be described as 3PL. Main research steps are shown in the figure 2.

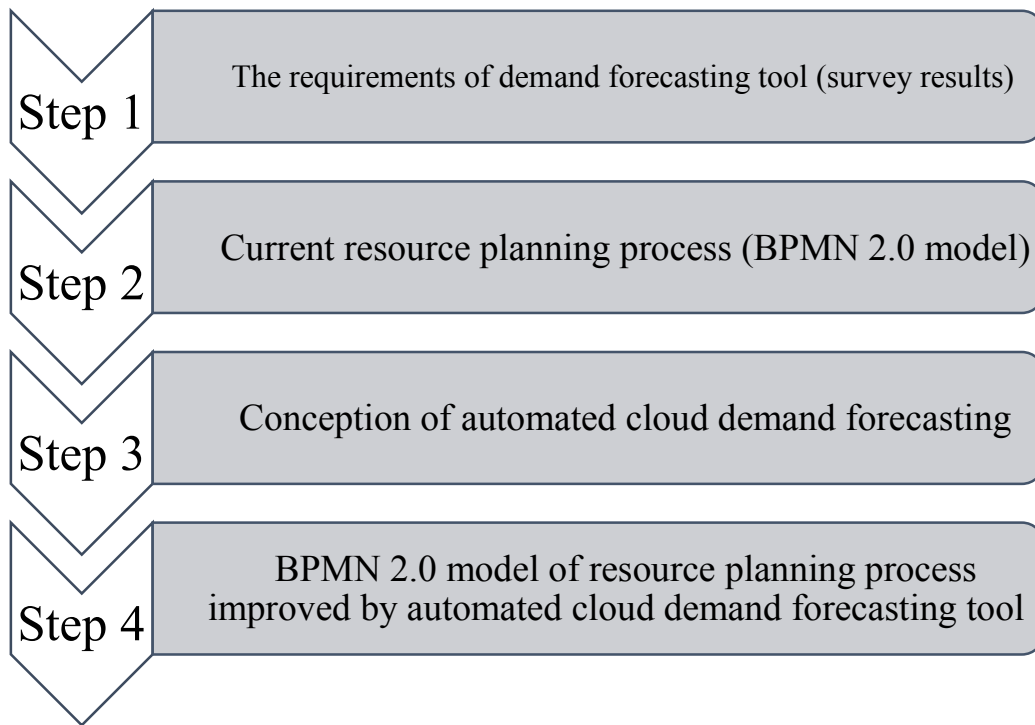


Figure 2. Main research steps.

Research was focused on the four main research steps. It answered to the two main research questions:

Q1: What are the main expectations of 3PL operational managers about usage and accuracy of demand forecasting tool?

Q2: What benefits will bring the automation from the perspective of resource planning process time?

The main hypothesis in the research was focused on following issue:

H1: Automated, cloud-based solution connected with demand forecasting used at simulation model will reduce the time of resource planning process at least by 60%.

Gaining the answers for research questions and verification of research hypothesis were achieved, at first, by analyzing the results of survey. The survey was created to check the main area of usage of demand forecasting tool in the chosen 3PL enterprise and to check the benefits which brings the proper implementation of the tool. Research sample are the warehouse operational, co-packing and co-manufacturing managers in the chosen logistics operator which provides logistics services (like warehousing, transportation, co-packing, co-manufacturing, cross-docking and processes engineering and implementation) to huge manufacturers.

The range of offered and handled SKUs is wide – from building materials, furniture to food. In the survey participates the 60 managers – 43 managers (72%) from Poland, 11 managers (18%) from Czech Republic and 6 managers (10%) from Slovakia. Mentioned managers are striving with the warehouse operational problems every day, they have a lot of practical experience and author think that is a proper research sample. The examined research sample states 82,19% (60 examined managers from 73 total) of all managers connected with managing the warehousing processes.

Currently the processes in the warehouse are not supported by any demand forecasting tool. Whole processes connected with resource planning are based on managers experience or, in the case of some small group of serviced manufacturers, on aggregated forecasts which are send by them. In the following research paper was created the simulation model of resource planning based on BPMN 2.0 (Business Process Modelling Notation 2.0). The sequence of the process was visualized in the BPMN 2.0. The process parameters connected with activities time, sub-sequences probability of decisions gates output, human resources were added to the BPMN 2.0 map and the computer model was created. To the computer model were added the simulation assumptions about simulation time and starting generators. Nextly, was showed the author's conception of cloud-based demand forecasting tool as an input to resource planning processes automation. This conception is based on the current research connected with the implementation tests of cloud-based forecasting in the activity of chosen 3PL and forecasts accuracy. In this case there were also created a simulation model which shows the benefits of automated resource planning.

3. Automation of warehouse resource planning process

3.1. Main 3PL operational requirements about demand forecasting tool (step 1)

Research sample are the warehouse operational, co-packing and co-manufacturing managers in the chosen logistics operator which provides logistics services manufacturers. In the survey participates the 60 managers:

- 43 managers (72%) from Poland.
- 11 managers (18%) from Czech Republic.
- 6 managers (10%) from Slovakia.

Mentioned managers strive with the warehouse operational problems every day, they have a lot of practical experience and author thinks that is a proper research sample. The examined research sample states 82,19% of all managers connected with managing the warehousing processes in the considerate case of 3PL. Whole three questions are the type of closed questions

with one possible answer. Last question was created based on the answer about the main utility area of demand forecasting tool.

First question (figure 3) was connected with the main utility area for demand forecasting tool in the operational warehousing activity of 3PL.

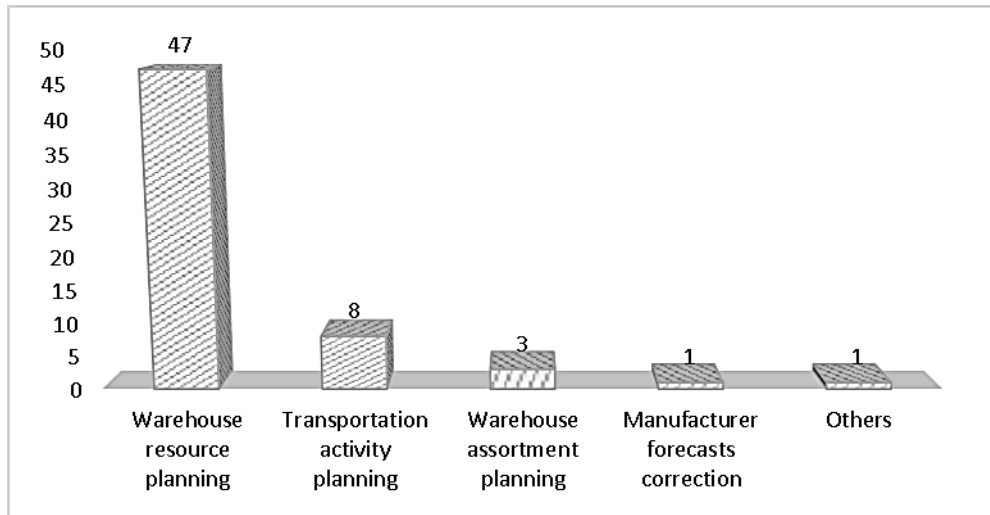


Figure 3. 1st question: in which area do you see the greatest opportunity to use the demand forecasting tool?

The 13,33% of answers were connected with usage of demand forecasting tool as a tool for support the transportation activity. It could be achieved by forecasting the distribution quantities in pallet places. Few of answers is connected with usage a tool for support the warehouse assortment planning (5,00% of answers) where the demand forecasting tool could be used for support the ABC assortment analysis or two-criteria analysis ABC/XYZ. There is also a possibility of use the forecasting tool to correct the manufacturers predictions, but this option states just about 1,66% of answers. The vast majority of answers (78,33%) were connected with usage of forecasts results as a tool of warehouse resource planning support. Warehouse resource planning, in the following questionnaire, was understood the estimation in advance the proper quantity of warehouse workers and warehouse infrastructure (like forklifts or data collectors) to handling the current warehouse activity. According to questionnaire and authors' opinion, the demand forecasting tool in the activity of 3PL should focus mainly on this need.

Second question (figure 4) focused on demand forecasting tool accepted accuracy. The accuracy mentioned in following question is the MAPE (Mean Average Percentage Error) to one-week period. MAPE is calculated as follow:

$$MAPE = \frac{1}{n} \sum_{t=1}^n \left| \frac{A_t - F_t}{A_t} \right| * 100\%$$

where:

$t = 1, 2, \dots, n$ – considered periods.

A_t – real warehouse distribution quantity in period t .

F_t – forecasted warehouse distribution quantity in period t .

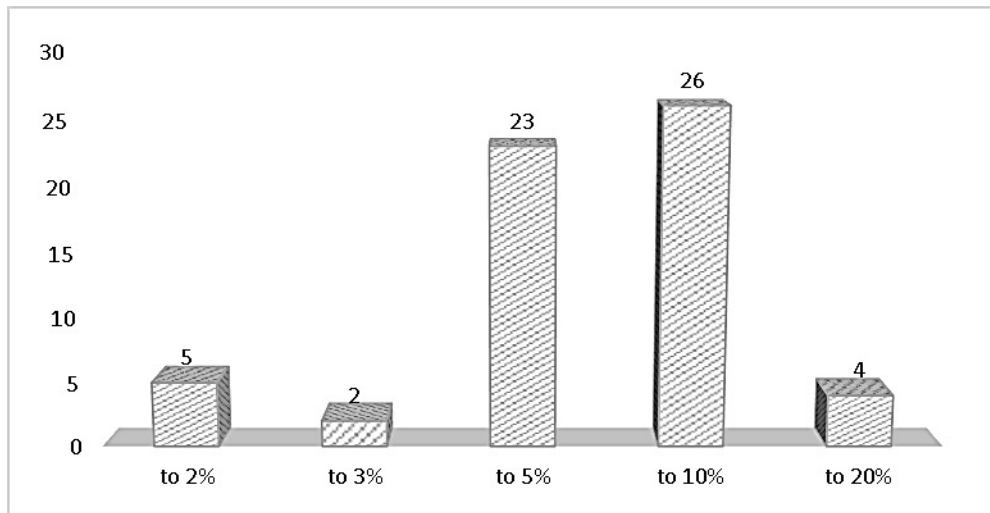


Figure 4. 2nd question: for which maximum error level (based on weekly MAPE) the forecasts are useful?

Second question was focused on the maximum possible error, which will be accepted in operational activity of 3PL. Based on answers (figure 4) it could be state as follow:

- Weekly MAPE in the maximum level of 2% will meet the 100% requirements.
- Weekly MAPE in the maximum level of 3% will meet the 92% requirements.
- Weekly MAPE in the maximum level of 5% will meet the 88% requirements.
- Weekly MAPE in the maximum level of 10% will meet the 50% requirements.
- Weekly MAPE in the maximum level of 20% will meet the 7% requirements.

Based on presented results as a key accuracy level for operational needs, in the following research paper, the 5% was assumed.

Presented questionnaire analysis gives the possibility to answer the first research question (Q1: What are the main expectations of 3PL operational managers about usage and accuracy of demand forecasting tool?). The main expectations of 3PL operational managers about usage the demand forecasting tool is the supporting of warehouse resource planning. They also state that the expected accuracy of such a tool is the weekly MAPE not greater than 5%.

Based on the results of question one the potentially time saving in resource planning were examined (figure 5).

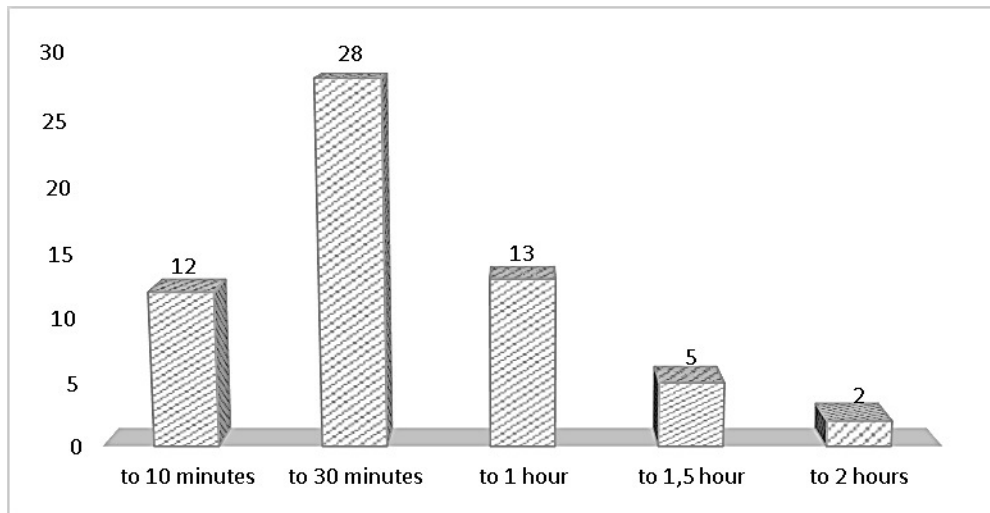


Figure 5. 3rd question: how much time do you spend on resources allocation during resource planning process?

Third question has on purpose to determine the current time which managers spend on resource allocation during resource planning process. Based on this question it could be state that about 70% of managers spend above 30 minutes for this activity. Additionally, according to sum of ratios divided into sum of expected results, it can be concluded that the proper creation, implementation and integration of forecasting tool will decrease the managers workload in this activity in average level of 29,83 minutes. Which gives in potential time saving in one week (based on 5-days work system) in the level of about 149,15 minutes, in one month (based on 4-week month assumption) in the level of about 9,94 hour. The results from mentioned question analysis will be taking into account also during simulation. It is worthy to mention that even that the resource planning is not a value added activity it is an activity which is necessary to making a proper warehouse processes. So, shortening the resource planning process will have influence on whole 3PL activity.

3.2. Resource planning process in the selected logistics operator (step 2)

Warehouse manager is the main swimlane involved in the resource planning process. The process begins and ends in this entity. There are two main sequences of process flows – first when the manufacturer sends the prediction of sales (about 15% of situations) and second when the manufacturer doesn't sent the predictions (about 85% of situations). When the manufacturer sends the prediction then manager checks the latest database with predictions and if there is an available update (about 20% of situations in this sequence) there is a checking the fulfillment and compatibility with contract statements and possible activity ad-hock with manufacturer. If manufacturer doesn't send the forecasts, the warehouse manager checks the historical data and try to estimate the future value of SKU releasing quantity. After this there are a resource allocation activity (based on the survey the author assumed the time of this activity is in the range of 20-40 minutes). When the resources are allocated the information is

sharing with team leaders to make possible modifications. Whole model in BPMN 2.0 is showed in figure 6.

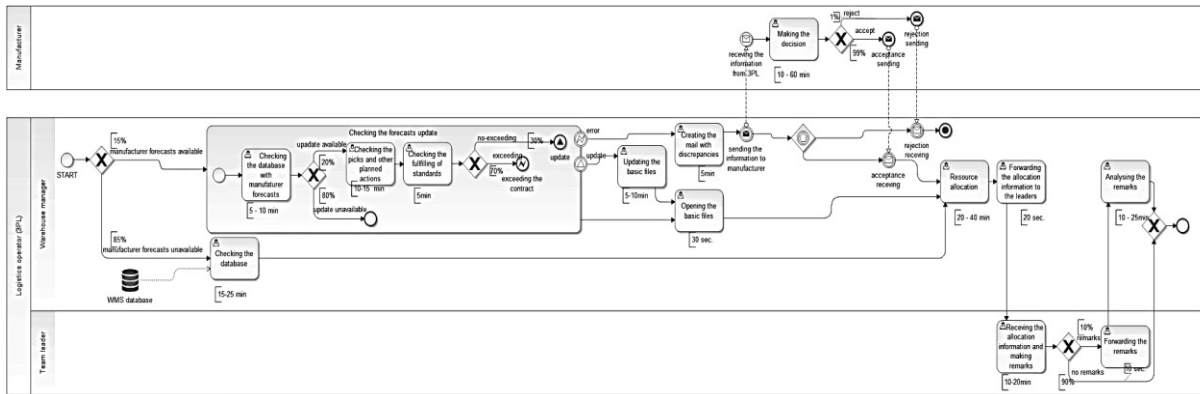


Figure 6. Resource planning process model in BPMN 2.0 (high quality map is available at: <https://tiny.pl/9g2p6>, 21.09.01).

Times of particular activities to simulation model is estimated based on author’s participant observation of the process and the results is showed in table 2.

Table 2.
Activities times parameter to the BPMN 2.0 model

No.	Swimlane*	Activity	Time**	No.	Swimlane*	Activity	Time**
1	WM	Checking the database with manufacturer forecasts	5-10 min	8	M	Making the decision	10-60 min
2	WM	Checking the picks and other planned actions	10-15 min	9	WM	Resource allocation	20-40 min
3	WM	Checking the fulfilling of the standards	5 min	10	WM	Forwarding the allocation information to the leaders	20 sec.
4	WM	Checking the database	15-25 min	11	TL	Receiving the allocation and making remarks	10-20 min
5	WM	Updating the basic files	5-10 min	12	TL	Forwarding the remarks	10 sec.
6	WM	Creating the mail with discrepancies	5 min	13	TL	Analyzing the remarks	10-25 min
7	WM	Opening the basic files	30 sec.	*WM – warehouse manager; TL – team leader; M - manufacturer **in the case of time range the simulation time is calculated from normal distribution			

Main assumptions about simulation scenario were as follow:

- One work shift which takes 8 hours, there are 5 workdays in one week.
- Resources are planned once per day starts at 08:00 am. In the simulation are considered the standard month (without any holidays, 22 workdays).
- Simulation consists of planning resources in 20 warehouses simultaneously, so each simulation starts at 08:30 am generates the 20 sequenced runs in the considerate 1-month period.

- In the one process sequence are involved 1 Warehouse Manager (WM) and 2 Team Leaders (TL), so daily sequence generates the usage of 20 WM and 80 TL. The availability of WM is 90% per one process run with 10 minutes break in the random moment of workday. The availability of TL is 85% with 10 minutes break in the random moment of workday.

The general results of simulation are gathered in the table 3.

Table 3.

General simulation results – resource planning process

Parameter	Parameter description	Parameter value
Total time	Total process time of simulation	611,62 h
Total transactions	Total number of ran sequences in the simulation	440 transactions
Average process time	Total time divided by total transactions	1,39 h
Manufacturer activity	Number of transactions flowed by manufacturer pool	4 transactions
Number of rejections	Number of situations when the manufacturer did not agree with additional fee	2 times

Whole simulation takes 611,62 hours, total number of sequences ran through it was equal to 440 (20 warehouses daily planned resources in the range of 22 days). Average process time is equal to 1,39 hours. Manufacturer was involved into process 4 times and the process ends in the different way than standard twice. During the simulation there were also checked the chosen indicators connected with process resources (WM, TL and M) usage (figure 7).

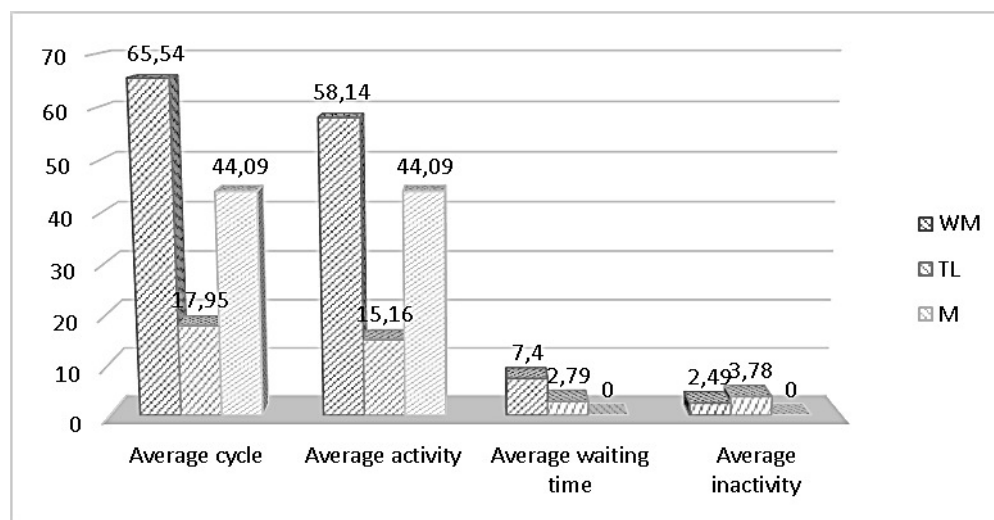


Figure 7. Simulation results connected with process resources.

Average cycle is the time period of transactions done in the particular resources for WM it takes 65,54 minutes, for TL 17,95 minutes and for M 44,09 minutes. The most workload resource is the WM, but the fact of occasional involving to the process of M is also increased the total time of process. The average cycle consists of average activity (time of active processing the transaction by the particular resources) and average waiting time (time of waiting of transaction caused by inactivity, blocked or waiting for resources). Average inactivity is the time when the resources were scheduled, but there were not available in sequence. Simulation also allowed to

distinguish the activities average time of waiting for resources (average waiting for resources). It is connected with process delays indicated by the sequences stops. The six main activities which generates about 90% of average waiting for resources in the process is shown at figure 8.

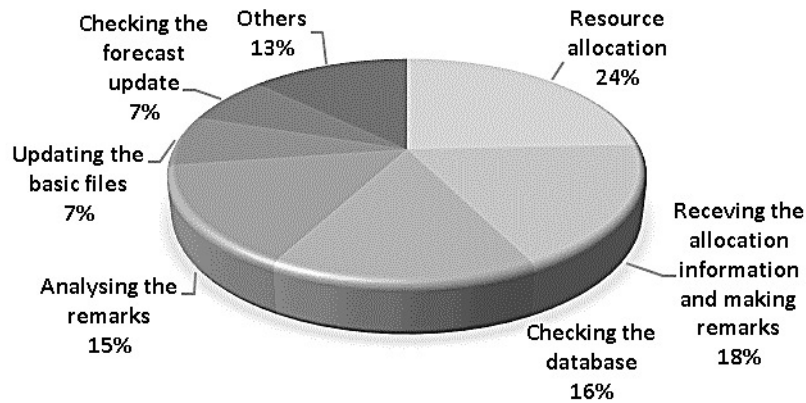


Figure 8. Average waiting for resources – activities.

The activity with the largest average waiting for resource indicator is resource allocation. In the top of such activities there is also a receiving the allocation information and making remarks by TM and checking the database by WM – this whole activity is connected with necessity of manually establishment of warehousing resources with no supports by statistical analysis system of resource planning. The simulation approved the survey results about the necessity of support this area by demand forecasting system.

3.3. Cloud demand forecasting tool as a tool for resource planning automation (step 3 & 4)

Proposed solution assumes implementation of cloud-based forecasting tool and usage the standard indicators about warehouse resources capacity to automate the process of resource planning. Cloud technology will provide the possibility of improve the calculation power in the process of forecasts creation. The proposed sequence of the process is shown in figure 9.

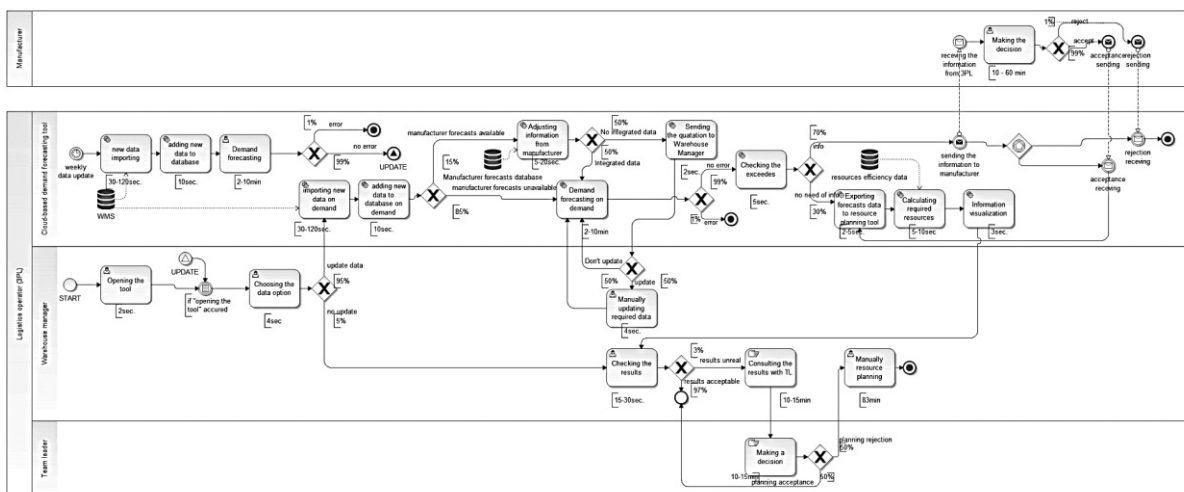


Figure 9. Cloud-based resource planning process supported by demand forecasting tool model in BPMN 2.0 (high quality map is available at: <https://tiny.pl/9g6fv>, 21.09.01

The process assumes the connection of WMS databases with cloud queries and usage of always updated data from warehouse operations. The forecasting tool is integrated with the database and forecasts will be updated automatically once per week. Core of the process assumes the running the process on demand (95% of cases), but there is a possibility of acting on previous generated forecasts. Table 4 consists of the activity's times parameter description.

Table 4.

Activities times parameter to the cloud-based resource planning process BPMN 2.0 model

No.	Swimlane*	Activity	Time**	Kind***	No.	Swimlane*	Activity	Time**	Kind***
1	CDF	New data importing	30-120 sec.	R	11	CDF	Calculating required resources	5-10 sec.	A
2	CDF	Adding new data to database	10 sec.	R	12	CDF	Information visualization	3 sec.	R
3	CDF	Importing new data on demand	30-120 sec.	R	13	M	Making the decision	10-60 min	A
4	CDF	Demand forecasting	2-10 min	R	14	WM	Opening the tool	2 sec.	A
5	CDF	Adding new data to database on demand	10 sec.	R	15	WM	Choosing the data option	4 sec.	A
6	CDF	Adjusting information from manufacturer	5-20 sec.	A	16	WM	Manually updating required data	4 sec.	A
7	CDF	Demand forecasting on demand	2-10 min	A	17	WM	Checking the results	15-30 sec.	A
8	CDF	Sending the quotation to WM	2 sec.	A	18	WM	Consulting the results with TL	10-15 min	A
9	CDF	Checking the exceeds	5 sec.	A	19	WM	Making a decision	10-15 min	A
10	CDF	Exporting forecasts data to resource planning tool	2-5 sec.	A	20	WM	Manually resource planning	83 min	A
<p>*WM – warehouse manager; TL – team leader; M – manufacturer; CDF – cloud-based demand forecasting tool **in the case of time range the simulation time is calculated from normal distribution *** A – assumed time based on expert experience, R – assumed time based on the current part of process tested in the warehouse operation</p>									

In the order of answering the second research question the time parameter were analyzed. The simulation scenario was the same like before, the same amount of transactions with the same sequences generations were tested. Activities times which were considerate during simulation were settled in the following way: some activities are tested right now and the time parameter was calculated based on experience of current work and some activities time were assumed based on expert experience. Whole times are shown as a process time when the

workers were getting enough knowledge about that, so it did not include the managers and team leaders training. General results from simulation were shown in the table 5.

Table 5.

General simulation results – cloud-based resource planning process

Parameter	Parameter description	Cloud-based tool	Current solution	Increase (+) decrease (-) percentage
Total time	Total process time of simulation	102,54 h	611,62 h	-83,23%
Total transactions	Total number of ran sequences in the simulation	440 transactions	440 transactions	0%
Average process time	Total time divided by total transactions	0,23 h	1,39 h	-83,45%
Manufacturer activity	Number of transactions flowed by manufacturer pool	63 transactions	4 transactions	+93,65%
Number of rejections	Number of situations when the manufacturer did not agree with additional fee	1 time	2 times	-100%

Total time of simulation is equal to 102,54 hours which states about 16,77% of basic time which will be possible to achieve using automated, cloud-based demand forecasting tool. Also, the average process time is lower (of about 83,45%) than in the case of standard resource planning process realization. However, the manufacturer activity in the case of automated tool is bigger, it is indicated by the agreement's issues. Whole picks, as a deviation from contract values, required the formal confirmation by manufacturer. Every time when the demand forecasting tool will recognize the picks in forecasted horizon it sends the information to manufacturer. According to the author's opinion, this situation will force the more agile approach to collaboration between 3PL and manufacturer. Results connected with influence of proposed cloud-based tool on resources used in the process are shown in the figure 10.

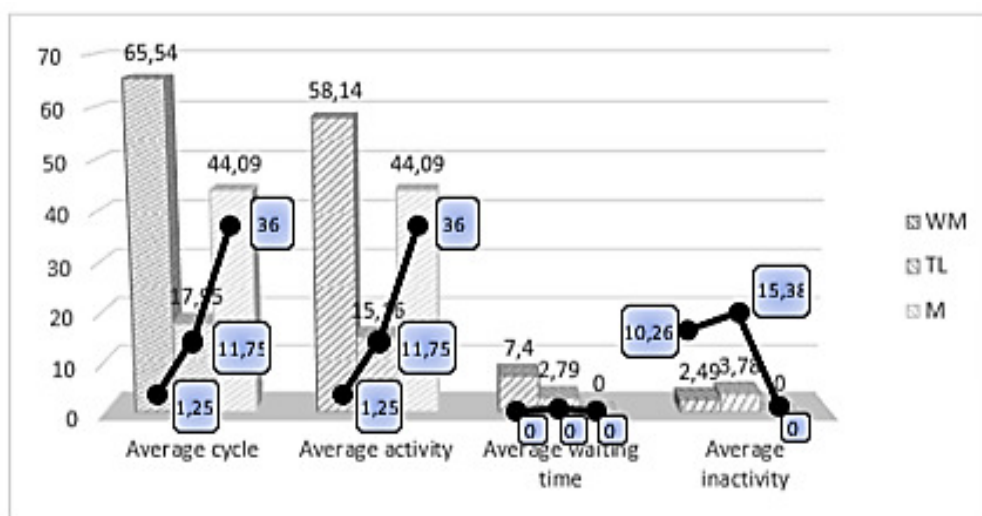


Figure 10. Cloud-based solution simulation results – influence on process resources.

Like it could be concluded from figure 10, the average cycle time of resources usage was decreased and it is equal to average activity time of resources. It means there is no waiting time of resources in queue. It was indicated by usage an additional pool of cloud-based demand forecasting system where the activities are automated computing and whole prediction and almost whole decision part is done automatically. One parameter which increases in the conception of automation is average inactivity of resources. It is connected with time shortage. In the author's opinion, the increasing value of this parameter should not be treated like disadvantage. More inactivity time, not connected with resource waiting in queues, could be used for support other activities which are done by particular resources.

Presented analysis allowed to answer the second research question (Q2: What benefits will bring the automation from the perspective of resource planning process time?). The main benefit is the time decreasing, increasing the level of automation, showing the main areas when the agile point of view should be implemented and showing the perspective of resource possibility of usage in the different activities (beside the resource planning process). There is also no fundamentals to reject the paper hypothesis (H1: Automated, cloud-based solution connected with demand forecasting used at simulation model will reduce the time of resource planning process at least by 60%). Like was presented, automation and fully cloud integration will allow to reduce the process time more than 60% (in total and in average one process time).

4. Conclusions

Presented research paper answered on two basic research questions. First of all, there were stated the main expectations of 3PL operational warehouse managers about usage and accuracy of demand forecasting tool. For that reason, managers opinions were examined by survey. According to this the managers see the greatest opportunity of tool usage in the process of warehouse resource planning, so they want to use demand forecasting tool results as an input to quantitative analysis of required human and material resources in the particular days of warehouse activity. They also required the accuracy level at the minimum MAPE level at 5% (it will cover 88% of manager expectations) in the daily forecasts. The automation- and cloud-driven improvement of the process was considered by building and testing simulation models based on BPMN 2.0. There were built two simulation models (first connected with current process shape and second connected with usage of automated cloud-based demand forecasting to support the resource planning process) and both of them were tested in the same simulation scenarios about sequence generations, time and human process resources parameters. One of the most important improvement is the possibility of process time reduction. Using mentioned technologies, it will be possible to reduce the time of resource planning process more than 60%, which allows to accept the paper's hypothesis. What is worth

mentioned the cloud-based solutions are usually very efficient (Kumar, Singh, 2019; Chou, Truong, 2019) in the case of IT infrastructure usage. Of course, the author, sees the both advantages and barriers of proposed solution. The most important of them, according to the author opinion, is shown in the table 6.

Table 6.
Brief SWOT analysis of proposed solution

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> -Automation and time reduction. -Huge cloud-based calculation power. -Fully data flows integration with WMS databases. -Decision making supported process. -Promoting of agile management. 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> -Necessary of modification of logistics contracts. -Data highly depended solution. -Risky data required from manufacturer to improve the calculations.
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> -Possibility of developing the demand forecasting algorithms with other large input data which could shaped the algorithms parameters. -Cloud & automation market trends. -Logistic 4.0 & Logistics Operators 4.0 market trends. -Easily to maintenance IT infrastructure. 	<p style="text-align: center;">Tears</p> <ul style="list-style-type: none"> -Manufacturer could feel moved away from demand planning. -Overfitting of algorithms connected with neural networks or machine learning (to fitted algorithms).

As was presented in the table 6 there an advantage of strengths and opportunities in the comparison with weaknesses and tears. One of the major advantages is automation and time reduction in accordance to contemporary market trends connected with implementation of Industry 4.0 solutions. There will not be also any issues with calculation power because of huge available cloud calculation power resources and pipelines calculation technologies which provides the possibility of calculate forecasts in parallel for huge number of manufacturers. Cloud technology provides also possibility to fully integration of input data possessing from WMS. Proposed solution will also provide the possibility of support the decision-making process by providing the warehouse managers necessary information about planned processes and predicted values connected with warehousing activity. Cloud-based solution will also implicate the need of promoting the agile approach to contract logistics with minimize the formal regulations and maximize the collaboration with manufacturer. Opportunities to development the tool are possibilities of developing the demand forecasting algorithms due to nowadays highly advance forecasting methods which could increase 3PL innovative level. Opportunities to tool implementation are also current trends connected with cloud-based technologies, automation and Industry 4.0 where the companies are encouraged to implement the solutions in these areas. Cloud-based solutions are usually also easy in IT maintenance which is also an opportunity.

The weaknesses and tears are the areas in which proposed conception could be improved and the possible areas of future research. First of all, there is a necessary of modification of logistics contracts – logistics contracts provide the standardization which often replace the proper collaboration level between 3PL and manufacturer. To gain the best level of forecasts the proper collaboration between this and other nodes of distribution network will be required.

This solution is also highly depended on data, so if the input of data be not proper then the results also will be disrupted. On the other hand, the highly accurate data usually contains the data about planned picks, promotions or sales strategies which manufacturer could classified as risky data to share. In this case also the technology could help. In the author's opinion one of solution of this problem is blockchain technology, when it will be possible to use the blocks – hidden and public. In public block could be more general information connected with the data specific. In hidden block could be delivered the data directly to forecasting tool without sending their specific to the 3PL. The idea of connect the cloud technology with blockchain is currently considerate by the authors like Kumari et al. (2020). Research paper provides answers to created research questions and positively vitrified the hypothesis.

Acknowledgements

Research paper was supported by 13/050/BK-22/0001.

References

1. Ageron, B., Benzidia, S., Benthari, O., Husson, J. (2018). Investigating automation and AGV in healthcare logistics: a case study based approach. *International Journal of Logistics Research and Applications*.
2. Aremu, A.Y., Shahzad, A., Hassan, S. (2018). Determinants of enterprise resource planning adoption of organizations' performance among medium enterprises. *LogForum*, 14(2), pp. 245-255.
3. Arshinder, K., Kanda, A., Deshmukh, S.G. (2008). Supply chain coordination: perspectives, empirical studies and research directions. *Int. J. Production Economics*, vol. 115, pp. 316-335.
4. Barczak, A., Dembińska, I., Marzantowicz, Ł., Nowicka, K., Szopik-Depczyńska, K., Rostowski, T. (2020). The impact of unpredictable factors on the uncertainty's structure in the management of logistics processes. *European Research Studies Journal*, vol. XXIII, pp. 186-200.
5. Chou, J.S., Truong, N.S. (2019). Cloud forecasting system for monitoring and alerting of energy use by home appliances. *Applied Energy*, 249, 166-177.
6. Chu, Z., Feng, B., Lai, F. (2018). Logistics service innovation by third party logistics providers in China: Algnig guanxi and organizational structure. *Transportation Research, Part E*, 118, pp. 291-307.

7. Cimini, Ch., Lagorio, A., Romero, D., Cavalieri, S., Stahre, J. (2020). Smart logistics and the logistics operator 4.0. *IFAC PapersOnLine*, 53-2, 10615-10620.
8. Devarajan, Y. (2018). A study of robotic process automation use cases today for tomorrow's business. *International Journal of Computer Techniques*, vol. 5, pp. 12-18.
9. dos Santos, C.H., Lima, R.D.C., Leal, F., Queiroz, J.A., Balestrassi, P.P., Montevechi, J.A.B. (2020). A decision support tool for operational planning: a Digital Twin using simulation and forecasting methods. *Production*, vol. 30.
10. Dou, Z., Sum, Y., Zhang, Y., Wang, T., Wu, Ch., Fan, S. (2021). Regional manufacturing industry demand forecasting: a deep learning approach. *Applied Sciences*, vol. 11, 6199.
11. Erceg, A., Sekuloska, J.D. (2019). E-logistics and e-sc: how to increase competitiveness. *LogForum*, vol. 15, pp. 155-169.
12. Giannakis, M., Spanaki, K., Dubey, R. (2019). A cloud based supply chain management system: effects on supply chain responsiveness. *Journal of Enterprise Information Management*, vol. 32, pp. 585-607.
13. Karaenko, P., Bichler, M., Minner, S. (2019). Coordination is hard: electronic auction mechanism for increased efficiency in transportation logistics. *Management Science*, vol. 65, pp. 44578.
14. Kmiecik, M. (2020). Transfer the function of forecasting to 3PL enterprise in distribution network - theoretical considerations. *Zeszyty Naukowe Politechniki Śląskiej*, No. 145, pp. 221-232.
15. Kmiecik, M. (2021a). Concept of distribution network configuration in the conditions of centralised forecasting. *Organization & Management Scientific Quarterly*, No. 1(53), pp. 29-40.
16. Kmiecik, M. (2021b). Implementation of forecasting tool in the logistics company - case study. *Scientific Papers of Silesian University of Technology*, No. 152, pp. 119-126.
17. Koliński, A., Werner-Lewandowska, K. (2021). Determinants of the usage of logistics labels by 3PL and 4PL operators – results of studies in Poland. *European Research Studies, Journal*, vol. XXIV, pp. 871-881.
18. Krajovic, M., Grzmar, P., Fusko, M., Skokan, R. (2018). Intelligent logistics for intelligent production system. *Komunikacie*, vol. 20, pp. 16-23.
19. Kumar, J., Singh, A.K. (2019). *Cloud resource demand prediction using differential evolution based learning*. 7th International Conference on Smart Computing & Communications (ICSCC), pp. 1-5. IEEE.
20. Kumari, A., Gupta, R., Tanwar, S., Kumar, N. (2020). Blockchain and AI amalgamation for energy cloud management: Challenges, solutions, and future directions. *Journal of Parallel and Distributed Computing*, 143, 148-166.
21. Pandain, A.P. (2019). Artificial intelligence application in smart warehousing environment for automated logistics. *Journal of Artificial Intelligence and Capsule Networks*, vol. 1, pp. 63-72.

22. Rai, H.B., Verlinde, S., Macharis, C. (2018). How are logistics service providers adapting to omnichannel retail? *IFAC Papers OnLine*, vol. 51-11, pp. 588-593.
23. Shee, H., Miah, S.J., Fairfield, L., Pujawan, N. (2018). The impact of cloud-enabled process integration on supply chain performance and firm sustainability: the moderating role of top management. *Supply Chain Management: An International Journal*, vol. 23, pp. 500-517.
24. Spiliotis, E., Makridakis, S., Semenoglou, A-A., Assimakopoulos, V. (2020). *Comparison of statistical and machine learning methods for daily SKU demand forecasting*. Operational Research Springer.
25. Szozda, N., Werbińska-Wojciechowska, S. (2013). Influence of the demand information quality on planning process accuracy in supply chain – case studies. *LogForum*, 9(2), pp. 73-90.
26. Wang, J., Lim, M.K., Zhan, Y., Wang, X. (2020). An intelligent logistics service system for enhancing dispatching operations in an IoT environment. *Transportation Research, Part E*, vol. 135, p. 101886.
27. Wright, L., Davidson, S. (2020). How to tell the difference between a model and a digital twin. *Advanced Modeling and Simulation in Engineering Sciences*, vol. 7.

PATTERNS IN CORPORATE TRADE CREDIT MANAGEMENT: INSIGHTS INTO THE POLISH TRADE SECTOR

Julia KORALUN-BEREŹNICKA

University of Gdańsk, Faculty of Management; julia.koralun-bereznicka@ug.edu.pl,
ORCID: 0000-0003-4498-0381

Purpose: The study identifies the intra-industry and cross-size regularities in corporate trade credit policies of Polish firms operating in the trade sector. It aims to verify whether the intra-industry effect is more likely to affect corporate trade credit behaviour than the firm size effect.

Design/methodology/approach: The research is based on yearly data from the ECCBSO trade credit database for three trade industry sub-sections (motor vehicle trade, wholesale trade and retail trade) and four size groups in the period 2005-2017. The rich collection of variables employed enables detailed insights into the corporate trade credit management practices. Methods include the analysis of variance, cluster analysis and multidimensional scaling.

Findings: Findings provide evidence that both size-related features and intra-industry specificity are significant determinants of corporate trade credit behaviour. The study also reveals that the industrial breakdown of trade firms into sub-sections is of greater importance in comparison to the size-based classification of firms.

Research limitations/implications: The dataset employed in the research offers aggregated information instead of firm-level data, which inevitably reduces the information resource, but also ensures data harmonisation and comparability. Narrowing the research to just one industrial section in Poland makes the study specific. Further investigation of the patterns in trade credit could be directed at other industries and (or) other countries.

Practical implications: The reported findings might be of interest to those involved in corporate finance management. Recognising the differences in receivables and payables management resulting mainly from the intra-industry specificity can contribute to a better understanding of business financing and its operational functioning. This knowledge may support the effective management of receivables and liabilities, especially in companies operating in developing countries.

Originality/value: The study contributes to the existing literature mainly through the application of the multi-sectional approach to private companies, covering the dimension of time, firm size and industry sub-section. This offers grounds for detailed multi-layered conclusions in terms of corporate trade credit behaviour in the Polish trade sector.

Keywords: trade credit, intra-industry effect, firm size, trade sector, classification methods.

Category of the paper: Research paper.

1. Introduction

Apart from using capital borrowed from financial institutions, ever since commerce appeared firms have commonly used funds from their suppliers, i.e. funds made available through trade credit. Whenever a delay is arranged between the purchase of goods or services and the payment for these purchases, trade credit is created, which constitutes one of the major sources of short-term financing for most businesses (Brick, Fung, 1984a). Trade credit can be considered both from the point of view of a buyer and a seller. Trade credit received is a short-term source of financing reported under current liabilities in the balance sheet, whereas trade credit granted can be seen as an investment in accounts receivable reported under current assets (García-Teruel, Martínez-Solano, 2010).

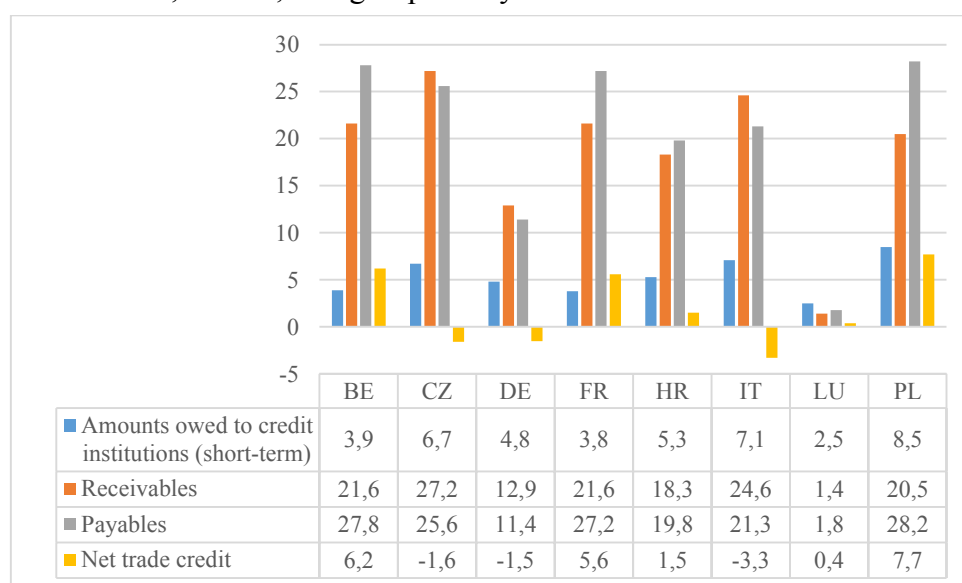
The funds obtained through trade credit are likely to be considered as a complementary source of capital to the funds transferred via financial channels, i.e. mainly through banks, but also – and in an increasing number of cases – as a substitute for traditional bank credits (Burkart, Ellingsen, 2004). According to the European BACH database (BACH, 2021), in 2019 trade payables amounted to as much as 28.2% of the assets for a sample of all-sized firms in the Polish trade sector, while the amounts owed to credit institutions revealed in the current liabilities accounted only for 8.5%. Similarly, the relation of trade receivables to assets in that sector, which reflects the scale of trade credit granted, was 20.5%. This indicates that the trade credit policy, which involves not only accounts payable, but also receivables management, is an important component of working capital management. The numerosity and interdependence of theories explaining trade credit, combined with an even larger set of factors and motives behind supplying and using trade credit by firms, make the issue highly researchable. Therefore, although working capital management has been an area of interest of virtually countless studies, it continues to attract attention among scholars. Given the considerable variations in trade credit usage, terms, and maturity periods across countries and industries, and even within industries, Dary and Harvey (2020) suggest that the research in this area should focus on specific industries. Following this recommendation and taking into account the fact that industry-level studies are relatively rare, this paper is restricted to just one specific sector of trade in Poland.

The contribution of this study to the existing literature on trade credit is three-fold. Firstly, this research covers private firms of various sizes, including even the often neglected micro firms. Secondly, the adopted multi-sectional approach encompassing the time cross-section, cross-size section and intra-industry cross-section provides a framework for multi-layered conclusions in terms of corporate trade credit behaviour. Thirdly, an unusually detailed set of variables was employed. As a result, the analysis provides deep insights into the trade credit behaviour of Polish firms, thus updating and broadening the knowledge in the field.

The remainder of this paper is organized as follows. The scale of use of corporate trade credit across industries and European economies is briefly reported in section 1, whereas section 2 provides a review of the major trade credit theories. Based on previous research findings, the role of the firm size and its industrial classification in corporate trade credit behaviour is also discussed here. The description of the sample, variables and methods used can be found in section 3, which is followed by the results and discussion. The study ends with a summary and conclusions.

2. The role of trade credit in the trade sector

A glance at the scale of use of the trade credit by firms from the trade sector across countries (Figure 1) and across industries in Poland (Figure 2) seems a purposeful prolegomenon to the more detailed study of the phenomenon. The data was retrieved from the European database (BACH, 2021), which provides aggregated and comparable data from financial statements of firms across countries, sectors, size groups and years.



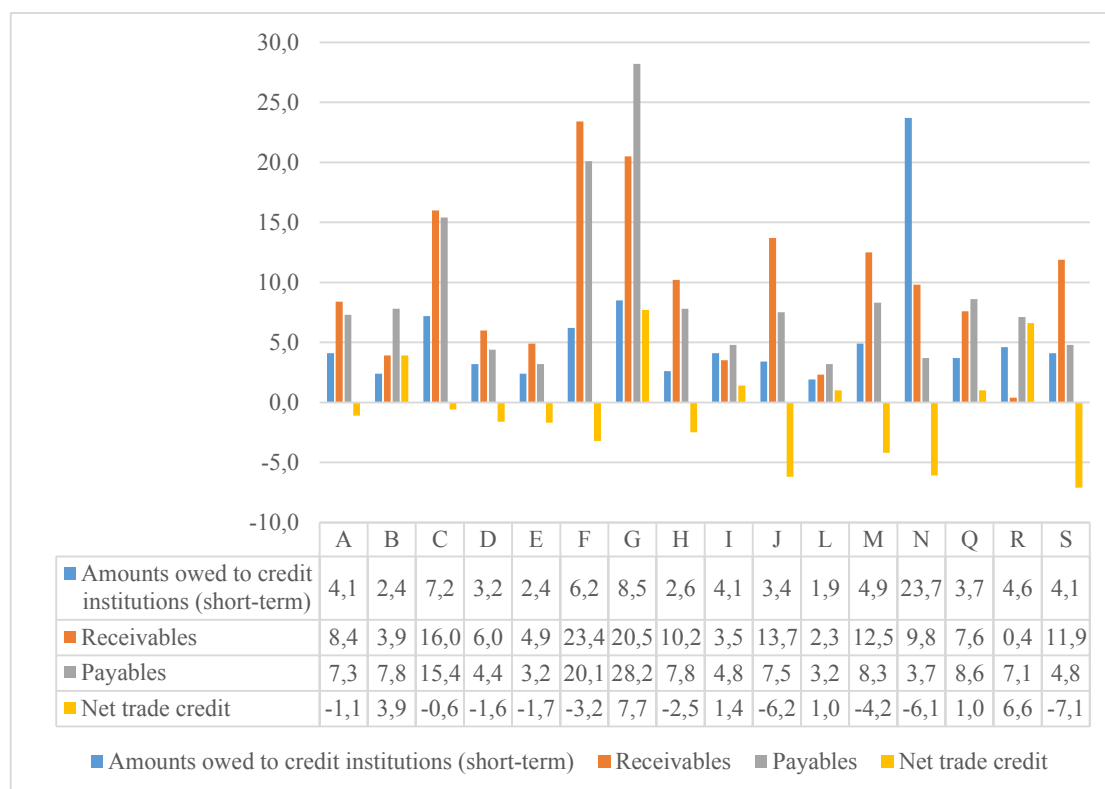
Note. The numbers represent percentage shares of the given amounts in total assets based on a sample of all-sized firms available in the database. The net trade credit is calculated as the difference between accounts payable and accounts receivable.

Figure 1. The use of short-term credit from financial sector and trade credit and in the trade sector across countries in 2019.

Source: own elaboration based on BACH (2021) database.

As for the international cross-section, the most obvious regularity characteristic for most countries, for which the relevant data was available in the most recent year in the BACH database, is the considerably lower share of short-term financial debt compared to trade credit received, illustrated by the share of accounts payable in assets. The only exception from this rule is Luxemburg, where the situation is inverse. It is also rather more typical for trade sector

companies to be net users of trade credit; only Czech, German, and Italian companies are net suppliers, on average. It appears that the Polish trade sector is characterised by the highest share of accounts payable to assets in comparison with several other EU countries. Similarly, the highest level of short-term financial debt and net trade credit can be observed for Poland. The relation of accounts receivable to assets is not the highest, but well above the average level for the considered countries. As a result, the net trade credit for companies from the Polish trade sector is the largest in the analysed group.



Note. The numbers represent percentage shares of the given amounts in total assets based on a sample of all-sized firms available in the database. The net trade credit is calculated as the difference between accounts payable and accounts receivable. Sector designations follow the NACE symbols: A – Agriculture, forestry and fishing, B – Mining and quarrying, C – Manufacturing, D – Electricity, gas, steam and air conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, **G – Wholesale and retail trade, repair of motor vehicles and motorcycles**, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, Q – Human health and social work activities, R – Arts, entertainment and recreation, S – Other service activities.

Figure 2. The use of short-term credit from financial sector and trade credit and in the trade sector across industries in Poland in 2019.

Source: own elaboration based on BACH (2021) database.

When considering the cross-industry section in Poland, again it can be observed that accounts payable on average roughly double the short-term amounts owed to financial institutions. The difference is almost triple in the case of the trade sector. The only industry where trade credit received is smaller than financial short-term debt is the sector of administrative and support service activities.

3. Literature review and hypotheses development

There is a number of theories explaining the reasons for which on the one hand non-financial companies offer trade credit, and, on the other hand, other firms use this financial instrument. A review of the main trade credit theories can be found in Petersen and Rajan (1997), whereas Bhattacharya (2011) and Dary and Harvey (2020) offer a thorough historical evolution of these theories. A synthetic summary of these considerations can be found in Table 1.

Table 1.
Review of theories explaining trade credit

Theory	Explanation of the role of trade credit	Literature
Financing advantage	The supplier's better ability to evaluate customers' creditworthiness and execute repayments in comparison to traditional lenders (resulting from advantages in information acquisition, controlling the buyer, and recouping value from existing assets) may provide him with a cost advantage over financial institutions in offering credit to a buyer. Trade credit serves as a substitute for institutional finance, especially for firms with limited access to such financing and (or) poor creditworthiness.	Meltzer (1960); Schwartz (1974); Brennan et al. (1988); Smith (1987)
Liquidity	Sellers with advantageous access to capital may benefit from offering trade credit to customers with limited access to capital (trade credit as an instrument of redistribution). Firms suffering from low financial liquidity need trade credit to improve their cash flows.	Meltzer (1960); Schwartz, (1974); Emery (1984)
Financial distress	It might be more difficult for financially distressed firms to obtain trade credit, but they need larger amounts of trade credit to substitute alternative sources of financing when they become unavailable. The financial distress of a supplier makes the buyer more reluctant to pay on time, which aggravates the crisis.	Wilner (2007); Baxter (1967); Molina, Preve (2012)
Transactions costs	In the case of frequent transactions between parties, trade credit can serve as a means of reducing transaction costs for both buyers and sellers who might economise by periodic payments.	Williamson (1979); Ferris (1981); Emery (1984); Petersen, Rajan (1997)
Quality guarantee	If the quality of goods cannot be determined at the time of their purchase, trade credit serves as a guarantee by providing buyers additional time for verification of that quality before payment.	Smith (1987); Lee, Stowe (1993); Long et al. (1993); Fafchamps et al. (1995); Deloof, Jegers (1996)
Price discrimination	In highly competitive markets, sellers may deploy trade credit as a tool of indirect price discrimination (when the straightforward one is impermissible), which favours riskier and (or) low credit quality customers.	Brennan et al. (1988); Petersen, Rajan (1997); García-Teruel, Martínez-Solano (2010)
Product differentiation	Similarly to advertising, trade credit can serve as a marketing tool or sales promotion device to differentiate products from the competition and thus stimulate demand and increase market share.	Nadiri (1969); Wilner (2000); Summers, Wilson (2000); Cheng, Pike (2003)
Market power	As opposed to developed countries, companies with market power in developing economies tend to abuse their position to become net users of trade credit by extracting much more trade credit from the suppliers than granting it to the buyers.	Cheng, Pike (2003)

Cont. table 1.

Tax	Under cash accounting systems, firms can defer their tax liabilities and therefore enhance their cash flows by offering trade credit, especially in high-tax jurisdictions. Trade credit may be used to reallocate capital between different tax jurisdictions.	Brick, Fung (1984b); Brennan et al. (1988); Mian, Smith (1992); Desai et al. (2016)
Long-term relationship	Firms, especially newly established market entrants or operating in highly competitive industries, may invest in trade credit as a means of attracting customers, building long-term relationships with them and preventing them from defection.	Nadiri (1969); Ng et al. (1999); Wilner (2000); Summers, Wilson (2000); Cuñat (2007)

Source: own elaboration based on Petersen, Rajan (1997), García-Teruel, Martínez-Solano (2010), Bhattacharya (2011), and Dary, Harvey (2020).

As can be inferred from the summary of the trade credit theories collated in Table 1, both from the explanations and repeated literature items, the theories tend to overlap and interrelate rather than be mutually exclusive (Dary, Harvey, 2020). Similar interrelations can be observed in the case of the motives behind trade credit activity. It is not unusual for researchers to find confirmation for more than one theory in one study. This indicates that firms might get involved in trade credit activities for different reasons, which can further vary depending on such circumstances as economic situation or trading partners. Such a variety and interdependence of factors affecting firms' trade credit behaviour provides grounds for further research of this phenomenon both cross-sectionally and across time.

A wide range of factors has been found to affect corporate trade credit policies. The two factors of particular interest in this paper are the firm size and its industrial classification. It appears that the empirical evidence on the effect of firm size and the amount of trade credit granted and received is ambiguous (Dary, Harvey, 2020). A summary of some of the previous research findings in the field can be found in Table 2.

Table 2.

Summary of the research findings on the relation between firm size and trade credit

Relation	Trade credit supplied	Trade credit received
+	Petersen, Rajan (1997); Lin, Chou (2015); Carvalho, Schiozer (2015); Bougheas et al. (2009);	Bougheas et al. (2009); Lin, Chou (2015); García-Teruel, Martínez-Solano (2010); Ferrando, Mulier (2013); Fisman, Raturi (2004)
-	Long et al. (1993); Alarcón (2011); Jaleel et al. (2014); Wilson, Summers (2002)	Kihanga et al. (2010); Jaleel et al. (2014); Dulinić, Świda (2021)

Source: own elaboration based on Dary and Harvey (2020).

As for the industrial classification of firms as a factor affecting corporate trade credit behaviour, a number of various sector-related firm characteristics can be distinguished. A synthetic summary of such industry-specific factors based on previous literature is presented in Table 3.

Regardless of which industry-specific factor is responsible for the amount of trade credit or the trade credit period, the cross-industry variety of trade credit terms seems unquestionable, as widely evidenced by different studies. Similarly, the multiple reports on the existence of the size effect in corporate trade credit management make the firm size one of the key issues in the field.

Table 3.
The impact of industry-related factors on trade credit

Factor	Relation with trade credit amount and (or) period	Literature involved
Amount of goods purchased	The higher the amount of purchase, the more likely it is for trade credit to occur. Firms operating in industries where bulk purchases are common tend to offer trade credit more often than retail firms.	Burkart, Ellingsen (2004)
Liquidity of goods	In industries where goods are with a low degree of liquidity, larger amounts of trade credit are likely to occur.	Dary, Harvey (2020)
Quality verification	Higher amounts of trade credit and (or) longer periods occur in transactions between suppliers and international customers, especially when it is purposeful to verify the quality of goods sold.	Long et al. (1993); Deloof, Jegers (1996); Ng et al. (1999)
Uniqueness of goods	The amounts of trade credit are likely to be higher in industries where the goods involved in the exchange are highly specific.	Long et al. (1993)
Market concentration	Higher trade credit amounts are more typical for industries characterised by high competition, as opposed to monopolies.	Fisman, Raturi (2004)
Inventory volume	Firms with greater levels of inventory may also offer more trade credit. Large volumes of inventories usually suggest a greater volume of purchases from suppliers and hence greater demand for trade credit.	Elliehausen, Wolken (1993)
Production cycle	Larger trade credit amounts and (or) longer periods are associated with industries offering goods with long production cycles, implying their high quality or complexity. Low-quality or highly perishable products, like food, are less likely to be sold on credit.	Long et al. (1993); Fafchamps et al. (1995); Deloof, Jegers (1996); García-Teruel, Martínez-Solano (2010)
Product complexity	Longer trade credit periods are associated with hard or complex goods.	Klapper et al. (2012)

Source: own elaboration based on literature items listed in the table.

A question that remains partly open to debate is which of the two factors prevails in terms of trade credit behaviour. This leads to the formulation of the following research hypotheses:

- H1: trade credit behaviour varies significantly across sub-sections of the Polish trade sector in all size groups of firms.
- H2: trade credit behaviour varies significantly across size groups in the Polish trade sector and its sub-sections.
- H3: the intra-industry specifics is a more important determinant of corporate trade credit behaviour than the firm size in the Polish trade sector.

While the literature background for the first two hypotheses has already been discussed here, the third hypothesis might need some justification. The hypothesised hierarchy of the size effect and the intra-industry effect, in which the latter is favoured, derives from previous studies aiming at evaluating the relative importance of these two effects. The available evidence in other corporate finance areas, such as general corporate performance (Koralun-Bereźnicka, 2013) or capital structure (Koralun-Bereźnicka, 2016) more often than not gives priority to the industry effect.

4. Data and methods

The comparative analysis of the relative importance of the intra-industry sections and firm size effect in corporate trade credit behaviour is based on the data from the ECCBSO (European Committee of Central Balance Sheet Data Offices) Trade Credit Database (ECCBSO, 2020). The database contains results of Financial Statement Analysis Working Group (FSA WG) on the calculation of indicators of days sales outstanding (DSO) and days payable outstanding (DPO), used as proxies for customer and supplier payment periods, based on accounting information drawn from financial statements of firms. Apart from Poland, the database covers eight other countries, seven of which are also EU member states. The one country from outside the EU included in the database is Turkey. Of the three industrial sectors captured by the ECCBSO Trade Credit Database, namely the construction industry, manufacturing, and trade, only the latter is further broken into the sub-sections of motor vehicle (MV) trade, wholesale trade (WS), and retail trade (RT). This subdivision enables deeper insights into the trade credit behaviour of firms in this sector, which was found to be characterised by generally shorter receivables and payables cycles, compared to the manufacturing and construction sections.

As for the size breakdown, the data is available for four size groups, i.e. micro firms (with the sales lower or equal to €2 mln), small firms (with sales higher than €2 mln but lower than or equal €10 mln), medium firms (with sales between €10 mln and €50 mln) and large firms, whose sales exceed €50 mln. The time span for Poland covers the period from 2005 to 2017, and the frequency of data is yearly. Apart from the cross-size and intra-industry breakdown of the data for the analysed trade sector, the aggregated data items are also provided for all size groups without micro firms. The aggregation base varies across the years, as the number of companies included is different in each period. Table 4. shows the number of companies for each year and in each category of size and trade sub-sector.

Table 4.

The number of Polish trade sector companies covered by the ECCBSO trade credit database by size group, trade sub-sections, and years

Year	Trade sub-sector	Firm size			
		Micro	Small	Medium	Large
2005	MV	255	383	151	34
	WS	1 013	1 941	1 012	319
	RT	679	628	205	69
2006	MV	233	358	166	39
	WS	880	1 951	1 044	352
	RT	632	669	214	79
2007	MV	212	347	190	51
	WS	776	1 921	1 145	389
	RT	628	701	236	95
2008	MV	224	352	195	49
	WS	993	2 133	1 183	378
	RT	643	772	234	98

Cont table 4.

2009	MV	233	365	189	46
	WS	1 013	2 158	1 102	337
	RT	666	830	240	94
2010	MV	229	366	187	55
	WS	995	2 118	1 104	336
	RT	661	813	245	97
2011	MV	240	366	180	53
	WS	929	2 067	1 138	357
	RT	640	848	265	93
2012	MV	247	352	184	49
	WS	1 046	2 088	1 124	365
	RT	656	856	242	94
2013	MV	268	344	176	53
	WS	1 118	2 146	1 128	366
	RT	707	912	236	104
2014	MV	252	311	190	50
	WS	1 076	2 151	1 151	368
	RT	713	917	239	99
2015	MV	210	309	200	59
	WS	897	2 086	1 158	385
	RT	597	942	259	103
2016	MV	206	291	207	77
	WS	902	2 135	1 183	388
	RT	610	1 020	266	114
2017	MV	178	275	217	80
	WS	775	1 994	1 239	407
	RT	560	1 018	295	111
Average	MV	230	340	187	53
	WS	955	2068	1132	365
	RT	646	840	244	96

Note. MV – motor vehicle trade, WS – wholesale trade, RT – retail trade.

Source: own elaboration based on ECCBSO (2020) trade credit database.

The variables involved in the study include the following ratios:

- Days Sales Outstanding (DSO), defined as:

$$DSO = \frac{\text{Trade Receivables} - \text{Customer Prepayments}}{\text{Net Turnover}} \cdot 360, \quad (1)$$

where the customer prepayments are defined in 4th EU Directive as: “Payments received on account of orders in so far as they are not shown separately as deductions from stocks”;

- Days Payables Outstanding (DPO), defined as:

$$DPO = \frac{\text{Trade payables} - \text{Advances to Suppliers}}{\text{Purchases}} \cdot 360, \quad (2)$$

where the advances to suppliers are defined in 4th EU Directive as “Payments on account”, and purchases – as a sum of material expense and services rendered;

- Trade Credit Balance (TCB), defined as:

$$TCB = \frac{DSO \cdot Net\ Turnover - DPO \cdot Purchases}{Net\ Turnover} \quad (3)$$

For each of the three ratios (1) – (3), the following information is provided:

- the percentage share of companies with the ratio value falling into a certain range,
- the ratio's distribution in days,
- the weighted mean based on percentile distribution.

The details of the data available for each ratio are shown in Table 5, along with the symbols assigned to each variable for easier identification in the remainder of the study.

The structure of the analysed data is three-dimensional and can be visualised by a data cube in Figure 3. The dimensions correspond to the trade industry sub-sections, four size groups of firms and to the number of years in the analytical period, i.e. from 2005 to 2017. Then, for each object defined by the three dimensions, 42 variables are available, as specified in Table 5. Overall, the data cube creates 6552 aggregated data items, 504 per year.

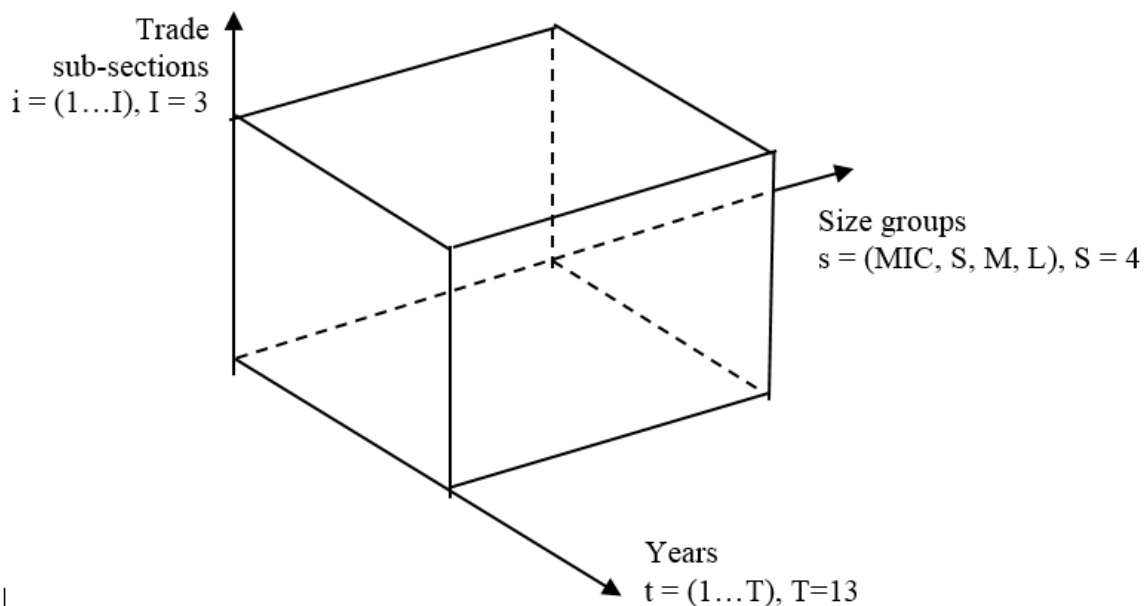


Figure 3. Data structure.

Source: own elaboration.

The selection of research methods is mainly determined by the aim of the study, which is to evaluate the relative importance of the firm size versus intra-industry effect in corporate trade credit behaviour of the Polish trade sector firms. At the same time, however, the very data structure, composed of multi-dimensional objects (i.e. size groups in years, industries in years, size groups in industries) described by numerous diagnostic variables, implies the need to simplify the data organisation to identify the main regularities. The multivariate statistical analysis provides an adequate means of realising this objective.

Table 5.
Variables characteristics and symbols

Ratio	Specification	Symbol of variable	
DSO (Days Sales Outstanding)	a) % of companies with	1. $DSO < 0$	$DSO_{<0}$
		2. $DSO \in (0; 30)$	DSO_{0-29}
		3. $DSO \in (30; 60)$	DSO_{30-59}
		4. $DSO \in (60; 90)$	DSO_{60-89}
		5. $DSO \in (90; 120)$	DSO_{90-119}
		6. $DSO \geq 120$	DSO_{120+}
	b) distribution in days	1. P_{05}	DSO_{P05}
		2. P_{10}	DSO_{P10}
		3. P_{25}	DSO_{P25}
		4. P_{50}	DSO_{P50}
		5. P_{75}	DSO_{P75}
		6. P_{90}	DSO_{P90}
		7. P_{95}	DSO_{P95}
		8. weighted mean	DSO_{WM}
DPO (Days Payables Outstanding)	a) % of companies with	1. $DPO < 0$	$DPO_{<0}$
		2. $DPO \in (0; 30)$	DPO_{0-29}
		3. $DPO \in (30; 60)$	DPO_{30-59}
		4. $DPO \in (60; 90)$	DPO_{60-89}
		5. $DPO \in (90; 120)$	DPO_{90-119}
		6. $DPO \geq 120$	DPO_{120+}
	b) distribution in days	1. P_{05}	DPO_{P05}
		2. P_{10}	DPO_{P10}
		3. P_{25}	DPO_{P25}
		4. P_{50}	DPO_{P50}
		5. P_{75}	DPO_{P75}
		6. P_{90}	DPO_{P90}
		7. P_{95}	DPO_{P95}
		8. weighted mean	DPO_{WM}
TCB (Trade Credit Balance)	a) % of companies with	1. $TCB < 0$	$TCB_{<0}$
		2. $TCB \in (0; 30)$	TCB_{0-29}
		3. $TCB \in (30; 60)$	TCB_{30-59}
		4. $TCB \in (60; 90)$	TCB_{60-89}
		5. $TCB \in (90; 120)$	TCB_{90-119}
		6. $TCB \geq 120$	TCB_{120+}
	b) distribution in days	1. P_{05}	TCB_{P05}
		2. P_{10}	TCB_{P10}
		3. P_{25}	TCB_{P25}
		4. P_{50}	TCB_{P50}
		5. P_{75}	TCB_{P75}
		6. P_{90}	TCB_{P90}
		7. P_{95}	TCB_{P95}
		8. weighted mean	TCB_{WM}

Source: own elaboration based on ECCBSO (2020) trade credit database.

The first stage of the empirical part of the study involves the basic statistical analysis of the diagnostic variables. This was performed taking into account the following cross-sections: across size groups of firms, across sub-sections of the trade industry, and across time. Insights into the descriptive statistics of the trade credit ratios, such as mean value or standard deviation, set up a preliminary diagnosis of their diversity in the above-mentioned cross-sections and enable the initial recognition of the main regularities within the analysed population.

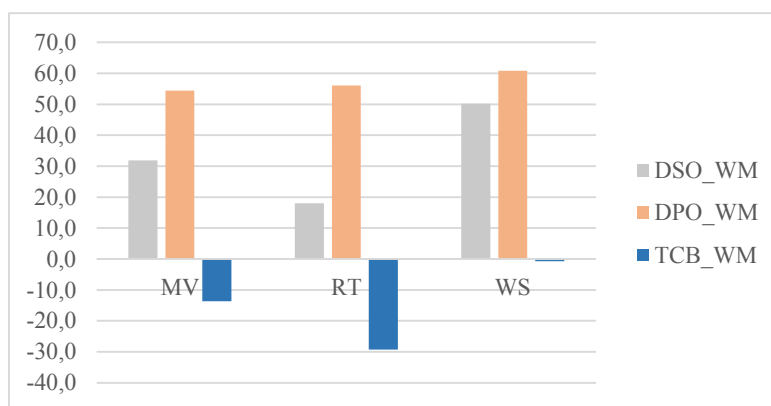
Although descriptive statistics constitute a rich source of basic knowledge about the examined dataset, they do not portray any information on the significance of the identified differences. Therefore, to evaluate the statistical significance of the ratios' diversity, the one-way analysis of variance (ANOVA) was applied (Fisher, 1954). The following grouping factors were involved in the ANOVA: firm size, industrial sub-section, and year.

The heterogeneity of the analysed population, as well as its multidimensionality, imply the need to organise its objects into groups of a clearer internal structure and more characteristic features, i.e. to classify them according to certain criteria. In this study, two commonly applied classification algorithms were used, namely the agglomerative cluster analysis, as well as the k-means grouping technique (Wishart, 2003) available in the STATISTICA software package. In the case of agglomerative clustering, the squared Euclidean distance metric was used to measure the distances between objects, whereas the Ward hierarchical method was applied in the amalgamation procedure, i.e. for determining the similarity of clusters (Ward, 1963). A detailed analysis of the grouping results, including the internal structure of each cluster, may provide an answer to whether the objects bear more similarity according to their intra-industrial classification, or whether they tend to get clustered by size groups.

To simplify the data structure, an exploratory technique of multidimensional scaling was applied (Springall, 1978; Mugavin, 2008). The use of multidimensional scaling (MDS) was specifically aimed at constructing a two-dimensional map of binomial objects formed by trade sub-sections in size groups. Through the MDS the objects are located in a space of a declared number of dimensions in such a way, that the obtained configuration provides the best approximation of the observed distances. Reducing the number of dimensions (variables) allows to easily visualise the identified patterns, as well as extract the unrecognised factors which explain the observed (dis)similarities between the objects.

5. Results and discussion

As indicated in the previous section, the first stage of the analysis was aimed at the preliminary recognition of the main trade credit patterns based on the basic statistics. A glance at the mean values of the three main weighted mean ratios across the three sub-sections of the trade industry (Figure 4) reveals the longest cycles of receivables and payables in the wholesale trade sector.



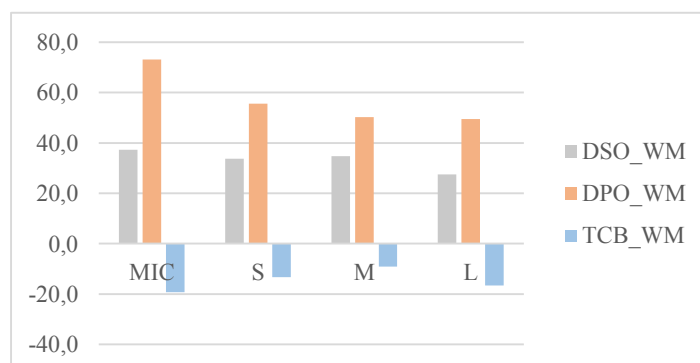
Note. MV – motor vehicles trade, RT – retail trade, WS – wholesale trade; weighted mean ratios: DSO – days sales outstanding, DPO – days payable outstanding, TCB – trade credit balance.

Figure 4. Average values of the weighted mean ratios across trade sub-sections.

Source: own elaboration based on ECCBSO (2020) trade credit database.

On average, it takes about 17 days longer for wholesale trade companies to collect their receivables than the average for all trade sector firms, whereas firms from the retail trade sector on average manage to do that within a period two weeks shorter. This should not be surprising though, as it is less common for retailers to credit their customers, especially in business-to-customer relations. Companies operating in the motor vehicle trade section remain closest to the industrial mean both in terms of receivables and payables management. Much less remarkable intra-industry-related differences are noticeable in the area of days payables outstanding ratio, which is on average 57 days long for the whole trade sector, and only three days longer in the case of the wholesale trade firms. These firms, however, face the highest trade credit balance, though still negative as for the whole trade sector. Retail trade companies are characterised by the considerably longest, almost a month-long trade credit balance, as well as the shortest receivables turnover. The greatest variability of all three ratios can be noticed in the case of the wholesale trade.

As for the cross-size section, the average values of the main variables can be traced in figure 5.



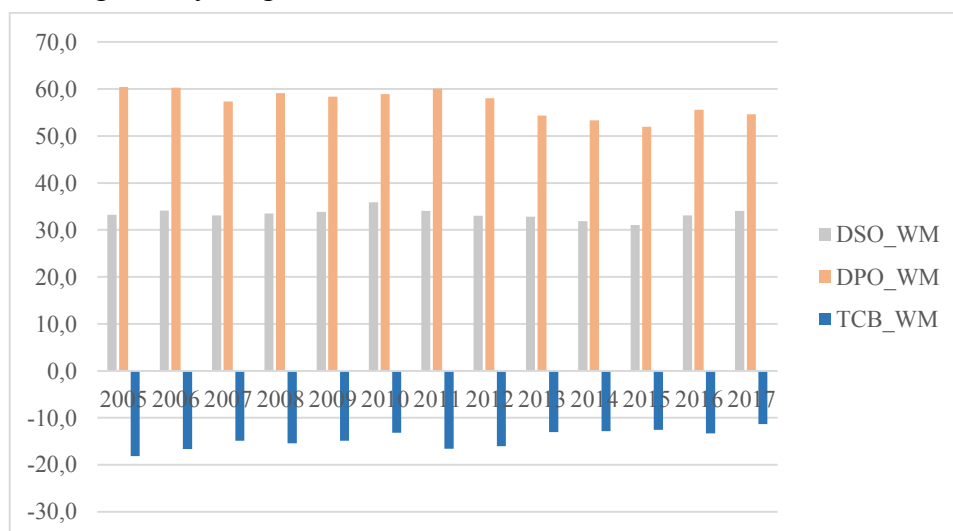
Note. MIC – micro firms, S – small firms, M – medium firms, L – large firms; weighted mean ratios: DSO – days sales outstanding, DPO – days payable outstanding, TCB – trade credit balance.

Figure 5. Average values of the weighted mean ratios across size groups.

Source: own elaboration based on ECCBSO (2020) trade credit database.

An interesting regularity noticeable regarding the receivables management is that trade companies tend to become slightly more restrictive with collecting their receivables as they grow larger in size. On average micro-firms allow their customers to pay their bills about ten days later than large companies. A similar consistency can be detected in terms of payables days outstanding, where micro-firms on average delay their payments by about three weeks longer than large ones. The most remarkable difference, however, is observed between micro firms and other sized firms. The group of small, medium and large firms appears as more homogeneous. No clear patterns can be distinguished between size and trade credit balance ratio; the average trade credit balance is negative for all size groups and rather only slightly varied - the span between the longest and shortest trade credit balance on average is about 10 days only.

When taking into account the time cross-section of the data visualised in Figure 6, it appears that no obvious or evident tendencies are observable. The level of days payables outstanding ratio appears as the most stable across the analysed period, whereas the DPO_{WM} decreases slightly, though not regularly. As a result the trade credit balance in 2017 is about a week shorter than in 2005, though always negative.



Note. Weighted mean ratios: DSO – days sales outstanding, DPO – days payable outstanding, TCB – trade credit balance.

Figure 6. Average values of the weighted mean ratios across time.

Source: own elaboration based on ECCBSO (2020) trade credit database.

In the case of observing differences between variables across the considered categories, it should be verified whether they are statistically significant. This issue was addressed by using the univariate analysis of variance across sub-sections of the trade sector and size groups of firms. The results – for the sake of brevity – are reported only for the three main weighted mean variables and are collated in tables 6 and 7, with the grouping variables as industry and size, respectively.

Table 6.*Total and by-size ANOVA results with trade sub-section as the grouping factor*

Variable	All size groups		Size group			
			MIC	S	M	L
DSO _{WM}	F	486.5*	202.3*	1018.5*	778.5*	739.8*
	p	0.000	0.000	0.000	0.000	0.000
DPO _{WM}	F	4.4*	18.0*	20.4*	4.4*	161.7*
	p	0.014	0.000	0.000	0.000	0.019
TCB _{WM}	F	205.7*	56.1*	237.3*	314.0*	513.0*
	p	0.000	0.000	0.000	0.000	0.000

Note. * – significant at $p=0.05$, MIC – micro firms, S – small firms, M – medium firms, L – large firms, weighted mean ratios: DSO – days sales outstanding, DPO – days payable outstanding, TCB – trade credit balance.

Source: author's calculations based on ECCBSO (2020) trade credit database.

As can be seen in tables 6 and 7, the ANOVA procedure was performed for the analysed population as a whole, and then in individual size groups and trade sub-sections. All of the three main trade credit ratios demonstrate significant variation both across trade sub-sections, as well as across size groups of firms. Moreover, this is observed not only in terms of the whole population examined, but also in individual size groups of companies – with industry as the grouping variable, and individual trade sub-sections – with the size factor.

Table 7.*Total and by-section ANOVA results with firm size as the grouping factor*

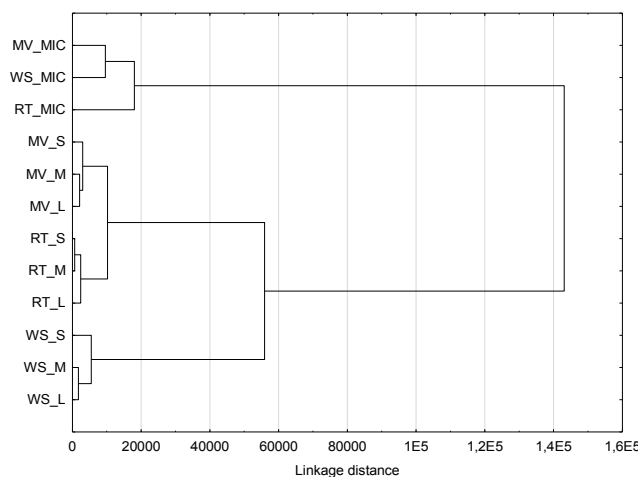
Variable	All trade sub-sections		Trade sub-section		
			MV	WS	RT
DSO _{WM}	F	3.5*	20.4*	142.8*	53.1*
	p	0.017	0.000	0.000	0.000
DPO _{WM}	F	103.4*	96.5*	85.8*	58.0*
	p	0.000	0.000	0.000	0.000
TCB _{WM}	F	4.3*	7.3*	43.0*	81.6*
	p	0.006	0.000	0.000	0.000

Note: * – significant at $p=0.05$, MV – motor vehicles trade, RT – retail trade, WS – wholesale trade, weighted mean ratios: DSO – days sales outstanding, DPO – days payable outstanding, TCB – trade credit balance.

Source: author's calculations based on ECCBSO (2020) trade credit database.

As for the remaining variables, their vast majority is also characterised with significant cross-industry variability when the whole population is considered. The only exceptions from this rule, i.e. the only ratios for which no significant cross-industry variability was found are the following: DPO₁₂₀₊, DPO_{P90}, and DPO_{P95}. However, when taking into account the size factor as the qualitative predictor, the cases with lack of significant variability were more numerous and pertained to the following ratios: DSO₀₋₂₉, DSO₃₀₋₅₉, DSO₉₀₋₁₁₉, DSO₁₂₀₊, DSO_{P25}, DSO_{P50}, DSO_{P75}, TCB_{<0}, TCB₀₋₂₉, TCB₃₀₋₅₉, TCB₆₀₋₈₉, TCB_{P50}, TCB_{P75}.

The ANOVA results provide a preliminary indication that while the industrial breakdown proves quite meaningful for corporate trade credit behaviour, the firm size appears to be of slightly lower importance in that matter. These insights might be better visualised by a tree diagram in figure 7.



Note. The tree diagram for binomial objects is based on all variables except $DSO_{<0}$, $DPO_{<0}$, and $TCB_{<0}$. The distance between objects was measured with the square Euclidean distance, and the Ward linking method was applied. MV – motor vehicles trade, RT – retail trade, WS – wholesale trade, MIC – micro firms, S – small firms, M – medium firms, L – large firms.

Figure 7. Agglomerative cluster analysis results for trade sub-sections in size groups.

Source: own elaboration based on ECCBSO (2020) trade credit database.

If the tree branches were intersected where the linkage distance is around 40000, three clear clusters can be identified, only one of which a size-oriented one, while the other two are industrially-dominated. The first cluster from the top consists of only micro-firms of all three trade sub-sections. The second cluster contains firms of three different sizes from two trade sub-sections of motor vehicles and retail trade. The last cluster again has the features of sectoral concentration around the wholesale trade.

Another way of verifying whether the binomial objects in the form of trade sub-sections in size groups bear more resemblance across industries or size groups is to perform a more detailed cluster analysis, e.g. with the use of the k -means method. The number of clusters was predefined at the level of four, which corresponds to the number of different size classes. The clustering was based on mean values of ratios for the whole period and was performed with the following sets of variables:

- all ratios except $DSO_{<0}$, $DPO_{<0}$, and $TCB_{<0}$,
- only three main weighted mean ratios: DSO_{WM} , DPO_{WM} , and TCB_{WM} ,
- DSO ratios except for $DSO_{<0}$,
- DPO ratios except for $DPO_{<0}$,
- TCB ratios except for $TCB_{<0}$.

Using such configurations of variables was meant to identify whether the prevalence of a given effect pertains to all areas of trade credit policy or is specific only to some of them. The k -means grouping results of industry-size items can be found in Table 8.

The clustering results for the whole dataset based on the largest set of ratios indicate the greater importance of the intra-industry effect. Three of the four clusters correspond ideally to the three trade sub-sections whereas one cluster is a size-oriented one, containing elements from

all industries, but only representing one size, namely micro-firms. Similar conclusions can be drawn from the grouping procedures performed for other sets of variables, except for the ratios characterising payables management, where the dominant effect cannot be identified based on the clustering results, as there is only one size-oriented cluster, while the remaining three are indefinable.

Having identified the structure of clusters, it is purposeful to find what trade credit features are particularly responsible for the differences observed between the groups of objects. At the same time, given the number of diagnostic variables, some simplification of the data structure would be worthwhile. One of the methods enabling both of the above intentions is the multidimensional scaling (MDS), applied here on the matrix of distances between all variables except $DSO_{<0}$, $DPO_{<0}$, and $TCB_{<0}$. The MDS results in the form of a two-dimensional scatterplot are reported in figure 8.

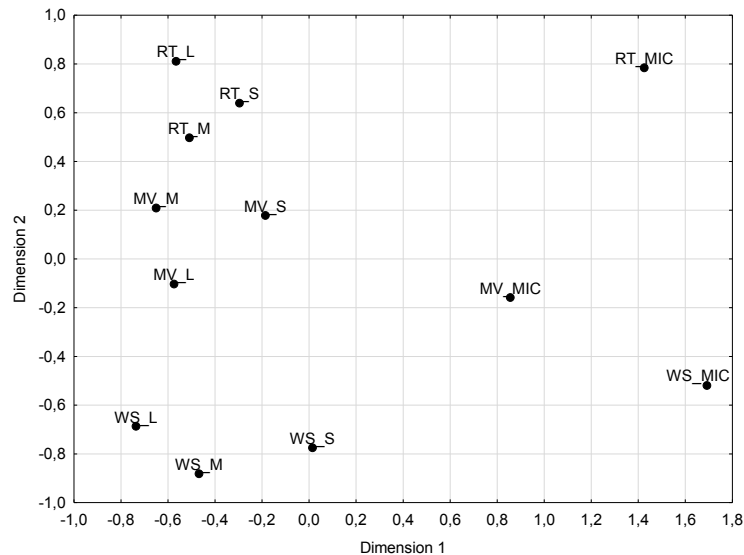
Table 8.

K-means grouping results of industry-size items into four clusters

Variables included	Cluster number and content			
	1	2	3	4
All but $DSO_{<0}$, $DPO_{<0}$, $TCB_{<0}$	MV_S MV_M MV_L	RT_S RT_M RT_L	MV_MIC WS_MIC RT_MIC	WS_S WS_M WS_L
DSO_{WM} , DPO_{WM} , TCB_{WM}	MV_S MV_M MV_L RT_S RT_M	MV_MIC WS_MIC	RT_MIC RT_L	WS_S WS_M WS_L
DSO without $DSO_{<0}$	MV_MIC MV_L	MV_S MV_M	RT_MIC RT_S RT_M RT_L	WS_MIC WS_S WS_M WS_L
DPO without $DPO_{<0}$	WS_S	MV_S WS_M RT_S RT_M	MV_M MV_L WS_L RT_L	MV_MIC WS_MIC RT_MIC
TCB without $TCB_{<0}$	WS_MIC RT_MIC	MV_S MV_M RT_S RT_M RT_L	MV_MIC MV_L	WS_S WS_M WS_L

Note. Industry-dominated clusters were shaded and size-dominated clusters were bolded. Variables as in Table 5. MV – motor vehicles trade, RT – retail trade, WS – wholesale trade, MIC – micro firms, S – small firms, M – medium firms, L – large firms.

Source: author's calculations based on ECCBSO (2020) trade credit database.



Note. The scatterplot is based on the matrix of distances between all variables except $DSO_{<0}$, $DPO_{<0}$, and $TCB_{<0}$. MV – motor vehicles trade, RT – retail trade, WS – wholesale trade, MIC – micro firms, S – small firms, M – medium firms, L – large firms.

Figure 8. Multidimensional scaling results – scatterplot of binomial objects: trade sub-sections in size groups.

Source: own elaboration based on ECCBSO (2020) trade credit database.

The information conveyed by the scatterplot corresponds to the clustering results mainly by demonstrating the dissimilarity of micro firms. All other sized firms bear much more resemblance, at least with regard to the first dimension. Wholesale trade firms of all sizes except micro-firms create another clearly separated group, quite different from motor vehicles and retail trade firms in terms of the second dimension. A crucial issue in applying the MDS method is to assign meaning to the artificial dimensions which replace the original variables. A closer look at the raw data indicates that micro firms are characterised by considerably higher values of ratios describing days payable outstanding than all other sized firms. Therefore the first dimension is likely to correspond to payables management, whose higher values are on the right-hand side of the graph. As for the other dimension, it should be noted that wholesale trade firms had apparently higher ratios of days sales outstanding, compared to the motor vehicles and retail trade firms placed in the upper part of the graph. As a result, a reasonable interpretation of the second dimension is the conservatism in receivables collection with the lowest values at the bottom of the scatterplot.

Summing up, the importance of the industrial classification of firms as a determinant of corporate trade credit policy – confirmed in this study – is a finding supported by several published works, such as Fisman and Love (2003), Fisman and Raturi (2004), or more recently Shi (2022). Similarly, support for the relevance of firm size in trade credit behaviour has been delivered e.g. by Burkart and Ellingsen (2004) or García-Teruel and Martínez-Solano (2010). The research results from this study, which indicate that the intra-industry specificity of companies is of slightly higher relevance than firm size in trade credit, contribute to the existing findings.

6. Conclusions

Theoretically, corporate trade credit behaviour is supposed to be affected both by the industrial specifics of the firm, as well as by the firm size. This study finds both of these factors as important determinants of trade credit management in the Polish trade sector. This is in line with the large body of literature, where the impact of industrial specificity and (or) firm size has been empirically confirmed.

Considerable intra-industry differences identified in trade credit patterns, both in the area of receivables and payables and, as a result, in the area of trade credit balance, provide support for the first research hypothesis (H1) concerning the significant variability of trade credit behaviour across the sub-sections of trade firms in Poland. The support for this hypothesis was found not only for the whole population examined, but also – for most trade credit variables – in each size group of firms, i.e. micro, small, medium, and large enterprises.

As for the cross-size variability of trade credit management policies addressed in the second research hypothesis (H2), the findings from this study indicate that while the firm size is a significant factor affecting corporate trade credit in the Polish trade sector as a whole, the firm size effect is definitely less evident in individual trade sub-sections. Moreover, the analysis has shown that these are mainly the micro-firms that are responsible for the size effect in trade credit patterns. This means, that while micro-firms do differ significantly from their larger peers, other firms, i.e. small, medium and large ones, are more homogeneous in terms of receivables and payables management. As a result, only partial support for H2 has been delivered.

The prevalence of the intra-industry effect over the firm size effect in trade credit behaviour reported using statistical multivariate analysis implies that the third hypothesis (H3) is quite likely to be truthful. Therefore, it can be expected that trade credit management policies should be different across firms operating in different sub-sections of the Polish trade sector, but similar across firms of different size groups, except for micro-firms.

Two main limitations of the study should be highlighted. Firstly, the dataset employed in the research offers aggregated information instead of firm-level data. On the one hand, this inevitably reduces the information resource but, on the other hand, ensures that the data is harmonised and comparable. Secondly, narrowing the research to just one industrial section in Poland makes the study quite specific. Nevertheless, the reported findings might be of interest to those involved in corporate finance management. Recognising the differences in receivables and payables management resulting mainly from the intra-industry specificity can contribute to a better understanding of business financing and its operational functioning. This knowledge may support the effective management of receivables and liabilities, especially in companies operating in developing countries. Further investigation of the patterns in trade credit could be directed at other industries and (or) other countries. This is left for future research.

References

1. Alarcón, L. S. (2011). The trade credit in the Spanish agrofood industry. *Mediterranean Journal of Economics, Agriculture and Environment*, Vol. 10, Iss. 2, pp. 51-57.
2. BACH (2021). *Bank for the Accounts of Companies Harmonized*. Retrieved from: <https://www.bach.banque-france.fr>, 20.11.2021.
3. Baxter, N.D. (1967). Leverage, risk of ruin and the cost of capital. *Journal of Finance*, Vol. 22, Iss. 3, pp. 395-403. doi: 10.2307/2978892.
4. Bhattacharya, H. (2011). Theories of Trade Credit: Limitations and Applications. *SSRN Electronic Journal*. doi: 10.2139/ssrn.1286443.
5. Bougheas, S., Mateut, S., Mizen, P. (2009). Corporate trade credit and inventories: New evidence of a trade-off from accounts payable and receivable. *Journal of Banking and Finance*, Vol. 33, Iss. 2, pp. 300-307. doi: 10.1016/j.jbankfin.2008.07.019.
6. Brennan, M.J., Maksimovics, V., Zechner, J. (1988). Vendor Financing. *Journal of Finance*, Vol. 43, Iss. 5, pp. 1127-1141. doi: 10.2307/2328210.
7. Brick, I.E., Fung, W.K. (1984a). Taxes and the Theory of Trade Credit. *Journal of Finance*, Vol. 39, Iss. 4, pp. 1169-1176. doi: 10.1111/j.1540-6261.1984.tb03900.x.
8. Brick, I.E., Fung, W.K. (1984b). The Effect of Taxes on the Trade Credit Decision. *Financial Management*, Vol. 13, Iss. 2, pp. 24-30. doi: 10.2307/3665443.
9. Burkart, M., Ellingsen, T. (2004). In-kind finance: a theory of trade credit. *American Economic Review*, Vol. 94, Iss. 3, pp. 569-590. doi: 10.1257/0002828041464579.
10. Canto-Cuevas, F.J., Palacín-Sánchez, M.J., di Pietro, F. (2016). 'Trade credit in SMEs: a quantile regression approach', *Applied Economics Letters*, Vol. 23, Iss. 13, pp. 945-948. doi: 10.1080/13504851.2015.1122727.
11. Carvalho, C.J. de, Schiozer, R. (2015). Determinants of Supply and Demand for Trade Credit by Micro, Small and Medium-Sized Enterprises. *Revista Contabilidade & Finanças*, Vol. 26, Iss. 68, pp. 208-222. doi: 10.1590/1808-057x201500940.
12. Cheng, N.S., Pike, R. (2003). The trade credit decision: evidence of UK firms. *Managerial and Decision Economics*, Vol. 24, Iss. 6-7, pp. 419-438. doi: 10.1002/mde.1049.
13. Cuñat, V. (2007). Trade Credit: Suppliers as Debt Collectors and Insurance Providers. *Review of Financial Studies*, Vol. 20, Iss. 2, pp. 491-527. doi: 10.2139/ssrn.423501.
14. Dary, S.K., and Harvey, S.J.J. (2020). Trade Credit Contracts, Theories and their Applications: A Synthesis of the Literature. *Ghana Journal of Development Studies*, Vol. 17, Iss. 1, pp. 86-91. doi: 10.4314/gjds.v17i1.4.
15. Deloof, M., Jegers, M. (1996). Trade credit, product quality, and intragroup trade: some European evidence. *Financial Management*, Vol. 25, Iss. 3, pp. 33-43. doi: <https://doi.org/10.2307/3665806>.
16. Desai, M.A., Foley, C.F., Hines, J.R.J. (2016). Trade Credit and Taxes. *Review of*

- Economics and Statistics, Vol. 98, Iss. 1*, pp. 132-139. doi: 10.1162/REST_a_00534.
17. Duliniec, A., Świda, N. (2021). Factors influencing the use of trade credit in financing Polish listed companies. *Economics and Business Review, Vol. 7, Iss. 21*, pp. 113-134. doi: 10.18559/ebr.2021.1.7.
 18. ECCBSO (2020) *Trade Credit Data Base*. Retrieved from: <https://www.eccbso.org/wba/pubblica/database.asp>, 10.11.2021.
 19. Elliehausen, G.E., Wolken, J. (1993). The demand for trade credit: an investigation of motives for trade credit use by small businesses. *Staff Studies. Board of Governors of the Federal Reserve System, No. 165*, pp. 1-18.
 20. Emery, G.W. (1984). A Pure Financial Explanation for Trade Credit. *Journal of Financial and Quantitative Analysis, Vol. 19, Iss. 3*, pp. 271-285. doi: 10.2307/2331090.
 21. Fafchamps, M., Pender, J., Robinson, E. (1995) *Enterprise finance in Zimbabwe*. Retrieved from: <https://documents1.worldbank.org/curated/en/389241468140649660/pdf/56870-Replacement-File-PUBLIC.pdf>, 15.11.2021.
 22. Ferrando, A., Mulier, K. (2013). Do firms use the trade credit channel to manage growth? *Journal of Banking and Finance, Vol. 37, Iss. 8*, pp. 3035-3046. doi: 10.1016/j.jbankfin.2013.02.013.
 23. Ferris, J.S. (1981). A transactions theory of trade credit use. *Quarterly Journal of Economics, Vol. 96, Iss. 2*, pp. 243-270. doi: <https://doi.org/10.2307/1882390>.
 24. Fisher, R.A. (1954). *Statistical Methods for Research Workers*. Edinburgh: Oliver and Boyd.
 25. Fisman, R. Love, I. (2003). Trade Credit, Financial Intermediary and Industry Growth Development. *Journal of Finance, Vol. 58, Iss. 1*, pp. 353-374.
 26. Fisman, R., Raturi, M. (2004). Does Competition Encourage Credit Provision? Evidence from African Trade Credit Relationships. *Review of Economics and Statistics, Vol. 86, Iss. 1*, pp. 345-352. doi: 10.1162/003465304323023859.
 27. García-Teruel, P.J., Martínez-Solano, P. (2010). Determinants of trade credit: A comparative study of European SMEs. *International Small Business Journal, Vol. 28, Iss. 3*, pp. 215-233. doi: 10.1177/0266242609360603.
 28. Jaleel, A., Hui, X., Jaweria, K. (2014). Determinants of Trade Credit: The Case of a Developing Economy. *European Researcher, Vol. 83, Iss. 9-2*, pp. 1694-1706. doi: 10.13187/er.2014.83.1694.
 29. Kihanga, E. et al. (2010). Determinants of trade credit demand and supply in the Tanzanian rice market: A Structural Modelling Approach. *SSRN Electronic Journal*, pp. 1-42. doi: 10.2139/ssrn.1674842.
 30. Klapper, L., Laeven, L., Rajan, R. (2012). Trade credit contracts. *Review of Financial Studies, Vol. 25, Iss. 3*, pp. 838-867. doi: 10.1093/rfs/hhr122.
 31. Koralun-Bereźnicka, J. (2013). *Corporate Performance. A Ratio-Based Approach to Country and Industry Analyses*. Springer.

32. Koralun-Bereźnicka, J. (2016) *Wpływ kraju i sektora oraz wielkości przedsiębiorstwa na strukturę kapitału przedsiębiorstw w krajach Unii Europejskiej*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
33. Lee, Y.W., Stowe, J.D. (1993). Product Risk, Asymmetric Information, and Trade Credit. *Journal of Financial and Quantitative Analysis*, Vol. 28, Iss. 3, pp. 285-300. doi: 10.2307/2331291.
34. Lin, T.-T., Chou, J.-H. (2015). Trade credit and bank loan: Evidence from Chinese firms. *International Review of Economics and Finance*, Vol. 36, pp. 17-29. doi: 10.1016/j.iref.2014.11.004.
35. Long, M.S., Malitz, I.B, Ravid, S.A. (1993). Trade credit, quality guarantees, and product marketability. *Financial Management*, Vol. 22, Iss. 4, pp. 117-127. doi: 10.2307/3665582.
36. Meltzer, A.H. (1960). Mercantile credit, monetary policy, and size of firms. *Review of Economics and Statistics*, Vol. 42, Iss. 4, pp. 429-437. doi: 10.2307/1925692.
37. Mian, S.L., Smith, C.W. (1992). Accounts Receivable Management Policy: Theory and Evidence. *Journal of Finance*, Vol. 47, Iss. 1, pp. 169-200. doi: 10.2307/2329094.
38. Molina, C.A., Preve, L.A. (2012). An Empirical Analysis of the Effect of Financial Distress on Trade Credit. *Financial Management*, Vol. 41, Iss. 1, pp. 187-205. doi: 10.1111/J.1755-053X.2012.01182.X.
39. Mugavin, M.E. (2008). Multidimensional Scaling: A Brief Overview. *Nursing Research*, Vol. 57, Iss. 1, pp. 64-68. doi: 10.1097/01.NNR.0000280659.88760.7c.
40. Nadiri, M.I. (1969). The Determinants of Trade Credit in the U.S. Total Manufacturing Sector. *Econometrica*, Vol. 37, Iss. 3, pp. 408-423. doi: 10.2307/1912790.
41. Ng, C.K., Smith, J.K., Smith, R.L. (1999). Evidence on the Determinants of Credit Terms Used in Interfirm Trade. *Journal of Finance*, Vol. 54, Iss. 3, pp. 1109-1129. doi: 10.1111/0022-1082.00138.
42. Petersen, M., Rajan, R. (1997). Trade Credit: Theories and Evidence. *Review of Financial Studies*, Vol. 10, Iss. 3, pp. 661-691. doi: 10.1093/rfs/10.3.661.
43. Schwartz, R.A. (1974). An Economic Model of Trade Credit. *Journal of Financial and Quantitative Analysis*, Vol. 9, Iss. 4, pp. 643-657. doi: 10.2307/2329765.
44. Shi, G. (2022). Does industry-specific information disclosure improve trade credit financing? *China Journal of Accounting Studies*, pp. 1-25. doi: 10.1080/21697213.2022.2086028.
45. Smith, J.K. (1987). Trade Credit and Informational Asymmetry. *Journal of Finance*, Vol. 42, Iss. 4, pp. 863-872. doi: 10.2307/2328295.
46. Springall, D.A. (1978). A review of multidimensional scaling. *Journal of Applied Statistics*, Vol. 5, Iss. 2, pp. 146-192. doi: 10.1080/768370750.
47. Summers, B., Wilson, N. (2000). Trade Credit Management and the Decision to Use Factoring: An Empirical Study. *Journal of Business Finance and Accounting*, Vol. 27, Iss. 1-2, pp. 37-68. doi: 10.1111/1468-5957.00305.

48. Ward, J.H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, Vol. 58, Iss. 301, pp. 236-244. doi: 10.1080/01621459.1963.10500845.
49. Williamson, O.E. (1979). Transaction-cost economics: The governance of contractual relations. *Corporate Governance: Values, Ethics and Leadership*, Vol. 22, Iss. 2, pp. 133-162. doi: 10.1086/466942.
50. Wilner, B.S. (2000). The exploitation of relationships in financial distress: The case of trade credit. *Journal of Finance*, Vol. 55, Iss. 1, pp. 153-178. doi: 10.1111/0022-1082.00203.
51. Wilson, N., Summers, B. (2002). Trade credit terms offered by small firms: Survey evidence and empirical analysis. *Journal of Business Finance and Accounting*, Vol. 29, Iss. 3-4, pp. 317-351. doi: 10.1111/1468-5957.00434.
52. Wishart, D. (2003). k-Means Clustering with Outlier Detection, Mixed Variables and Missing Values. In: M. Schwaiger, O. Opitz (Eds.), *Exploratory Data Analysis in Empirical Research. Studies in Classification, Data Analysis, and Knowledge Organization* (pp. 216-226). Berlin-Heidelberg: Springer. doi: 10.1007/978-3-642-55721-7_23.

MAPPING LEADERSHIP STYLES IN THE WORLDVIEW SPACE

Tatiana KRAWCZYŃSKA-ZAUCHA

Uniwersytet Pedagogiczny w Krakowie; tatiana.krawczynska-zaucha@up.krakow.pl,
ORCID: 0000-0001-6530-4206

Purpose: The purpose of this article is to identify the theoretical sources of the process of acquisition and development of leadership styles represented by managers in many industries.

Design/methodology/approach: The article analyzes five distinct management paradigms and leadership styles as emerging from five distinct worldviews currently present in the world.

Findings: It turns out that the realization, conscious or unconscious, of one paradigm of reality implies the adoption of a particular management style, which then influences the actions with groups, teams and entire organizations. Worldviews form a specific loop with a leader's mindset, which influences his actions and performance.

Research limitations/implications: The major limitations of this analysis are its theoretical nature and the question of whether it can be confirmed by a real life research.

Practical implications: Understanding the sources of behavior has implications for how organizations operate and can significantly impact the design of recruitment, initial training, and development programs as well as on what curriculum business schools offer..

Social implications: People interpret the reality around them through the worldview. It influences their values, beliefs, communication or management style. Companies with knowledge of the sources of management styles can intentionally create these styles through organizational culture and thus influence the surrounding community.

Originality/value: Sources of management and leadership styles as a prelude to the Industrial Revolution 4.0.

Keywords: paradigms of management, leadership styles, worldviews, Industrial Revolution 4.0.

Category of the paper: Research paper.

1. Introduction

Today's world provides many challenges for managers and leaders. In particular, the pandemic and resulting lockdown have exposed managerial competency gaps at unprecedented levels, and, although managers typically have access to training, mentoring, and coaching opportunities, these gaps are not shrinking or being altogether eliminated (Garcia

et al., 2020; Peters, 2020, WEF, 2020). Due to its complexity and unpredictability, managing in a VUCA (Krawczyńska-Zaucha, 2019) world presents leaders with novel challenges on an ongoing basis. Today, special attention is being paid to the: what is necessary for teams to function effectively and efficiently; organizations' true levels of communication; what actually motivates employees; and how leaders' behaviors contribute to their own professional development. Moreover, post-pandemic studies have shown that employees and managers who worked from home during the pandemic do not necessarily want to return to the office now but would appreciate the opportunity to continue working from home, where they can work flexible hours, lower stress levels, and increase work-life balance (Bailey, Rehman 2022). To satisfy this desire, some companies have adopted a four-day work week, and, based on research-study findings indicating that the average employee spends only 20% of his or her time in the office working effectively, seems to be a step in the right direction (Pelta, 2022).

Unfortunately, many managers who are highly skilled in hard competencies exhibit deficiencies in such soft-competency areas as communication, professional relationship building, planning, delegating authority, receiving and giving feedback, and team building (Parker, 2020). Furthermore, as also indicated in published research (Gallup, 2019), some do not fully understand what is expected of them, as, for instance, a manager that has difficulty delegating complex tasks because he/she is unsure what those tasks actually are. Problems with such soft skills as delegation extend to all levels of management, including the highest. However, as employees, including managers, typically participate in training and have access to ample coaching and mentoring opportunities, access to knowledge is not the cause of managerial soft-skill deficiency. Instead, we argue in this paper, managers' and leaders' competency levels, and the degree to which these are developed in any given individual, depend primarily on the individual's own beliefs and values.

Every individual and society has a particular worldview, and those that have appeared throughout human history and that exist today have been studied extensively. Upon close examination, most of the theories advanced in these studies are compatible with or complement one another or else broaden our perspective on or understanding of the worldview concept. However, the influence of individual worldview on managerial mindset has not yet been studied even though this relationship appears to be strong. That a manager's worldview significantly influences his/her mindset constitutes the first hypothesis explored here. The second is that leaders construct their mindsets within one of at least five reality paradigms, and the particular paradigm selected then influences a manager's choices with respect to managerial-competency development, including its level. The five worldview paradigms are discussed in detail below, and the specific behaviors of leaders resulting from this choice and the management and leadership styles they adopt as a result provide the starting point of this analysis.

It is worth noting that the subject of leadership paradigms affects many related fields, such as business ethics or leader's performance. If a leader's mindset, including his/her managerial competencies and the level of their development, is assumed to depend on the worldview he/she

has adopted, then every worldview existing today is the source of attitudes that influence level of behavior. Hence, their worldviews influence the ethical behaviors of managers, employees, and executives—an important point because, as is shown later in the paper, an individual is typically unaware of his/her particular worldview, which is an unconscious choice and which results from the individual's upbringing and education.

2. What is a worldview?

Originally a philosophical concept, the word “worldview” is now widely used and transdisciplinary. Kant first used the German term *Weltanschauung*, literally translated as “worldly view,” in his *Critique of the Power of Judgment*, to denote a concept implied by his philosophical system that could be reflected upon (Kant, 2013). Kant's approach makes it possible for an individual to recognize that he/she is constructing the reality around himself/herself (Copleston, 1996). Employing it in a broader sense than Kant had, Hegel used it to refer to the collective and historical subject, and his synthesis of history made worldview dependent on the collective cognitive subject and historical moment. The notion of worldview has since been linked to constant change, dynamism, and the laws governing cultural evolution.

Wilhelm von Humboldt postulated an unbroken link between worldview and language, stating that language subjectivizes cognition and so reflects the worldview of a collective entity such as a community or nation. His theses were later developed by many ethnolinguists, leading to claims that language itself encompasses a particular worldview. “Language is a factor that shapes people's ideas about the world. The language of a community organizes its culture because it classifies and organizes the impressions people receive from the world, structuring, as it were, a particular reality” (Polanski, 1993, p. 209).

The notion of worldview entered 20th century humanities thanks to the theory of worldviews formulated by Wilhelm Dilthey, who sought to analyze the reality of philosophical systems that had been in conflict for centuries and who questioned whether one of these was, in fact, the correct one (Dilthey, 1954, 2002). However, the creator of the theory of worldviews claimed that such a choice is impossible, because an individual's choice of any worldview system is determined by his/her own worldview, a tendency that, according to Dilthey, is conditioned by environmental and personality factors (Dilthey, 2002).

In his theory, Dilthey distinguishes between several types and forms of worldviews. However, only the structure that binds these worldviews together, which he describes as follows, is of interest in the context of this discussion:

All worldviews have ... essentially the same structure. This structure is each time a system, in which on the basis of a certain image of the world it is possible to solve the question about the meaning and sense of the world and on this basis to derive an ideal, the highest good, the most general principles governing life (Dilthey, 1954).

However, the conclusions that can be drawn from Dilthey's theory are crucial to the present analysis. When choosing a certain worldview, an individual falls into a vicious circle because this choice constitutes both a cause and an effect; the choice of a reality paradigm is made based on a foundation of values and beliefs that exist because of the reality paradigm already chosen. In addition, this "choice" is the result of an unconscious process determined by environment and personality.

Max Scheler also discussed the concept, stating that worldviews are: not necessarily, by way of reflection, realized and known, each time factual forms of looking at the world and ordering of visual data and data from the sphere of values by social entities (peoples, nations, cultural circles). These worldviews can be found and studied in the syntax of languages, but also in religion, ethos, etc. (Scheler, 1973).

According to Scheler, the worldview construct consists of two dimensions: a cognitive, conscious layer and unconscious presuppositions. Providing a succinct definition of the notion in question, Sire described it as a set of attitudes, values, narratives, and perceptions concerning the surrounding world that influence an individual's every thought and action. Worldview is therefore expressed in a person's ethics, religion, philosophy, scientific beliefs, and so on (Sire, 2004).

For the purposes of this analysis, "worldview" is treated as a paradigm of reality and hence is defined here as "a view on the world" (*Weltanschauung*, world view, or worldview). Moreover, the term is not viewed as referring to a fragment of reality only but rather to the entire spectrum of possible and existing things and phenomena, including man—with "man" denoting both an individual and humanity in general. Thus, in the context of this analysis, the term 'worldview' acts as a universal explanation of the world, simultaneously incorporating and intertwining the values and beliefs that constitute it and the values and beliefs, metaphysical assumptions, and conception of man that it implies and underlies. At the same time, the term gives all of these meanings within their own contexts and uses a particular semantics to express and describe the whole that, in fact, defines the worldview and serves to interpret reality.

Due to the existence of a worldview, individuals and societies do not come to know the world as such, but only through their presuppositions concerning it. In effect, we do not live in the real world but rather in our idea of what that world is like. Thus, *de facto*, we live in a specific interpretation of the real world, chosen either consciously or unconsciously, that our mind has created based on specific beliefs, values, presuppositions, concepts, and theories, and, in addition, we use specific semantics to describe and explain a given image within this context.

3. The worldviews that exist today

Starting with Maslow, who described the evolution of needs, many researchers have pointed to the evolution of individuals and societies. Thus, theories have been developed on the evolution of identity (Loevinger, 1976), morality (Kohlberg, 1985, Gilligan, 1977, 1982), values (Graves, 1970), spirituality (Fowler, 1981), consciousness (Gebser, 1985), and leadership (Kegan, 1982; Torbert, 1991). Evolution, however, is associated with the replacement of something by something different, i.e., with succession. Meanwhile, worth emphasizing is that, with respect to all evolution concerning the human mind, i.e., the sphere of emotions or spirituality, one should speak not about succession but rather about coexistence and development. In the case of such broad and multidimensional concepts as worldview, too, one should begin to think in terms of coexistence, not substitution. While Gebser spoke of mutations in consciousness, we are convinced that what was meant was, instead, the co-existence and co-evolution of worldviews. Here, co-evolution means different worldviews influence one another. This situation can occur through an individual's use of words characteristic of another worldview, although in this case they then do not have the same meaning as they do in that individual's own paradigm, or by the individual's changing to another paradigm when the one in which he/she was raised proves insufficient for his/her coherent realization of reality, a situation that, however, occurs, with extreme rareness (Wilber, 2000). Today, no single coherent worldview exists, and the belief in its existence is merely an illusion. Thus, the definition of a worldview should contain values, beliefs derived from values, and predispositions, assumptions, and theories that gather the above elements into a fairly coherent whole, expressed in a paradigm-specific language.

Beginning with the management and leadership styles known and used today, employing induction to isolate existing worldviews and proceeding through values and semantics reveals the worldviews that exist today. A leader's actions that treat people as only a means to achieve a goal set by the leader indicate the 'boss' style of management; these people are not respected; their needs, feelings, and aspirations are marginalized; and their worth in the leader's eyes rests only in their contribution to achieving the goal that he/she seeks to achieve. It is he/she who issues the orders, defines the goals, and sets the tasks and scope of the work, which he/she expects his/her subordinates to perform without discussion, suggestions for improvement, or refusal. Also crucial to recognizing this style of management is that the goal being worked toward satisfies only the leader's needs, which typically involve possession and attaining boundless power.

The values underlying these needs are typically power and money; and rule is exercised through fear, violence, and force. Beliefs arising from these values are easy to formulate: the world is a jungle, a place ruled by the stronger, richer, and more powerful; position must be won, no matter the cost; the weak are unimportant, do not count, and can be manipulated and

used by the leader to achieve his goals. The contextual worldview for this style of management is that the world is a place of struggle where winners are stronger, smarter, richer, and more influential and have better connections than their rivals.

Paradigms of reality affect an individual's entire perception of reality, and so his/her extending the 'boss' approach to other spheres of his/her life is inevitable. Here, relationships are important only insofar as they benefit his/her; trust is lacking, and compliance is obtained through exercising control, giving a reward, or, far more frequently, meting out punishment for noncompliance. The leader views the world as beginning and ending with him/her.

Within this paradigm of reality, the environment is seen as a place to be ruthlessly subjugated and exploited to the greatest extent possible to benefit an individual, a group, or a community. Graves' theory terms this paradigm "impulsive," and his students, who have called it "red" because such a worldview can color the world red not only figuratively but in some instances literally, further describe it as egocentric, imperialistic in structure, and exploitative in approach (Beck, Cowan 1996). Although it might seem that there is no place for leaders of this type in the twenty-first century, nothing could be further from the truth, as they can be found in almost every corporation and organization at various levels of management and in politics and science. Thus, this reality paradigm exists and appears to be flourishing.

The second style to be discussed that of 'director,' and individuals having this style are characterized by beliefs such as these: My authority is based on my position; I am right and know better than my subordinates how things should be done; I must, however, listen to those in authority above me in the hierarchy. To the 'director' type, another individual's value is directly proportional to the position he/she holds, the place he/she occupies in the social hierarchy, and the connections he/she has. One should not fraternize with those lower than oneself, he/she believes. The goal is to fulfill the duties belonging to the position, but quality in doing so is not a consideration; rather, it is to complete them, even if they are done poorly.

Three main values motivate the 'director' paradigm: rootedness in tradition ("It has always been done this way and so it works"); absolute submission to the hierarchy of positions, or seniority; and obedience to orders even if they seem unreasonable. Employees are seen merely cogs in an eternal mechanism of work and must perform in accordance with the scope of their duties, completing it within a specified time and displaying the expected behavior. Their feelings, thoughts, and emotions are not important; these must be kept hidden, and the world must be shown a cheerful face in spite of everything. The managerial context of such a paradigm is therefore a hierarchical world structured according to a particular pattern, idea, or key. Each individual occupies a specific place in such a structure, and this place defines the duties which he/she must perform. Everything that falls within the hierarchy, structure, or paradigm is good; what is outside it is bad. The world is seen as black and white with good fighting evil. If people do not fulfill their duties or do not behave according to expectations and duty, they have been tempted by evil in various forms or possessed by it, and they must atone

and return to the right way, even if they must sacrifice themselves. Beck and Cowan called this worldview “purposeful” with “an absolutist style of thinking, a pyramid structure, and an authoritative process” (Beck, Cowan 1996).

An achievement approach, termed “target achievement” by corporate employees, characterizes the ‘manager’ style of management (Beck, Cowan, 1996). A manager having this style is interested in what others think and feel when working with them but with the aim of utilizing their abilities to their full potential to achieve a set goal, which is to ensure that the manager, the organization, and the people working within it achieve well-being and an appropriate, i.e. a lavish, lifestyle. Should this not be the case, it is necessary to take out loans in order to achieve an adequate standard of living and to be able to show on social media that the company exists, because it has followers. This approach encourages consumerism and living beyond one's means, i.e., “work hard, play hard” slogans, using nurseries that teach toddlers three languages to prepare them for excellent primary schools, etc. The ‘manager’ style is characterized by several values: achievement, success, striving for a goal (often at any cost), ROI, a business plan, etc.

The characteristic features of the paradigm of reality from which this approach derives is the conviction that an individual can achieve anything if he or she invests the correct amount of work, commitment, and self-denial in doing so. The hierarchy or structure that gives everything its shape is not rigid, as in the earlier paradigm, but open, so that “from zero to hero” is possible. The world offers many opportunities for development, but not everyone is able to cope with the associated challenges and problems and are therefore “corpses on the side of evolution,” as Darwin said. In such a world, only the best win, the right strategy and the available technology must be utilized, and an individual must continue to pushing forward. Considered more broadly, this paradigm enables the development and progress of science and technology, because it allows questioning of the status quo and is characterized by multifaceted thinking, delegative structures, and strategy-based process (Beck, Cowan 1996).

The next style to be considered, the leader paradigm, encompasses qualities lacking in a manager's style, including noticing and appreciating the efforts of those working under him/her and not just the accomplishments attained through those efforts. To the leader, the path selected to achieve the goal is more important than actually achieving the goal, and he/she and the members of his/her team can travel this path together, supporting one another, even if those comprising the team differ. In fact, such diversity gives the team its strength, because, qualitatively, the team is more than the sum of its members’ abilities. The beliefs that provide the leadership style its foundation revolve around everyone’s ideas, which can be realized in concert, including weaker individuals, because everyone brings something unique to the team or community. The key values forming the “green” (Beck, Cowan, 1996) paradigm of reality are the following: community, team, group, togetherness, ideas, the good of all, respect, trust, and the attitude that everyone has the right to live. While this paradigm causes its possessor to treat everyone with respect, it also broadens spaces of respect, embracing the animal world and

all of nature, both animate and inanimate. Crucial to relationships is an awareness of the futility of judging others according to one's own criteria and achievements, because not everyone has access to the same opportunities to succeed and so not succeeding is not always the fault of individuals or even of entire societies. Children born in the slums of Cape Town have a completely different start in life and different opportunities than children born into the middle class in New York or the suburbs of Paris. The 'leader' paradigm is therefore grounded in pluralism and egalitarianism.

The "shared style" paradigm is an extremely rare leadership style. However, due to globalization and easy access globally to courses, training, and high-quality coaching, awareness of this style is becoming increasingly widespread, and some companies are now consciously and intentionally striving to reinforce this style among their management. It is not only the most employee-friendly style but also the most effective over the long term (Laloux, 2010).

Shared leadership is based on the belief that responsibility should not be strictly concentrated in only one person but, rather, dispersed among several people. The governing bodies of companies are typically made up of many people, assembled into boards of directors and supervisory boards, or divided among several stakeholders. Underlying this sharing of responsibility is the belief that combining the skills, competencies, and experiences of many people may prevent mistakes, and all focusing on one goal can create a new quality of interaction. The key values of this worldview are authenticity, building on strengths, collaboration, co-determination, and transitive decision-making (based on differing competencies) or synthetic insights. The shared leadership style has a dimension that the styles discussed previously lack—a holistic view, often referred to as "seeing the big picture" in management, which encompasses a perception of the time factor, i.e., it perceives a system as evolving and changing over time. The paradigm of reality on which this style is based is a systemic picture where even the smallest element is connected to the whole and can affect it, a concept analogous to chaos theory, where the movement of a butterfly's wings in China can affect the formation of a hurricane on the east coast of the United States.

This style is a global and ecological paradigm (Beck, Cowan, 1996), where the descriptor "ecological" is employed in its literal sense based on its etymology. The word "ecology" is derived from two Greek words: οἶκος (oikos), meaning "house" and the suffix -logia, derived from the Greek λόγος (lógos) meaning "word," "subject of discussion," or "science". Thus, translated literally, ecology is the science of home. The etymology of the word "ecology" thus reveals the perspective and approach of "the teal paradigm" (Wilber, 2000). It is a systemic interaction of all elements. In the context of leadership, it means no hierarchy and working together for development – holocracy.

4. A loop in the worldview

The discussion above reveals the sequence stemming from a leader's realized worldview and ending with his/her behavior: This worldview provides the specific values to be pursued, and these and other, life values define his/her beliefs, which, in turn, then determine his/her behavior. Every leader, however, is born into a particular worldview that shapes his/her and that reflects the worldview of the community, group, and family into which he or she was born. Being raised and educated in one paradigm causes an individual to accept it as being valid or even as being the only valid paradigm. Therefore, behaviors or mistakes made by members of a family may be repeated by other family members, generation to generation. Even some stages of the educational process may not be able to change an individual's beliefs regarding the paradigm into which he/she was born, especially since primary and even secondary education often takes place in communities that implement the same paradigm or some variant of it.

Thus, although the aforementioned discussion presents its adoption by an individual as a linear sequence, worldview is, in fact, multidimensional and can change slightly over time. It is comprised of an entire system of beliefs and values that are reflected in a system of word meanings, including their interpretation and explanation, which support and reinforce each other and thus form a reasonably coherent picture of the world that enables an individual to pursue his/her daily life and work. Once again, we employ the term "reasonably coherent" because no worldview is fully coherent or provides a complete explanation of reality. Each suffers from limitations, some uncertainties, logical or semantic errors, and even contradictions. However, this does not prevent whole communities from pursuing and simultaneously creating a paradigm over the years.

A key challenge for leaders is to allow for the existence of other paradigms, a trait based on the ability to view oneself and one's own worldview from a different perspective. This perspective must, at the very least, be that of a third person and preferably should be a systemic, or even a changing systemic, perspective. Research indicates that the ability to perceive another's perspective by adopting their point of view is extremely rare, and only 1.5 people out of 100 possess the ability to see the big picture, which typically changes over time. Following acceptance of other worldviews, the next step, which often requires significant developmental work, is to accept the possible validity of other worldviews, which is actually a matter of changing semantics. For instance, one point of view may understand the meaning of the adjective "right" used to describe something as meaning that this something is completely correct. However, another point of view, even a privileged one (because it is mine), allows for other points of view, or even an infinity of them, to also be valid. In practice, this implies openness to new solutions, ideas, and willingness to engage in discussion. So, in order for an individual to consider other points of view as sufficiently valuable to be considered, a paradigm shift is needed, and this, as we know, happens rarely.

The type and degree of an individual's managerial and leadership competencies are dependent on the paradigm that the individual lives by. A manager functioning in the "manager" paradigm will not consider the opinion of his/her employees as having any value whatsoever and will not consider it worthwhile to listen to them. The fact that he/she occupies a managerial position implies that he/she is right, and anyone who claims otherwise is incorrect. Such a manager will therefore see no need to develop his/her communication skills; after all, why should he/she? Even if his/her subordinates' feedback is negative and the HR department has sent his/her to communication training, he/she will not gain much from it, because his/her beliefs, based on the values of his/her given worldview, will block any progress toward learning in this area. He/she may well practice certain behaviors that he/she has been trained in, but without their being grounded in his/her personal beliefs and professional values, these will be viewed as contrived or simply as training situations. When in difficult or challenging situations or when having to act under pressure, he/she will fall back on his/her reactive, belief-based behaviors.

Training, which typically focuses on imparting knowledge or modifying behaviors rather than on transforming worldviews by changing beliefs and values thus tends to have a very low ROI. Moreover, during managerial training in soft skills, lack of knowledge is typically not an issue. The level of managers' knowledge may be high, usually higher than they realize in fact. Instead, the problem is lack of the skills needed to apply this knowledge in specific situations. The knowledge then seems to be a "package" lacking context and context, analogous to a suitcase to which the owner has lost the key and so is unable to use its contents, which may be valuable. Only when opened by a person who is aware of its contents (context) will it prove useful, e.g., during a specialist conference or in an SPA hotel (situation).

Managers may have a great deal of knowledge but may not know how to use it, because it is incompatible with their paradigm of reality and so does not fit into their system of values, beliefs, and language, rendering them unable to actively and effectively use it. Therefore, we believe, a manager's development of personal and professional competence is less influenced by the studies and training to which he/she has been exposed and more influenced by his/her personal belief regarding the potential usefulness of the particular competence to him/her. Studies and training may open a leader to a different worldview, but without developmental work on his/her mindset, these will not succeed in changing his/her values and beliefs, and, even if he/she learns to use different words to express his/her aspirations, these words will have different meanings for him/her, or perhaps even be meaningless to him/her, because they are not compatible with his/her given worldview.

Thus, worldview influences managers' mindsets, forcing them to choose and develop specific competences that the point of view imparted by their given paradigm of reality causes them to deem important. Additionally, this paradigm allocates value to a competency through the prism of its own value system, employing its own semantics.

5. Discussion

The intent of this paper was to demonstrate that managerial competence can depend on one of the five worldviews identified and described here. Approaching the issue analytically, this research contributes to the theoretical conversation on leadership style that is based on one of the at least five worldviews that exist today. Isolating the beliefs and values expressed in particular semantics enabled analysis of the leadership style resulting from each worldview and identification of the worldview itself. Each of these worldviews, extrapolated to other aspects of individual and community life, thus emerged as a paradigm familiar to all from published research.

Our study nonetheless suffers from some limitations. One, the question arises as to whether the results of such a study can be confirmed by research. Other questions concern the percentage of each worldview that can be found in the world today and the percentage of managers that change their worldview? Moreover, is there an algorithm that enables or accelerates such a change? And finally, in light of the studies cited previously, is analysis of management and leadership style possible? That is, will a researcher's worldview, perhaps one not identified here, allow a genuine analysis to be performed?

The research of Beck and Cowan addresses the practicalities of worldview analysis. According to Wilber's nomenclature, although many portals exist that allow worldview or level of consciousness to be tested, no well-designed studies based on scientific standards exist. However, it would be worthwhile to conduct this research strictly involving only managers and preferably employing a cross-sectional analysis in different communities, countries, or organizations having differing cultures.

Another area for analysis is the contribution particular worldviews make within a particular context, a question answered by Wilber in *The Theory of Everything*. This answer was, however, given twenty years ago, and the views of both individuals and societies have changed significantly since that time. The global balance of political forces in the world has changed so significantly over twenty years and in such ways that no one from that time would have dared to predict. Therefore, we cannot assert that we have reliable data on the percentage of particular paradigms in today's world, let alone among today's business managers. This immediately raises the question: do the worldview distributions within corporations, NGOs, small- and medium-sized companies, etc., differ or are they homogeneous? Similar questions arise with respect to the percentage of managers who change worldview and whether these changes occur with any sort of regularity. Related questions concern what leads to such changes and whether they can be induced or accelerated. Only well conducted research can answer these questions.

An interesting issue within the worldview context involves managerial and business ethics. In a sense, each paradigm of reality creates its own ethics, sets its own boundaries, and establishes its own criteria to measure what is acceptable, and managers do not always

consciously adopt these in implementing particular paradigms. The influence of his/her worldview, therefore, extends beyond an individual leader's professional life. Moreover, within his/her professional life, it encompasses his/her team, subordinates, co-workers, and, in some cases, others. Would it not then be worthwhile to consider adoption of education in more integral ethics designed to show managers and leaders the broad spectrum of ethics that results from differing worldviews, along with the consequences of particular choices?

6. Conclusion

The Our study of the sources of leadership style paints a multi-dimensional picture of worldviews influencing every aspect of people's lives, including their ethical and communication choices, their relationship-building styles, the degree of delegation they practice, and even their approach to people. While the research raised many questions that remain unanswered, its findings suggest a broader look at the sources of managers' and leaders' behavior in companies and organizations. Awareness of the sources of behavior has implications for how organizations operate and can significantly impact the design of recruitment, initial training, and development programs as well as on what curriculum business schools offer. In light of the analyses described above, it is important to remember that knowledge is secondary to worldview, and the desire to acquire or deepen it correlates with an individual's personal and professional beliefs and values. Thus, the values of the best business studies, an MBA, or training must be measured by its compatibility with the paradigm in which the manager lives and works. If the knowledge he/she acquires is from a worldview differing from his/her, then it will most likely lack context for him and confer no ability to be applied to specific work situations. It remains useless.

The importance of evolving management and leadership styles in today's post-pandemic world remains a key issue, and the consciously designed change discussed herein could possibly be the focus of the fourth industrial revolution. This paper has clearly shown the origins of the various management styles and has isolated the key elements by which a particular style can be identified. Thus, we have the end of Ariadne's thread in our hands; it is now up to us to cooperate in escaping the maze.

References

1. Bailey, J.R., Rehman, S. (2022). How to Overcome Return-to-Office Resistance. *Harvard Business Review*, <https://hbr.org/2022/02/how-to-overcome-return-to-office-resistance>.
2. Beck, D.E., Cowan, Ch. (1996). *Spiral Dynamics: Mastering Values, Leadership and Change*. Blackwell Publishing.
3. Copleston, F. (1996). *Historia filozofii, t. 6*. PAX.
4. Dilthey, W. (1954). *The Essence of Philosophy*. University of North Carolina Press.
5. Dilthey, W. (2002). *The Formation of the Historical World in the Human Sciences*. Princeton University Press.
6. Fowler, J. (1981). *Stages of Faith: The Psychology of Human Development and the Quest for Meaning*. HarperOne.
7. Garcia, J., Maples, G., Park, M. (2020). Closing the capability gap in the time of COVID-19, *McKinsey Quarterly*, 11.
8. Gebser, J. (1985). *The Ever-Present Origin*. Ohio University Press.
9. Gilligan, C. (1977). In a Different Voice: Women's Conceptions of Self and of Morality. *Harv. Educ. Rev.*, 47(4), 481-517. DOI:10.17763/haer.47.4.g6167429416hg5l0.
10. Gilligan, C. (1982). In *A Different Voice: Psychological Theory And Women's Development*. Harvard University Press.
11. Graves, C. (1970). Levels of Existence: An Open System Theory of Values. *Journal of Humanistic Psychology*, 10(2), 131-155. DOI: 10.1177/002216787001000205.
12. Kant, I. (2013). *Critique of the Power of Judgment*. Cambridge University Press.
13. Kegan, R. (1982). *The evolving self: Problem and process in human development*. Harvard University Press.
14. Kohlberg, L. (1985). *Essays On Moral Development*. Harper & Row.
15. Krawczyńska-Zauchna, T. (2019). A new paradigm of management and leadership in the VUCA world. *Organization And Management Series*, 141, 221-230.
16. Laloux, F. (2014). *Reinventing Organizations*. Nelson Parker.
17. Loevinger, J. (1976). *Ego Development*. Jossey-Bass.
18. Parker, S.K., Knight, C., Keller, A. (2020). *Remote Managers Are Having Trust Issues*, HBR 07, <https://hbr.org/2020/07/remote-managers-are-having-trust-issues>.
19. Pelta, R. (2022). <https://www.flexjobs.com/blog/post/remote-flexible-companies-with-4-day-workweek/>.
20. Peters, E., (2020). Reinventing Workers for the Post-Covid Economy. *N.Y. Times*, Dec. 4, 2020, <https://www.nytimes.com/2020/12/01/business/economy/workers-jobs-training.html>.
21. Scheler, M. (1973). *Selected philosophical essays*. Publisher Evanston, Northwestern University Press.

22. Sire, J.W. (2004). *Naming the Elephant: Worldview as a Concept*. InterVarsity Press.
23. Torbert, W.R. (1991). *The power of balance: Transforming self, society, and scientific inquiry*. Newbury Park Sage.
24. Wilber, K. (2000). *A Theory of Everything: An Integral Vision for Business, Politics, Science, and Spirituality*. Shambhala Publications.
25. World Econ. F., The Future of Jobs Report 2020 6 (Oct. 2020), http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf.

CHANGES IN REMOTE EDUCATION INTRODUCED BY POLISH UNIVERSITIES OF ECONOMICS AS A RESULT OF THE COVID-19 PANDEMIC

Michał KRÓL^{1*}, Marcin ZAWICKI²

¹ Department of Public Economics, Krakow University of Economics; krolm@uek.krakow.pl,
ORCID: 0000-0001-9648-3139

² Department of Public Policy, Krakow University of Economics; zawickim@uek.krakow.pl,
ORCID: 0000-0002-3724-2658

*Correspondence author

Purpose: To determine how remote education at Polish universities of economics changed between the first and second term of classes held during the pandemic (March-June 2020 vs. October 2020-February 2021).

Design/methodology/approach: The paper is based on a survey of organisational changes implemented by four Polish universities of economics (in Katowice, Kraków, Poznań, and Wrocław) as a result of the Covid-19 outbreak.

Findings: It was found that in the winter term 2020/21, the timeliness of educational activities noticeably improved and synchronous methods were employed more frequently, whereas email was the preferred mode of communication for tutorials in both terms.

Social implications: The universities surveyed were able to respond to the crisis within a reasonably short time and continued to provide education throughout the pandemic. The findings imply that the interruption of face-to-face instruction should have little effect on their students' employment prospects after graduation.

Originality/value: The case study looks in depth at the process of organisational change forced by external circumstances at four organisations. It also illustrates the direction and magnitude of adjustments made by the selected HEIs as perceived by their students. To date, no comparable research on the subject has been published in the literature.

Funding: The publication was financed from the subsidy granted to the Cracow University of Economic – Project nr 046/GAP/2022/POT.

Keywords: emergency remote teaching, higher education, organizational change, Covid-19 crisis.

Category of the paper: Research paper, case study.

1. Introduction

The new coronavirus strain SARS-CoV-2, which causes COVID-19 disease, affected all the inhabited continents and was recognised as a global pandemic due to its severe morbidity and mortality (Chahrour et al., 2020). The pandemic was officially declared by the World Health Organisation on 12 March 2020 (WHO, 2020). Following this decision, 107 countries implemented measures to limit social contact, including the closure of educational facilities. In 29 countries, educational institutions had already been preventively closed a week earlier (Mahmood, 2020). According to UNESCO, on 1 April 2020, educational institutions were already shut in 193 countries, where a total of 91% of the world's pupils and students were educated (Zbarachewicz, 2020).

As of 12 March 2020, the possibility of providing classes in higher education institutions using remote teaching methods and techniques was introduced pursuant to the Minister of Science and Higher Education's Regulation of 11 March 2020 on the temporary suspension of the functioning of certain units of the higher education and science system in connection with the prevention, counteraction, and combating of COVID-19 (Ministry of Science and Higher Education, 2020). Poland's public universities of economics immediately responded to the crisis situation. In the days that followed, their authorities issued appropriate regulations and guidelines on taking classes, tests, and diploma examinations in a remote setting.

The purpose of this article is to discuss the findings of a study on the changes in remote education introduced by the Polish universities of economics in the second term of classes delivered under pandemic conditions, spanning the period from October 2020 to February 2021 (i.e. the winter term of the 2020/21 academic year) in comparison with remote education provided in the first term of classes delivered during the pandemic, spanning the period from March to June 2020 (the summer term of the academic year 2019/20).

2. Literature Review

2.1. Definition, methods, and tools of remote education

Remote education, distance learning, e-learning, distance teaching or e-education all refer to the delivery of teaching activities using a computer network and computers in a setting that involves temporal and/or spatial distance (Winiarczyk, Warzocha, 2021). Remote education, including remote teaching and learning, has been the subject of research for decades (Hodges et al., 2020). The potential of remote education was recognised long before the outbreak of the recent pandemic. In 2013, the European University Association (EUA) conducted a study on

the use of distance learning by European universities. The survey covered 249 universities, including 10 Polish educational institutions, of which 2 were universities of economics. The study found that virtually every one of them used distance learning methods (Gaebel et al., 2014). Eighty-one per cent of the universities surveyed offered online courses, 39% had online degree programmes, 91% provided hybrid classes, 55% had blended degree programmes, whereas 40% collaborated with other institutions to offer combined online courses (Gaebel et al., 2014). A repeat survey, conducted by the Association in 2018, found that universities were placing increasing importance on remote learning; 93% of universities surveyed recognised remote education methods and 87% used them in their educational processes (Gaebel, Zhang, 2018).

A turning point in remote education occurred in March 2020. With the announcement of the COVID-19 pandemic, remote learning gained prominence and researchers from around the world began to explore a wide range of issues related to teaching and learning during the global epidemic (Bond et al., 2021). Because of the constraints imposed on the educational process, it became imperative to abandon traditional methods and techniques in favour of online instruction. However, the phrase that best applies to the array of instruction methods employed during pandemic conditions is Emergency Remote Teaching, not remote teaching (ERT; cf. Hodges et al., 2020). Emergency teaching is a branch of remote distance learning (Bozkurt et al., 2020; Hodges et al., 2020), and its distinguishing feature is that it occurs in an unplanned manner (Bond et al., 2021). The strategies that most universities implemented at the onset of the pandemic were crisis teaching strategies (Bozkurt et al., 2020; Hodges et al., 2020).

The quality of distant education is generally high, as it results from meticulous design and planning (Hodges et al., 2020). Emergency procedures, on the other hand, are temporary in nature as they are prepared for crisis situations. They involve the use of fully remote teaching solutions in the learning process, which, however, once the emergency situation has subsided, are replaced again by traditional procedures appropriate to natural learning environments. The primary goal of teaching under crisis conditions is therefore not to recreate the natural educational ecosystem, but to temporarily ensure its continuity (Hodges et al., 2020). According to Gruszczyńska (2020), teaching under crisis conditions has little in common with a technologically planned and methodologically supported process.

Both in the planned and structured process of remote learning and teaching in a time of crisis, the same educational methods and tools are used. These include, among others, presentations (e.g. informative lecture), demonstrations (e.g. film), problem-based methods (e.g. problem solving on an online forum or document sharing), activating methods (e.g. teaching games or discussions), practical methods (the teacher sending diagrams or tasks to be performed), or programmatic methods (organising online courses) (Grzybowska, 2020).

However, these methods and techniques must be adapted to group preferences and take into account every student's capacity for participation.

There are two types of remote education: synchronous (two-way videoconferencing) and asynchronous (learning networks) (Wierzbik-Strońska, Ostopolets, 2021).

Synchronous teaching takes place in real time, usually follows a fixed timetable, and requires participants to use appropriate technology (Wierzbik-Strońska, Ostopolets, 2021; Witkowski, 2011). The advantages of this kind of instruction are the opportunity to ask questions of the teacher directly during the class and for the teacher to adapt the class session to the needs of the students. The disadvantage is the necessity to attend class on the date set by the instructor (Čelić, Dedeić, 2021). Examples of tools used in synchronous teaching include Google Meet and Cisco Webex.

Asynchronous instruction does not presume real-time communication. Learning in this model occurs at multiple locations and times, or at different times and locations (Witkowski, 2011). Asynchronous instruction, which takes advantage of specialised platforms, email, and discussion forums, allows learners and teachers to interact even when they are not all online at the same time. This is a key feature of this flexible learning model. Many people take online courses precisely because of their asynchronous nature, which allows them to combine education with work, family and other commitments. Asynchronous instruction allows learners to log into the online learning environment at any time and download documents or send messages to other learners (Wierzbik-Strońska, Ostopolets, 2021). The advantages of asynchronous learning are the ability to replay the recorded session, to learn as one's own time allows (at any time) and the possibility for everyone to ask questions (during synchronous learning at a specific time this is not always possible). However, this model also has disadvantages, as it creates a sense of distance from the subject and the instructor and requires the ability to learn independently (Čelić, Dedeić, 2021). Tools supporting asynchronous learning include Google Classroom and Padlet (Libasin et al., 2021).

2.2. Changes in teaching methods in higher education institutions in response to COVID-19

As a result of the COVID-19 pandemic, decisions to close schools and colleges have resulted in a shift from residential to remote learning. In practice, these are not unusual circumstances. The 2005 storm seriously damaged 27 schools and universities along the Gulf Coast, as well as several more in Texas. As a result of this disaster, the Alfred Sloan Foundation supported a partnership of 153 schools and universities to take prompt action, which included the creation of over 1300 classes that allowed students to continue their studies online (Murphy, 2020). Similar steps were taken in the aftermath of the New Orleans floods and the Christchurch earthquake (Domagała-Zyśk, 2020). The key difference, however, is that these disasters were regional, while the pandemic, which started in March 2020 is global in reach.

In the United States, more than 1300 universities across all 50 states cancelled or only offered remote courses during the 2020 spring semester (Smalley, 2020). According to data gathered by the European University Association and published in a study titled *Digitally enhanced learning*, 95% of European institutions have fully integrated online learning as of April/May 2020, whereas 4% had done so to a lesser extent (EUA, 2020b; IAU, 2020). Although European universities had the resources to introduce remote education, they were in many respects insufficient and the universities themselves were unprepared for the sudden increase in their use (Gaebel et al., 2021). In the aftermath of the pandemic, 70% of universities in Europe planned to increase their digital capacity, 87% to implement new teaching methods and 66% to develop online libraries, even though such services had already been offered by 90% of the institutions surveyed (EUA, 2020b; Gaebel et al., 2021). A study by the International Association of Universities (IAU) demonstrates that nearly 66% of universities worldwide world have replaced classroom teaching with remote instruction. Although universities responded flexibly to the epidemic crisis, many were not fully prepared to shift to remote teaching (IAU, 2020).

Interesting data are also provided by the results of a survey of teaching tools used in universities in response to the pandemic, conducted on a sample of 30,383 students from 61 countries, including 45% from the European Union (Aristovnik et al., 2020). The findings show that the most popular type of online instruction was classes taught using synchronous tools (59.4%). Asynchronous tools such as uploading presentations (15.2%), videos (11.6%), communicating via forums and chat rooms (9.1%), and audio recordings (4.7%) were less popular. Across the entire research sample, synchronous online activities were considered the most satisfactory by students and, as regards asynchronous tools, uploading presentations.

The adopted crisis teaching models varied by university size, the courses offered, and the management models. Large units generally found it more difficult to implement system-wide solutions. In decentralised HEIs, individualised remedies were employed more often, varying between faculties and even departments. However, in programmes requiring laboratory classes, practical experience and external cooperation, remote learning proved to be more problematic (EUA, 2020a).

The restrictions in force made it mandatory for academics to implement remote instruction (Gewin, 2020). Although this form of education has numerous advantages, it also has several disadvantages of which the most significant are the lack of direct contact between students and the teacher, insufficient student interaction, and low commitment to learning (Sito et al., 2018). These disadvantages of distance education raise legitimate concerns about the quality of instruction provided in this mode. According to Topol (2020), classes delivered remotely are, by definition, less effective than those delivered traditionally in the classroom. Concerns are also raised about the reasonable risk of a negative impact of the epidemic on students' academic

performance, fulfilment of their educational plans, participation in the labour market, and ability to achieve their intended professional goals (Aucejo et al., 2020). The authors of the report *Irish National Digital Experience Survey* (INDEX) also draw attention to the possibility that emergency modifications to the teaching strategies may have a negative effect on the quality of education. In their view, before March 2020, 70% of academics in Ireland and 74% in the UK had never taught in an online environment before (EUA, 2020a). In this context, the key question becomes: What remote methods and tools allow teaching to be delivered without compromising the level of education? The COVID-19 pandemic showed that a universal answer to this question does not exist (Bozkurt et al., 2020).

2.3. Changes to teaching methods in Polish higher education in response to the pandemic crisis

Pursuant to the said Regulation of the Minister of Science and Higher Education of 11 March 2020 (MNiSW, 2020), higher education institutions in Poland were obliged to modify their mode of instruction. It took some time for universities to adapt to the restrictions, specifically, to use appropriate electronic tools and systems, as well as develop and implement new ones (Kolańska-Morawska, Brzozowska, 2021).

The Minister of Science and Higher Education did not provide specific requirements for the platforms to be used in remote education. Decisions in this regard were left to university authorities, which, drawing on their experience, adopted specific solutions at their own discretion (Zbarachewicz, 2020). In the first weeks, a wide range of technology solutions were tried and tested. For example, the University of Mining and Metallurgy in Kraków used the UPEL platform, based on Moodle and featuring the Virtual Class plug-in from Click Meeting and the Microsoft Teams system (Topol, 2020). The University of Białystok relied on the Blackboard online learning platform integrated with the USOS system, as well as the Moodle platform, Blackboard Collaborate, and Zoom (Topol, 2020). At the University of Warsaw, on the other hand, classes were taught using Google Meet, Google Classroom, and the UW Kampus Platform based on the Moodle system (Topol, 2020).

The first wave of the pandemic demonstrated that universities which had previously focused on developing distance learning methodologies were in a privileged position regardless of the applied technology (Wojcik, 2022). One such instance is the Jagiellonian University, where 12.4% of all classes during the 2018/19 academic year were delivered via a distance learning platform (Topol, 2020).

Nonetheless, a significant proportion of Polish higher education institutions, even several months after the restrictions were announced, were still unprepared to fully implement their activities in the new online reality. In September 2020, a survey of public and non-public university authorities was conducted, which was reported in *How will COVID-19 affect higher education in the academic year 2020/21?* Its findings show that around 33% of university

representatives declared that their institution was not fully ready for the new academic year (i.e. the winter term of 2020/21). Smaller and private HEIs, with somewhat better prepared teaching staff in this respect, found it easier to switch to remote instruction (Effects Centre, 2020).

Despite these challenges, the COVID-19 outbreak has surely expedited the process of the higher education system entering a new stage of development, potentially leading to a new generation of distant learning offered by universities. Indeed, this epidemic has ushered in a digital revolution in the academic world (Strielkowski, 2020). There are many indications that university education is unlikely to return to the same form as before the pandemic, and that newly emerging technological solutions will enable remote learning and be successfully used in practice (Każmierczak, Sworowska, 2021).

3. Research methodology

The aim of the study was to determine how remote education at Polish universities of economics changed between the first term of classes held during the pandemic, which ran from March to June 2020 (the summer term of the 2019/20 academic year) and the second term, which covered the period from October 2020 to February 2021 (the winter term of the 2020/21 academic year). The aim of the study was operationalised into the following four research questions:

1. Did the teaching activities conducted in both terms of remote education take place as scheduled?
2. Did the synchronous learning methods and tools used during the second term of remotely delivered classes change compared with first term?
3. Did the asynchronous learning methods and tools used during the second term of remotely delivered classes change compared with the first term?
4. Did academic staff conduct tutorials differently in the second term of remotely taught classes than in the first term?

The study was conducted from March to June 2021 among the students of four Polish universities of economics in Katowice, Kraków, Poznań and Wrocław.

To answer the research questions, a survey questionnaire was developed, which included an introductory demographics section that identified the respondents' form, type, and year of study, as well as two identical groups of specific questions that addressed different aspects of remote education at universities during the summer term of the 2019/20 academic year and the winter term of the 2020/21 academic year.

With the permission of university authorities, the survey questionnaire was made available on their websites and circulated to students via social media platforms. Prior to submitting the official questionnaire, a pilot was done on 10 Krakow University of Economics students to check accuracy and comprehension. Minor changes were made in response to input from the pilot participants.

The research sample consisted of 614 full-time and part-time students who participated in courses taking place in both terms of interest. Specifically, the survey was conducted among second- and third-year full-time and part-time first cycle (bachelor's and engineering) students and second- and third-year full-time and part-time uniform master's students, as well as first- and second-year full-time and part-time second cycle (master's) students and fourth- and fifth-year full-time and part-time uniform master's students. The breakdown of the research sample is presented in Table 1.

Table 1.
Breakdown of a research sample

	Full-time	Part-time	Total
Students in the 2 nd and 3 rd year of bachelor's and engineer's degree programmes and the 2 nd and 3 rd year of uniform master's degree programmes.	286	89	375
Students in the 1 st and 2 nd year of second-cycle (master's) studies and 4 th and 5 th year of uniform master's studies	160	79	239
Total	446	168	614

Source: own study.

For the sake of clarity, the following acronyms are used to refer to individual groups in the study sample:

- 1FT – second- and third-year students of full-time first-cycle programmes (bachelor's and engineering) and second- and third-year students of full-time uniform master's programmes,
- 1PT – second- and third-year students of part-time first-cycle programmes (bachelor's and engineering) and second- and third-year students of part-time uniform master's programmes,
- 2FT – first- and second-year students of full-time second-cycle programmes (master's) and fourth- and fifth-year students of full-time uniform master's programmes,
- 2PT – first- and second-year students of part-time second-cycle programmes (master's) and fourth- and fifth-year students of part-time uniform master's programmes.

As requested by the authorities of some HEIs included in the survey, the breakdown of the research sample and survey findings are presented in general terms, i.e. without highlighting differences between individual HEIs across the studied issues. The results of the research concerning individual terms are presented as the summer term 2019/20 and the winter term 2020/21 (abbreviated as ST 19/20 and WT 20/21, respectively).

4. The study results

The study's conclusions will be reported in the order in which the individual research questions were asked, namely: (1) compliance of the implementation of teaching activities with the timetable; (2) synchronous teaching methods and tools; (3) asynchronous teaching methods and tools; and (4) forms of tutorials.

4.1. Compliance with the timetable

One of the first challenges faced by Polish universities of economics in response to the COVID-19 epidemic that began in Poland in March 2020, apart from the widespread implementation of remote education tools, was to ensure the timeliness of the teaching process. The yardstick we adopted to illustrate the effectiveness of the university's efforts in this respect is the percentage of remotely delivered classes that were held as scheduled. Data illustrating the timeliness of the delivery of remote teaching at the universities surveyed in the summer term 2019/20 and the winter term 2020/21 are presented in Table 2.

Table 2.

Percentage of remote instruction delivered as scheduled in the summer term 2019/20 and winter term 2020/21 (n = 614)

	< 30%	30-50%	51-70%	71-90%	> 90%
Summer term 2019/20	7.5%	10.6%	14.8%	25.7%	41.4%
Winter term 2020/21	0.5%	0%	1%	9.1%	89.4%

Source: own study.

Ensuring the timeliness of remote instruction by the surveyed universities in the summer term 2019/20 was moderately successful. Only 41.4% of the respondents said that at least 90% of teaching activities took place as scheduled, and a further 40.5% (25.7%+14.8%) estimated that between 51% and 90% of teaching activities were completed within the scheduled times. According to 10.6% of the students surveyed, 31–50% of classes were delivered according to timetable, and according to 7.5% of the respondents, no more than 30% of the total classes were delivered on time.

In the following winter term 2020/21, the timeliness of teaching significantly improved. The answer that more than 90% of teaching classes were conducted according to timetable during this period was selected by 89.4% of the students surveyed. According to 10.1% (9.1%+1%) of students, between 51% and 90% of classes were held on time, and only 0.5% of students considered that no more than 30% of classes were completed according to the timetable.

In contrast, the universities were unable to provide the same level of timeliness across all programme kinds and delivery formats. Figure 1 shows the discrepancies that have been found in this regard.

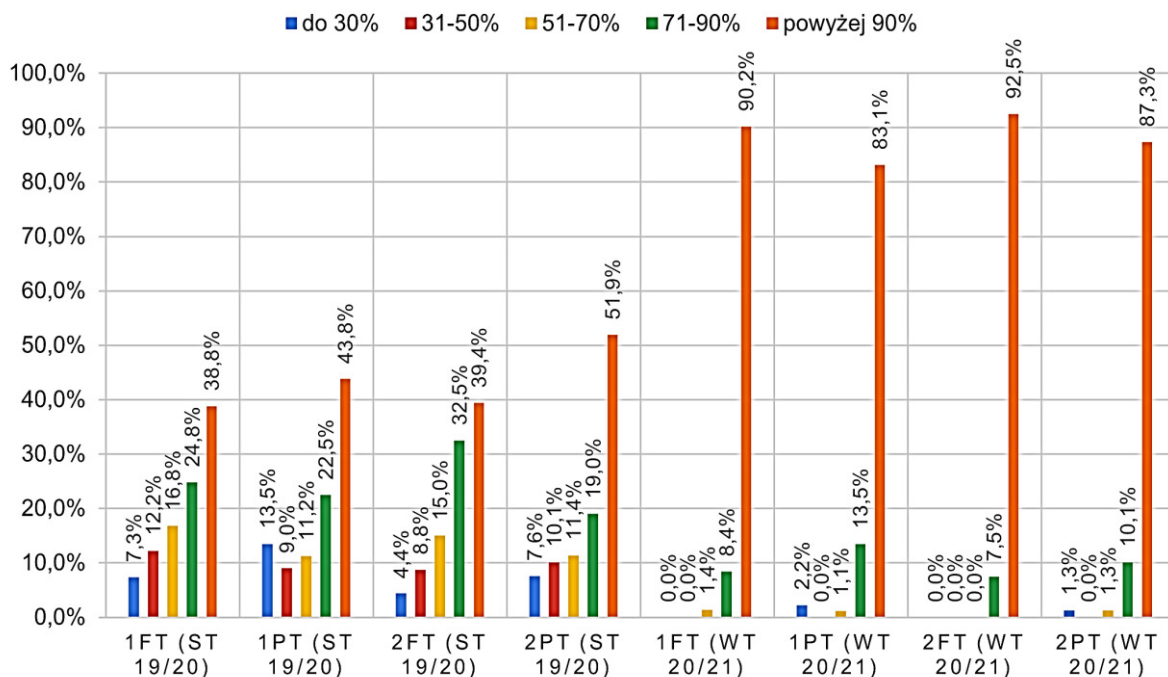


Figure 1. Percentage of remote classes delivered as scheduled in the summer term 2019/20 and winter term 2020/21 by form and type of programme. Own study.

In the summer term 2019/20, most classes held as scheduled, i.e. above 90%, was reported by part-time students, namely 43.8% of 1PT and 51.9% of 2PT. The same response was given by 38.8% of 1FT and 39.4% of 2FT students. The proportion of responses from part-time students to the question on the lowest (i.e. no more than 30%) percentage of teaching activities completed as scheduled was also higher. 1PT students reported 13.5%, 2PT – 7.6%, whereas 1FT – 7.3% and 2FT – 4.4%.

In the winter term 2020/21, the proportion of classes taught as scheduled markedly improved. The highest compliance with the timetable (i.e. more than 90%) was declared by 90.2% of 1FT, 92.5% of 2FT, 83.1% of 1PT and 87.3% of 2PT. On the other hand, only 1.4% of 1FT students, none of 2FT, 3.3% of 1PT and 2.6% of 2PT students said that the proportion of teaching occurring in a timely manner did not exceed 70%. In the winter term 2020/21, the proportion of classes taught as scheduled in full-time programmes was therefore slightly higher than in part-time programmes.

4.2. Synchronous teaching methods and tools

The second aspect of the teaching process to be surveyed was the use of synchronous methods and tools duringi classes.

Table 3 summarises the overall findings on the use of synchronous tools, which allow instructors and students to engage in classes in real time via an online meeting platform.

Table 3.*Percentage of classes delivered using remote synchronous tools (n = 614)*

	< 30%	30-50%	51-70%	71-90%	> 90%
Summer term 2019/20	15.1%	13.7%	17.3%	17.3%	36.6%
Winter term 2020/21	1.1%	0.3%	2.1%	9.4%	87%

Source: own study.

Throughout the summer term 2019/20, 36.6% of the total number of students surveyed reported using synchronous teaching tools during at least 90% of teaching sessions. These instruments were employed in 79–90% of educational activities, according to another 17.3%. The same proportion of students reported that tools enabling real-time remote education were employed in 50–70% of educational activities. In comparison, fewer than 29% (15.1%+13.7%) of respondents stated that they used synchronous technologies in at least 50% of their classes.

In the winter term 2020/21, however, synchronous online teaching methods were used in more than 90% of all classes by 87% of students and during 70–90% of classes by 9.4% of the survey participants. Only 1.4% (1.1% + 0.3%) of the respondents stated that these tools were used at most during 50% of the total teaching activities that took place during the term under consideration.

The study shows that while in the first term of classes held at the four Polish universities of economics during the COVID-19 pandemic, approximately 54% (36.6% + 17.3%) of students stated that they had participated in at least 71% of classes organised via online meeting platforms in real time, in the second term, the proportion increased to more than 96% (87% + 9.4%).

Let us now take note the differences in participation in remote synchronous activities among the various groups of students surveyed (Figure 2).

In the summer term 2019/20, there was a greater variation in the use of synchronous tools in part-time programmes. In 1PT, 62.9% (44.9% + 18%) of students declared that they attended at least 71% of classes using the online meeting platform and 44.9% of students attended more than 90% of classes, while in 2PT programmes, the respective figures were 62.0% (48.1% + 13.9%) and 48.1%. In contrast, 24.8% (16.9% + 7.9%) of 1PT students confirmed their participation in at most 50% of classes conducted using synchronous tools and 16.9% in at most 30% of classes. Among 2PT students, the figures were 27.9% (15.2% + 12.7%) and 15.2% respectively.

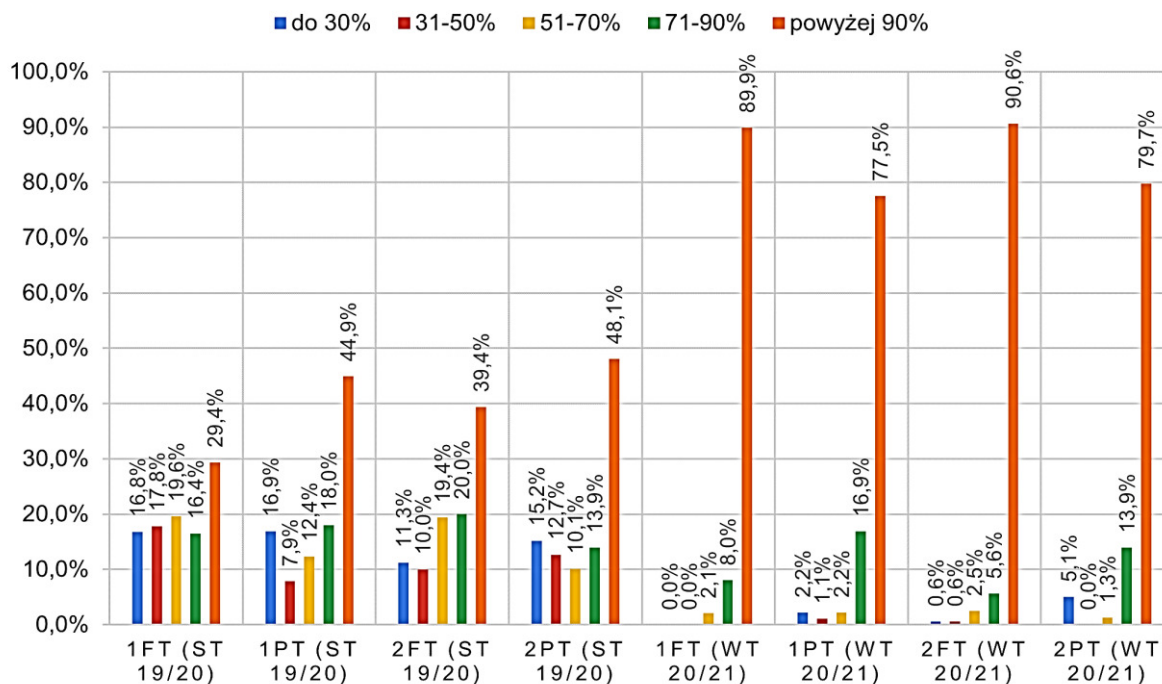


Figure 2. Percentage of classes delivered using synchronous tools across the groups of students surveyed. Own study.

In the case of 1FT students, only 45.8% (29.4% + 16.4%) attended at least 71% of classes in the same term using the online meeting platforms and 29.4% attended more than 90% of classes. Among 2FT students, the respective figures were 59.4% (39.4% + 20%) and 39.4%. On the other hand, in the case of 1FT students, the figures of interest were 59.4% (39.4% + 20%) and 39.4%. Among 1FT students, 34.6% (16.8% + 19.6%) reported participation in at most 50% of classes conducted using synchronous tools and 16.8% in at most 30% of such classes. In 2FT, this was declared by 21.3% (11.3% + 10%) and 11.3% of students, respectively. The conclusion to be drawn from these statistics is that more classes were cancelled or were only conducted using asynchronous tools during the summer term 2019/20, which is more noticeable in the findings for full-time students than for part-time students.

In the winter term 2020/21, the use of synchronous tools in the teaching process increased in every student group surveyed, with the highest noted for full-time courses. Participation in at least 71% of classes conducted using synchronous tools was declared by 97.9% (89.9% + 8%) of 1FT students, and in more than 90% of classes by 89.9% of this group of students. 2FT students reported participation in synchronous activities at 96.3% (90.6% + 5.6%) and 90.6% respectively. Participation in at least 71% of classes taken using the online meeting platform among 1PT and 2 PT students was 94.4% (77.5 + 16.9%) and 93.6% (79.7% + 13.9%), whereas above 90% of classes was 77.5% and 79.7%, respectively. The lowest response rate to the question on participation in at most 50% of classes conducted with the use of synchronous tools was noted in the group of 1FT (no responses) and 2FT students (1.2%), while the highest among 2PT (5.1%) and 1PT students (3.3%).

The next research topic concerned the types of synchronous tools utilised for teaching at economics universities in both terms (table 4).

Table 4.

Types of synchronous tools used in the teaching process (percentage of answers given; n = 614)

	Never		Rarely		Sometimes		Often		Very often	
	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21
Blackboard Collaborate	96.7	98.0	1.6	0.7	0.8	0.5	0.3	0.5	0.5	0.3
Cisco WebEx	98.4	99.7	0.5	0.3	0.8	0.0	0.2	0.0	0.2	0.0
Discord	95.0	98.5	2.3	1.0	2.3	0.5	0.5	0.0	0.0	0.0
Facebook Messenger	92.5	95.9	3.6	2.4	2.1	1.1	1.5	0.2	0.3	0.3
Google Meet (Classroom)	94.3	97.4	2.6	0.8	1.8	0.8	0.7	0.0	0.7	1.0
Microsoft Teams	37.3	46.4	7.8	2.1	6.0	2.0	10.3	1.3	38.6	48.2
Microsoft Skype	84.7	98.2	9.0	1.1	5.2	0.5	0.8	0.2	0.3	0.0
Zoom	25.1	42.2	11.7	4.2	15.1	2.3	15.0	1.1	33.1	50.2
Other	71.5	90.1	8.0	4.9	10.7	2.4	5.2	0.8	4.6	1.8

Source: own study.

In the summer term 2019/20, the most popular synchronous teaching tools used by the Polish universities of economics surveyed were Zoom and Microsoft Teams. Microsoft Teams was used very often or often in the teaching process according to 48.9% of all students in the research sample. The very frequent or frequent use of the Zoom platform was indicated by 48.1% of the total student sample. Academic teachers were far less likely to use Microsoft Skype, Facebook Messenger, Discord, Google Meet (Classroom), Blackboard Collaborate, Cisco WebEx or others. The response rate for very frequent or frequent use of these platforms was highest for Facebook Messenger (1.8%) and did not exceed 1.1% for the other tools.

The survey results indicate that the universities of economics chose the remote learning platforms that were appropriate or preferable for the teaching process during the winter term 2020/21. During this time, Microsoft Teams and Zoom, which were used very often or often by 49.5% and 51.3% of the students questioned, respectively, consolidated their position as the top tools. Simultaneously, the proportion of respondents who said they had never or rarely utilised synchronous tools, increased. While in the summer term 2019/20 it was declared that Microsoft Teams and Zoom were not or were rarely used by 45.1% and 36.8% of the students respectively, for the winter term 2020/21 the percentage of responses to these questions increased to 48.5% (Microsoft Teams) and 46.4% (Zoom). Furthermore, in the winter term 2020/21, the proportion of other tools used in synchronous learning declined; the percentage of responses concerning their very frequent or frequent use did not exceed 1% for any of them. It is thus clear that Zoom and Microsoft Teams dominated the market for synchronous learning platforms at the studied universities during the first year of enforced remote learning (March 2020-February 2021).

The teaching techniques utilised in synchronous online classes are an important aspect of remotely delivered education. The teaching approaches in this study were chosen after conducting a literature review (taking into account the methodologies described in the theoretical section of this paper), teaching practice, interviews with students and instructors, and a preliminary pilot study. Table 5 summarises the relevant findings.

Table 5.

Teaching techniques used in synchronous online classes delivered in the summer term 2019/20 and the winter term 2020/21 (percentage of responses given; n = 614)

Technique	Never		Rarely		Sometimes		Often		Very often	
	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21
Lecture (total)	1.5	0	4.9	0.2	11.1	1.0	25.6	11.4	57.0	87.5
1FT	2.1	0	3.5	0	13.6	1.0	28.0	12.6	52.8	86.4
1PT	2.2	0	3.4	0	12.4	1.1	32.6	14.6	49.4	84.3
2FT	0.6	0	6.9	0	6.3	1.3	21.3	7.5	65.0	91.3
2PT	0	0	7.6	1.3	10.1	0	17.7	11.4	64.6	87.3
Discussion (total)	16.0	5.2	29.6	16.9	26.2	27.7	16.0	27.9	12.2	22.3
1FT	16.8	3.8	32.9	16.8	26.6	27.6	15.0	30.4	8.7	21.3
1PT	14.6	2.2	20.2	19.1	31.5	32.6	15.7	23.6	18.0	22.5
2FT	16.3	9.4	30.0	11.3	25.0	30.6	15.6	26.3	13.1	22.5
2PT	13.9	5.1	27.8	26.6	21.5	16.5	20.3	26.6	16.5	25.3
Educational film (total)	47.9	36.3	26.2	30.8	18.2	23.5	4.2	5.4	3.4	4.1
1FT	48.6	35.0	24.8	30.1	18.5	25.2	4.9	5.9	3.1	3.8
1PT	38.2	32.6	36.0	31.5	18.0	29.2	4.5	4.5	3.4	2.2
2FT	53.8	40.0	22.5	32.5	16.9	18.8	3.1	4.4	3.8	4.4
2PT	44.3	38.0	27.8	29.1	20.3	20.3	3.8	6.3	3.8	6.3
Group work (total)	12.1	2.0	17.6	6.8	23.3	22.3	23.6	34.9	23.5	34.0
1FT	11.5	1.0	20.3	4.9	28.0	25.2	20.3	35.3	19.9	33.6
1PT	13.5	5.6	12.4	6.7	21.3	21.3	32.6	37.1	20.2	29.2
2FT	12.5	1.3	16.9	8.8	21.9	22.5	21.9	32.5	26.9	35.0
2PT	11.4	2.5	15.2	10.1	11.4	12.7	29.1	35.4	32.9	39.2
Case study analyses (total)	34.2	21.8	22.0	23.5	22.0	26.7	14.3	17.6	7.5	10.4
1FT	38.8	20.3	24.5	24.1	17.5	27.3	12.9	17.8	6.3	10.5
1PT	38.2	36.0	22.5	18.0	21.3	24.7	14.6	18.0	3.4	3.4
2FT	30.6	23.8	15.0	21.9	29.4	27.5	14.4	15.0	10.6	11.9
2PT	20.3	7.6	26.6	30.4	24.1	25.3	19.0	21.5	10.1	15.2
Teaching games (total)	70.2	65.0	19.2	20.0	7.3	9.4	1.1	3.3	2.1	2.3
1FT	71.3	57.7	19.9	26.2	6.6	10.5	1.4	3.5	0.7	2.1
1PT	67.4	70.8	24.7	18.0	4.5	10.1	2.2	1.1	1.1	0
2FT	71.9	73.8	15.0	9.4	8.8	9.4	0	4.4	4.4	3.1
2PT	65.8	67.1	19.0	21.5	10.1	5.1	1.3	2.5	3.8	3.8
Presentation of group projects (total)	18.9	6.0	16.3	13.2	25.7	25.7	20.8	29.5	18.2	25.6
1FT	20.3	6.6	18.5	12.6	28.7	29.4	17.1	28.0	15.4	23.4
1PT	21.3	14.6	18.0	14.6	20.2	21.3	23.6	31.5	16.9	18.0
2FT	16.9	2.5	13.8	10.0	24.4	24.4	21.9	32.5	23.1	30.6
2PT	15.2	1.3	11.4	20.3	24.1	20.3	29.1	26.6	20.3	31.6

Source: own study.

In the summer term 2019/20, by far the most widely used synchronous teaching technique was the lecture, according to 82.6% of all the students surveyed. The various course types and programmes did not significantly differ from one another in this regard. The second most frequently used synchronous teaching technique in that term was group work. Its very frequent or frequent use was reported by 47.1% of the total number of students participating in the study, with 2PT students using it the most frequently (very often + often) (62%), whereas the least frequent by 1FT students (40,2%). A slightly less popular technique was the presentation of group projects prepared in advance, reported by 39% of the total number of students surveyed, including 49.4% of 2PT and 45% of 2FT students. This was offered the least frequently to 1FT students – only 32.5% of respondents in this group declared that it had been used very often or often. Discussions and case study analyses were used very often or often during classes attended by 28.2% and 21.8% of the total respondents, respectively. In contrast, 7.6% and 3.3% of respondents, respectively, reported using educational films and teaching games very often or often.

The lecture had already become the most widely used synchronous teaching technique in the winter term 2020/21 (very often + often according to 98.9% of the total number of students surveyed). There was also a significant increase in the proportion of students who said they had participated in group work (68.9% of all respondents), group project presentations (55.1%), discussions (50.2%), and case study analysis (28%) very often or often during the classes held remotely that term. On the other hand, there was a small increase in the proportion of students who reported using synchronous teaching tools such as educational films (9.5% of the research sample) and teaching games (5.6%) on a regular or very regular basis. The educational film, on the other hand, turned into an important teaching tool used during classes with 2PTs: 12.6% of this group of students received instruction in this way as part of their coursework.

4.3. Asynchronous teaching methods and tools

The third aspect of the teaching process examined was the use of remote asynchronous teaching methods and tools during classes.

Table 6 Table 6 summarises the findings on the use of asynchronous tools.

Table 6.

Percentage of classes delivered using asynchronous tools (n = 614)

	< 30%	30-50%	51-70%	71-90%	> 90%
Summer term 2019/20	48.7%	21.5%	14.3%	10.1%	5.4%
Winter term 2020/21	79.2%	7.5%	2.4%	4.6%	6.4%

Source: own study.

Asynchronous tools were used apart from synchronous ones during the summer term 2019/20. Only 5.4% of the total number of students polled said that they had used synchronous learning tools during at least 90% of the teaching activities. According to a further 10.1%, these instruments were employed in 71.90% of the educational activities that term. Asynchronous tools were used for 51–70% of the classes held according to 14.3% of respondents. Thus, 70.2% (48.7% + 21.5%) indicated that asynchronous tools were utilised throughout at least 50% of the teaching sessions, with 48.7% of the research group indicating that they were used during fewer than 30% of the sessions.

The surveyed Polish universities of economics applied asynchronous tools in remote education to a limited extent in the winter term 2020/21. Although these tools were used during at least 90% of class time according to 6.4% of respondents, i.e. slightly more than in the previous term, their utilisation only during no more than 30% of sessions was reported by as many as 79.2% of the survey participants. The percentage of students who declared that asynchronous tools had been used by their instructors throughout 30-90% of teaching time in the winter term 2020/21 was also much lower than in the summer semester 2019/20.

The teaching techniques employed in asynchronous online classes are yet another component of remote education that was researched.

Table 7 shows the study's findings in this regard.

Table 7.

Teaching techniques used during asynchronous online classes delivered in the summer term 2019/20 and the winter term 2020/21 (percentage of responses given; n = 614)

Technique	Never		Rarely		Sometimes		Often		Very often	
	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21
Online courses developed using e-learning platforms (total)	22.6	25.9	11.2	14.7	17.3	14.0	18.9	14.0	30.0	31.9
1FT	18.9	22.7	10.5	14.0	15.4	12.6	18.9	12.6	36.4	36.0
1PT	19.1	18.0	12.4	20.2	18.0	18.0	28.1	18.0	22.5	29.2
2FT	28.8	35.6	11.9	13.1	18.8	13.8	15.6	13.8	25.0	26.3
2PT	27.8	26.6	11.4	13.9	20.3	15.2	15.2	15.2	25.3	31.6
Description of assignment posted by tutor – completed project, paper, presentation, etc. uploaded by students (total)	4.6	12.7	13.7	16.4	27.9	27.5	27.2	27.5	26.7	18.7
1FT	3.5	14.3	12.6	14.7	26.6	26.2	29.7	26.2	27.6	19.9
1PT	9.0	10.1	14.6	20.2	30.3	28.1	23.6	28.1	22.5	21.3
2FT	4.4	13.8	13.1	15.0	28.1	28.8	28.1	28.8	26.3	15.0
2PT	3.8	7.6	17.7	21.5	29.1	29.1	20.3	29.1	29.1	19.0
Uploading recorded lectures or multimedia presentations (total)	14.3	27.9	25.2	24.9	27.4	22.1	18.1	22.1	15.0	12.4
1FT	12.9	29.4	26.2	25.5	25.5	21.3	19.9	21.3	15.4	12.2
1PT	12.4	22.5	23.6	28.1	31.5	19.1	15.7	19.1	16.9	16.9
2FT	16.3	31.9	21.3	21.3	28.1	23.1	19.4	23.1	15.0	9.4
2PT	17.7	20.3	31.6	26.6	27.8	26.6	11.4	26.6	11.4	13.9

Cont. table 7.

Group work – e.g. joint projects, compiling glossaries and databases of terms (total)	16.6	13.4	18.9	15.1	25.6	26.4	19.2	26.4	19.7	23.3
1FT	14.7	13.3	21.7	14.7	26.9	29.0	18.5	29.0	18.2	21.3
1PT	18.0	15.7	20.2	18.0	25.8	22.5	22.5	22.5	13.5	25.8
2FT	18.8	14.4	14.4	12.5	25.6	26.3	20.6	26.3	20.6	22.5
2PT	17.7	8.9	16.5	19.0	20.3	21.5	15.2	21.5	30.4	29.1
Use of materials available on the internet e.g.: YouTube videos (total)	35.7	41.0	29.2	28.7	21.5	20.2	9.3	20.2	4.4	4.4
1FT	29.7	34.3	31.8	30.8	21.7	24.5	12.9	24.5	3.8	4.2
1PT	43.8	47.2	25.8	29.2	23.6	19.1	2.2	19.1	4.5	3.4
2FT	40.0	49.4	25.6	24.4	21.9	16.3	8.1	16.3	4.4	4.4
2PT	39.2	41.8	30.4	29.1	17.7	13.9	6.3	13.9	6.3	6.3
Quizzes (total)	16.4	21.5	19.2	16.8	21.7	21.7	24.3	21.7	18.4	19.7
1FT	13.6	17.5	14.0	16.8	23.8	24.8	28.3	24.8	20.3	19.2
1PT	22.5	30.3	21.3	13.5	16.9	13.5	22.5	13.5	16.9	20.2
2FT	17.5	23.1	23.1	18.8	21.3	20.6	21.3	20.6	16.9	18.8
2PT	17.7	22.8	27.8	16.5	20.3	21.5	17.7	21.5	16.5	22.8
Online forum discussions (total)	40.1	42.5	29.2	20.2	17.6	21.3	8.0	21.3	5.2	6.4
1FT	35.3	37.4	34.3	24.8	19.2	25.5	7.7	25.5	3.5	4.2
1PT	36.0	52.8	29.2	13.5	22.5	16.9	7.9	16.9	4.5	5.6
2FT	48.1	46.3	23.8	18.8	13.8	15.6	6.3	15.6	8.1	10.0
2PT	45.6	41.8	21.5	13.9	13.9	22.8	12.	22.8	6.3	7.6
Sharing materials (total)	40.6	45.6	25.9	21.8	17.4	15.3	9.6	15.3	6.5	8.1
1FT	37.1	41.6	26.6	28.0	22.4	15.4	8.4	15.4	5.6	7.3
1PT	46.1	51.7	27.0	14.6	18.0	15.7	5.6	15.7	3.4	4.5
2FT	45.6	51.3	23.1	16.9	11.3	15.0	11.9	15.0	8.1	7.5
2PT	36.7	41.8	27.8	17.7	11.4	15.2	13.9	15.2	10.1	16.5

Source: own study.

During the summer term 2019/20, the most commonly used asynchronous teaching technique required students to upload projects (papers, presentations, etc.) based on assignments posted by the teacher. According to 53.9% of all the participating students, it was done very often or often. Online courses developed using e-learning platforms were the second most commonly used technique. According to the findings of this study, undergraduate students were exposed to this type of teaching substantially more frequently than postgraduate ones. Of the total number of students participating in the study, 48.9% stated that they had used this technique very often or often. Slightly less popular asynchronous online teaching tools included tests (quizzes), group work, and uploading recorded lectures or multimedia presentations. These were used very often or often used according to 42.7%, 38.9%, and 33.1% of the students surveyed, respectively. Group work was used more frequently in second- than in first-cycle programmes. Asynchronous teaching tools such as sharing documents, materials available on the internet, and online forum discussions were employed much less frequently during the term in question. These were used very often or often according to 16.1%, 13.7%, and 13.2% of the survey participants, respectively. Online forum discussions and sharing materials were used more often with second-cycle students than with first-cycle ones.

Apart from the general decline in the popularity of asynchronous remote teaching methods in the universities studied during the winter term 2020/21, the structure of their use also slightly changed. Group work, assignments provided by the teacher, and uploading finished projects (papers, presentations, etc.) by students were the most often utilised methods at the time, as were online courses developed using e-learning platforms. These strategies were exploited very often or often by 49.7%, 46.2%, and 45.9% of respondents, respectively. Quizzes (41.4%) remained stable between terms. Other less frequently used methods included: 1. uploading recorded lectures or multimedia presentations – 34.5%; 2. online forum discussions – 27.7%; 3. use of materials available on the internet – 24.6%; and 4. sharing materials – 23.4% of study participants.

4.4. Forms of tutorials

The fourth aspect of education examined at Polish universities of economics during the COVID-19 pandemic was the forms of remote individual tutorials. The findings are presented in Table 8.

Table 8.

Forms of remote individual tutorials in the summer term 2019/20 and winter term 2020/21 (percentage of responses given; n = 614)

Form of tutorial	Never		Rarely		Sometimes		Often		Very often	
	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21	ST 19/20	WT 20/21
Email contact (total)	0	0.2	3.4	2.4	9.0	6.8	30.5	19.1	57.2	71.5
1FT	0	0	3.5	2.1	7.7	8.4	35.0	21.3	53.8	68.2
1PT	0	0	4.5	5.6	18.0	9.0	33.7	15.7	43.8	69.7
2FT	0	0.6	2.5	1.3	4.4	3.1	23.1	15.6	70.0	79.4
2PT	0	0	3.8	2.5	12.7	6.3	25.3	21.5	58.2	69.6
Telephone contact at times indicated by the teacher (total)	56.0	56.5	27.2	24.6	11.4	12.4	3.4	4.1	2.0	2.4
1FT	57.3	59.8	30.1	25.9	10.5	9.4	1.7	3.8	0.3	1.0
1PT	47.2	50.6	32.6	24.7	14.6	16.9	3.4	5.6	2.2	2.2
2FT	61.3	59.4	20.0	20.6	10.0	13.1	6.3	3.1	2.5	3.8
2PT	50.6	45.6	25.3	27.8	13.9	16.5	3.8	5.1	6.3	5.1
Contact using synchronous tools (e.g. Zoom) at times indicated by the teacher (total)	9.9	6.7	14.0	4.7	19.4	11.7	23.8	22.8	32.9	54.1
1FT	9.1	6.3	15.0	3.8	18.5	8.7	26.6	24.5	30.8	56.6
1PT	6.7	9.0	21.3	4.5	20.2	19.1	25.8	24.7	25.8	42.7
2FT	11.9	6.3	10.0	8.1	18.1	7.5	20.0	19.4	40.0	58.8
2PT	12.7	6.3	10.1	1.3	24.1	22.8	19.0	21.5	34.2	48.1
Contact via the university's e-learning platform (e.g. Moodle) (total)	17.6	22.1	16.6	17.3	18.6	16.8	27.2	21.2	20.0	22.6
1FT	14.7	20.6	17.5	16.1	18.5	17.5	29.7	23.8	19.6	22.0
1PT	15.7	16.9	23.6	20.2	24.7	24.7	20.2	15.7	15.7	22.5
2FT	21.9	26.3	11.9	20.0	16.3	13.1	29.4	21.9	20.6	18.8
2PT	21.5	25.3	15.2	12.7	16.5	12.7	21.5	16.5	25.3	32.9

Cont. table 8.

Contact via social media (e.g. Facebook) (total)	82.1	87.3	12.9	9.6	3.3	2.4	1.3	0.3	0.5	0.3
1FT	82.9	86.4	12.6	10.8	3.1	2.4	1.0	0	0.3	0.3
1PT	91.0	92.1	6.7	5.6	2.2	2.2	0	0	0	0
2FT	80.0	90.0	15.0	8.8	3.8	0.6	1.3	0.6	0	0
2PT	73.4	79.7	16.5	11.4	3.8	6.3	3.8	1.3	2.5	1.3

Source: own study.

In the summer term 2019/20, the primary form of tutorial was email contact, which was used very often or often according to 87.7% of all respondents. The next most popular one involved contact using synchronous tools (online platforms) at times indicated by the teacher, and contact via the university's e-learning platform (e.g. Moodle). These were used very often or often by 56.7% and 47.2% of the surveyed students, respectively. Telephone communication at times specified by the teacher and contact via social media were declared as very frequent or frequent by 5.4% and 1.8% of respondents, respectively.

In the winter term 2020/21, there were no notable changes in the ways in which students consulted their tutors. The only difference involved increased popularity of synchronous tools (online platforms) at times indicated by the teacher, which was used very often or often according to 76.9% of respondents, an increase of 20.2% on the previous term. Also noteworthy is the high frequency of use of telephone contacts at instructor-designated times by 2PT students, especially in comparison with 1FT students.

5. Conclusions and summary

The following are the key findings from the analysis of the changes to remote education arrangements at four Polish universities of economics in the second term of classes taught during the COVID-19 pandemic (the winter term 2020/21) as compared with the first one (the summer term of 2019/20).

1. The timeliness of teaching during the winter term 2020/21 considerably improved. Whereas only 41% of survey participants stated that more than 90% of teaching activities were carried out as scheduled before the pandemic in the summer term 2019/20, over 90% of surveyed students declared the same for the winter term 2020/21. More classes were held as scheduled for part-time students during the summer term 2019/20, and for full-time students during the winter term 2020/21. Despite significant progress, the timeliness of teaching at the surveyed universities has yet to return to pre-pandemic levels.

2. The universities used more synchronous teaching methods and tools during the winter term 2020/21 than they did during the summer term 2019/20, Zoom and MS Teams being the most popular communication platforms in both parts of the survey. The main synchronous teaching techniques used in both terms were lectures, group work, and in-class presentations. They were employed much more frequently in the winter term 2020/2021, as was open discussion. Synchronous tools were used more frequently in part-time programmes in the summer term 2019/20 than in full-time programmes in the winter term 2020/21. The gradual transition from asynchronous to synchronous teaching was the result of decisions made, the time required to implement organised solutions in synchronous teaching, and improved university staff preparation for the use of asynchronous tools in an emergency situation.
3. In the winter term 2020/21 relative to the summer term 2019/20, the universities surveyed used asynchronous teaching techniques less frequently as a result of the systematic implementation of synchronous distance learning standards. In the summer term 2019/20, asynchronous teaching methods most frequently involved uploading assignments by teachers/uploading completed projects by students, and online courses prepared using e-learning platforms. The variety of asynchronous teaching methods increased throughout the second term of crisis teaching deployment. Along with the methods used in the summer term 2019/2020, group assignments and quizzes were increasingly popular. In the summer term 2019/20, asynchronous teaching was used with a higher proportion of first-year than second-year students; as a result, the former were less likely to interact directly with academic staff.
4. Email contact was the predominant mode of remote tutorials in both periods studied, and full-time students relied on it more often than part-time students. The use of synchronous tools for this purpose expanded dramatically during the first year of the COVID-19 pandemic; there was, however, no discernible growth in the popularity of university e-learning systems for remote tutorials. Full-time students were more likely than part-time students to use email to contact their tutors in both terms.

Last but not least, the adjustments made to the process of education at the universities of economics surveyed in the winter term 2020/21 relative to the summer term 2019/20 show that these institutions succeeded in their efforts to adapt to crisis conditions. Synchronous teaching became the main model for remote and subsequently distance instruction, whereas asynchronous methods and tools complemented the basic model. However, email contact, which has remained the main form of remote tutorial, is not sufficient for this purpose and is being gradually superseded by synchronous techniques. Furthermore, throughout the first year of deployment, the variety of distance learning methods and instruments markedly increased, demonstrating a purposeful adaptation of academics and students to teaching and learning in a remote setting.

References

1. Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., Umek, L. (2020). Impacts of the COVID-19 Pandemic on Life of Higher Education Students: A Global Perspective. *Sustainability*, 12(20), 8438. <https://doi.org/10.3390/su12208438>.
2. Aucejo, E.M., French, J., Ugalde Araya, M.P., Zafar, B. (2020). The impact of COVID-19 on student experiences and expectations: Evidence from a survey. *Journal of Public Economics*, 191, 104271. <https://doi.org/10.1016/j.jpubeco.2020.104271>.
3. Bond, M., Bedenlier, S., Marín, V.I., Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online term. *International Journal of Educational Technology in Higher Education*, 18(1), 50. <https://doi.org/10.1186/s41239-021-00282-x>.
4. Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., Lambert, S.R., Al-Freih, M., Pete, J., Olcott, D. Jr, Rodes, V., Aranciaga, I., Bali, M., Alvarez, A.V., Roberts, J., Pazurek, A., Raffaghelli, J.E., Panagiotou, N., Coëtlogon, P.D., Paskevicius, M. (2020). *A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis*. <https://doi.org/10.5281/zenodo.3878572>.
5. Čelić, B., Dedeić, J. (2021). *Synchronous and asynchronous learning in online education*. XXVII Skup Trendovi Razvoja: On-Line Nastava Na Univerzitetima. Novi Sad, 15-18.
6. Centrum Efekty (2020). *Jak COVID-19 wpłynie na studia w roku akademickim 2020/21? Raport z badania opinii władz uczelni publicznych i niepublicznych*. Centrum Edukacji i Rozwoju EFEKTY.
7. Chahrour, M., Assi, S., Bejjani, M., Nasrallah, A.A., Salhab, H., Fares, M., Khachfe, H.H. (2020). A Bibliometric Analysis of COVID-19 Research Activity: A Call for Increased Output. *Cureus*, 12(3), e7357. <https://doi.org/10.7759/cureus.7357>.
8. Domagała-Zyśk, E. (Ed.) (2020). *Zdalne uczenie się i nauczanie a specjalne potrzeby edukacyjne: Z doświadczeń pandemii COVID-19*. Episteme.
9. EUA (2020a). *European higher education in the Covid-19 crisis*.
10. EUA (2020b). *Survey on "Digitally enhanced learning"- preliminary results, 19 June 2020*. www.eua.eu.
11. Gaebel, M., Kupriyanova, V., Morais, R., Colucci, E. (Eds.) (2014). *E-Learning in European Higher Education Institutions*.
12. Gaebel, M., Zhang, T. (2018). Learning and teaching in the European higher education area. Trends. *European University Association, Vol. 2018*. European University Association asbl.
13. Gaebel, M., Zhang, T., Stoebe, H., Morrisroe, A. (2021). *Digital Enhanced Learning and Teaching in European Higher Education Institutions*. European University Association.
14. Gewin, V. (2020). Five tips for moving teaching online as COVID-19 takes hold. *Nature*, 580(7802), 295-296. <https://doi.org/10.1038/d41586-020-00896-7>.

15. Grzybowska, A. (2020). *Różnorodność metod w nauczaniu zdalnym*. Centrum Edukacji Nauczycieli w Gdańsku, Jednostka samorządu województwa pomorskiego.
16. Hodges, C., Moore, S., Lockee, B., Trust, T., Bond, A. (2020). <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>.
17. IAU (2020). *Regional/National Perspectives on the Impact of COVID 19 on Higher Education*.
18. Kaźmierczak, P., Sworowska, A. (2021). Nauczanie języków skandynawskich w dobie pandemii – (konieczne) zmiany w programie nauczania, ich pozytywne i negatywne aspekty. *Kultura i Edukacja*, 133(3), 169-183. <https://doi.org/10.15804/kie.2021.03.09>.
19. Kolasińska-Morawska, K., Brzozowska, M. (2021). Czarny łabędź SARS-CoV-2 impulsem wirtualizacji procesów zarządczo-dydaktycznych uczelni w Polsce. *Media i Społeczeństwo*, 14, 38-54. <https://doi.org/10.53052/MiS.2021.14.03>.
20. Libasin, Z., Azudin, A.R., Idris, N.A., Abdul Rahman, M.S., Umar, N. (2021). Comparison of Students' Academic Performance in Mathematics Course with Synchronous and Asynchronous Online Learning Environments during COVID-19 Crisis. *International Journal of Academic Research in Progressive Education and Development*, 10(2). <https://doi.org/10.6007/IJARPED/v10-i2/10131>.
21. Mahmood, S. (2020). Instructional Strategies for Online Teaching in COVID - 19 Pandemic. *Human Behavior and Emerging Technologies*, 74(9), 1. <https://doi.org/10.1002/hbe2.218>.
22. MNiSW (2020). Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 11 marca 2020 r. w sprawie czasowego ograniczenia funkcjonowania niektórych podmiotów systemu szkolnictwa wyższego i nauki w związku z zapobieganiem, przeciwdziałaniem i zwalczaniem COVID-19, Dz.U. 2020, poz. 405.
23. Murphy, M.P.A. (2020). *COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy*, Vol. 41. <https://doi.org/10.1080/13523260.2020.1761749>.
24. Sito, P., Molga, A., Hermanowicz, A. (2018). E-learning – zalety i wady z punktu widzenia studenta. *Dydaktyka Informatyki*, 13, 105-112. <https://doi.org/10.15584/di.2018.13.13>.
25. Smalley, A. (2020). *Higher Education Responses to Coronavirus (COVID-19)*. National Conference Of State Legislatures. <https://www.ncsl.org/research/education/higher-education-responses-to-coronavirus-covid-19.aspx>.
26. Strielkowski, W. (2020). *COVID-19 Pandemic and the Digital Revolution in Academia and Higher Education*. <https://doi.org/10.20944/preprints202004.0290.v1>.
27. Topol, P. (2020). Metody i narzędzia kształcenia zdalnego w polskich uczelniach w czasie pandemii COVID-19 – Część 1, Dyskusja 2020. *Studia Edukacyjne*, 58, 69-83. <https://doi.org/10.14746/se.2020.58.4>.
28. WHO (2020). *Coronavirus disease 2019 (COVID 19) Situation Report 54*. World Health Organization.

29. Wierzbik-Strońska, M., Ostopolets, I. (Eds.) (2021). *Series of Monographs. Faculty of Architecture, Civil Engineering and Applied Arts. University of Technology, Katowice: Vol. 44. Role of science and education for sustainable development*. Publishing House of University of Technology.
30. Winiarczyk, A., Warzocha, T. (2021). *Edukacja zdalna w czasach pandemii COVID-19*. <https://doi.org/10.34862/fo.2021.1.4>.
31. Witkowski, Ł. (2011). *E-learning w praktyce: Materiały szkoleniowe dla uczestniczek i uczestników warsztatów*. Instytut Nauk Społeczno-Ekonomicznych.
32. Wójcik, J. (2022). *O skutecznym nauczaniu zdalnym*. <https://miesiecznik.forumakademickie.pl/czasopisma/fa-2-2022/o-skutecznym-%e2%80%a8nauczaniu-zdalnym%e2%80%a9/>.
33. Zbarachewicz, B. (2020). Uczelnie w czasie koronawirusa – problemy transformacji cyfrowej i postulaty na przyszłość. *Wiedza Obronna, Tom 272, Nr 3*. <https://doi.org/10.34752/vs7h-g944>.

THE RELATIONSHIP BETWEEN ENTREPRENEURIAL ORIENTATION AND ORGANIZATIONAL RESILIENCE IN THE DIGITAL CONTEXT

Anna KWIOTKOWSKA

Silesian University of Technology; akwiotkowska@polsl.pl, ORCID: 0000-0001-5204-1259

Purpose: Based on the theory of strategic entrepreneurship, the aim of this article is to identify the relationship between the dimensions of entrepreneurial orientation (innovativeness, proactiveness and risk-taking) and organizational resilience in the context of digital transformation of enterprises.

Design/methodology/approach: Due to the gap and considerable fragmentation of research in the existing literature on organizational resilience, particularly that on the whole combination of factors influencing it, in this study a set-theoretic analysis was performed using the fuzzy-set qualitative comparative analysis (fs/QCA). The fs/QCA was used to identify previously unknown combinations of entrepreneurial orientation dimensions and digital business capability dimensions that lead to high organizational resilience.

Findings: As indicated by the results of the conducted research, three different configurations are leading to high organizational resilience (digital-driven, digital and entrepreneurial orientation-driven, entrepreneurial orientation-driven). Moreover, it is impossible to create high organizational resilience driven by only one condition.

Research limitations/implications: The study was narrowed down to one selected strategic orientation hence future research can be extended to different levels and theoretical perspectives. To generalize the results and increase the level of universality, a larger research sample from multiple industries and regions can also be analyzed.

Practical implications: The study provides an important reference for companies to strengthen organizational resilience in the context of digital transformation. It pointed out that an entrepreneurial orientation can promote organizational resilience but requires managers to break the routine and focus on spreading the entrepreneurial spirit in the organization, creating a shared vision among individuals and improving employee creativity.

Originality/value: The paper explains the mechanism of the relationship between entrepreneurial orientation and organizational resilience from the perspective of digitization. The findings are relevant to the development of strategic entrepreneurship theory and provide implications for building the resilience of SMEs.

Keywords: entrepreneurial orientation, digital business capability, organizational resilience, digital transformation, fs/QCA.

Category of the paper: research paper.

1. Introduction

The COVID-19 pandemic has caused both supply and demand side shortages in many areas (Belhadi et al., 2021; Soluk et al., 2021), and numerous supply chain disruptions have significantly increased the risk of chain breakage capital for companies. This in turn presents companies with significant survival challenges (Hadjielias et al., 2022). Moreover, this situation is exacerbated by the emergence of a new generation of digital technologies, such as big data, artificial intelligence or mobile Internet, which on the one hand promote business innovation and improve efficiency (Ferreira et al., 2019; Martínez-Caro et al., 2020), and on the other hand, they have a destructive impact on the structure and operation of companies (Bresciani et al., 2021; Lee, Trimi, 2021). In this situation, organizational resilience was recognized as a key element in adapting and coping in such an uncertain, difficult and turbulent environment.

Strategic entrepreneurship and crisis management scholars have studied resilience for a long time and defined it from various perspectives. Due to the multidimensional and multilevel character of organizational resilience (Kantur 2012; Chewing et. al., 2013), its definition is controversial (Williams et al., 2017). However, an important aspect of resilience is that organizations adapt to strategic processes to find alternative solutions in the new reality (Khan et al., 2021). It is worth emphasizing that research on organizational resilience is fragmented and there is still widespread agreement that its development, especially with regard to empirical research, lags behind (Malik, Garg, 2020; Williams et al., 2017). Thus, the black box of shaping organizational resilience still needs to be explored.

Entrepreneurial orientation is a well-established construct in management science with a rich body of research. Some scholars point to its impact on high performance by providing access to lucrative new opportunities or gaining first-mover advantage (e.g. Covin et al., 2006), while others point to its negative impact on performance due to, for example, misuse of resources and execution of projects with excessive risk (Hult et al., 2003). According to strategic entrepreneurship theory, entrepreneurial orientation can create competitive advantage by locking in resources and building dynamic capabilities. Organizational resilience, on the other hand, as an inherent part of an organization, depends on the resources and capabilities of the firm. Moreover, within the functioning of companies, there are differences in the intensity of competition due to, for example, technology and the business model, which results in different difficulties in acquiring resources. All of this raises the following question: is organizational resilience related to entrepreneurial orientation, especially in relation to the current complex market situation?

Therefore, this study attempts to examine the impact of entrepreneurial orientation on organizational resilience in a complex digital transformation environment. In the digital age, traditional models of entrepreneurship face many new challenges. If digital opportunities are not used to achieve digital transformation, the likelihood of failure increases dramatically.

Currently, there is little research in the literature on entrepreneurial orientation in conjunction with the mechanisms of digitalization affecting organizational resilience. This paper describes the dimension variables in detail and identifies configurations leading to high organizational resilience through the use of fuzzy-set qualitative fuzzy comparative analysis (fs/QCA). The study was conducted among thirty-six manufacturing SMEs. The following research question was posed: What are the possible combinations of factors (dimensions of entrepreneurial orientation: innovativeness, proactiveness, and risk-taking, and dimensions of digital business capability including digital strategy, digital integration and digital control) that generate high organizational resilience?

This study offers several contributions to the literature. This study investigated the impact of entrepreneurial orientation on organizational resilience in a digital context, something not found in previous literature. Firstly, a framework was proposed to understand the configuration of the dimensions of entrepreneurial orientation and digital business capability leading to high organizational resilience. It was found that entrepreneurial orientation can promote organizational resilience, the creation of which is a process that requires the integration of resources and capacity building, inducing a spirit of innovation, learning, entrepreneurial alertness and sensitivity to opportunity. Entrepreneurial orientation prompts managers to explore resources and build networks that can improve digital business capability. This research has confirmed that digital business capability plays an important role in maintaining organizational resilience. Digitization is breaking the boundaries of companies and has helped them gain more opportunities to search for resources and may even determine the survival of companies. Secondly, the study reveals many equifinal configurations to high organizational resilience rather than one best solution offered in most of the literature research to date. The study helps to better understand the interdependence of causal conditions in established relationships with the test result.

The study is structured as follows: a theoretical framework that addresses organizational resilience, dimensions of entrepreneurial orientation and dimensions of digital business capability and the interactions of these concepts, the presentation of the method and results, and finally the discussions and conclusions.

2. Literature review

Resilience is a multidimensional and multidisciplinary concept used in psychology, ecology and engineering, which is gaining more and more importance in research conducted around business management (Duchek, 2020), especially in relation to crisis management or unstable changes (Dahles, Susilowati, 2015). As indicated in the literature, organizational resilience enables appropriate adaptation in crisis environments in order to survive, rebuild, develop

(Dahles, Susilowati, 2015; Torres et al., 2019) and achieve a competitive advantage. There is still a gap in the literature regarding a universally accepted definition of resilience. Some researchers draw attention to the capacity of resilience to renew and return to its original state (Freeman et al., 2003), others to adapt to change (Weick et al., 1999), or even to bounce back and transform challenges into opportunities and improve performance (Lengnick-Hall, Beck, 2003). In a systematic review of the literature on resilience, Linnenluecke (2017) defines organizational resilience as an attribute of responding to external threats through the use of internal resources. On the other hand, Ates and Bititci (2011), point to organizational resilience as the ability to predict key opportunities resulting from emerging trends and to maintain stability in a turbulent environment. This study uses the following definition of organizational resilience as the ability of companies to withstand discontinuous crises and respond to normal risk (Branicki et al., 2018).

Discontinuous crises are sudden and unexpected events spread over time and space, such as the COVID-19 pandemic, for example, which can be helped by strong resilience to overcome. Entrepreneurial orientation, on the other hand, is a strong motivation in running a business and is a key factor in resilience. It helps companies to better understand changes caused by sudden shocks, analyze their surroundings and develop appropriate countermeasures. Based on extensive literature in this area, it has been assumed that entrepreneurial orientation is the tendency to engage in innovation, and take risky ventures through proactive behavior, thus beating the competition (e.g. Vaznyte, Andries, 2019). Moreover, as shown by numerous studies, entrepreneurial orientation can increase the scope of connections with stakeholders and support the acquisition of diverse knowledge (Santoro et al., 2020). In turn, risk-taking is associated with bold decisions that the company takes to obtain specific benefits while being aware of potential losses. In this regard, risk-taking has a strong relationship with improvisation and bricolage behavior (Moenkemeyer et al., 2012). Entrepreneurial orientation may also stimulate the tendency to accumulate experiences in coping with failures and take more adequate measures in the face of the coming crisis (Williams et al., 2017). It should also be noted that companies are always exposed to normal risks in the course of their functioning in the market. Overcoming their innate rigidity, firms with a high entrepreneurial orientation are more likely to pursue risky ventures, seeking to innovate and build competitive advantage. As Zahra and Covin (1995) point out, a strong will to get ahead encourages firms to gain a first mover advantage, which significantly increases the flexibility of their operations. A manifestation of entrepreneurial orientation is also the implementation of a strategy aimed at catching early warning signs of market changes (Lee et al., 2013), for firms with few resources this is an effective way to explore new opportunities.

In the face of the digital economy, the importance of digital opportunities owned by companies is growing. Digitization, as indicated by Proksch et al., 2021 is the use of technology and digital infrastructure, widely in the economy, business and society. A digital business capability, the conceptual basis of which is provided by a resource-based view, is a dynamic

capability enhanced by a digital application. According to this well-established view, companies have resource configurations that lead to performance differences (Barney, 1991) and translate into capabilities. Dynamic capabilities allow companies to better adapt to the environment and achieve excellent results (Teece et al., 1997). Hence, according to Yeow, Soh, Hansen (2017) or Nasiri, Saunila, Ukko, Rantala, and Rantanen (2020) dynamic capabilities provide a strong means of testing the degree of digitization of companies. A digital business capability is manifested in the driving force of digitization in business processes, digital strategy, integration and digital control. The digital strategy focuses on creating value and business practices in digital transformation. In turn, digital integration leads to growth and value creation thanks to the coordination of organizational tensions arising from the misallocation of resources (Helfat, Raubitschek, 2018). Digital control by analyzing the return, costs and resources related to digitization supports the capture of new value and transformation of the digital strategy by adapting to and capturing the opportunities as well as the elimination of emerging threats (Wielgos et al., 2021).

Companies characterized by a high entrepreneurial orientation can use information from the network to make decisions for the integration of digital resources. Through such a strategy, companies develop their resource management capability, conduct digital learning and complement each other within digital technologies (Ravasi, Turati, 2005). Due to the entrepreneurial orientation, innovation drives companies towards introducing digital management mechanisms that support the linking of the innovation chain with digital technology. On the other hand, risk-taking leads to new challenges and added value, while being proactive allows the use of a variety of digital technologies and actively fits into the digital age. It also contributes to solving problems, especially those relating to resource constraints and market competition through digital transformation. Importantly, the success of innovation depends largely on the acquisition of knowledge (Zhou, Li, 2012). Digital business abilities, on the other hand, make it easier for enterprises to coordinate with partners, suppliers and customers, which greatly facilitate the acquisition of the desired technological knowledge (Helfat, Raubitschek, 2018). Digital integration can have a significant impact not only on the reconfiguration of free resources but also on the management of the learning mechanism and the creation of business value thanks to new knowledge (Easterby-Smith, Prieto, 2008). Digital Audit monitors the use of digitization and assesses the progress of digital business transformation to reduce potential risks. Importantly, digital business capability helps companies adapt to the adequate technology and lack of digital knowledge of stakeholders (Martinez-Conesa et al., 2017).

In summary, previous research indicates the relationship between entrepreneurial orientation and digital business capability. However, there is little research to support how entrepreneurial orientation and digital business capability interact with each other leading to the creation of high organizational resilience. Therefore, this study explores how entrepreneurial orientation and digital business capability work together in terms of

organizational resilience from a holistic perspective based on the configuration theory. The conceptual model is shown in Figure 1.

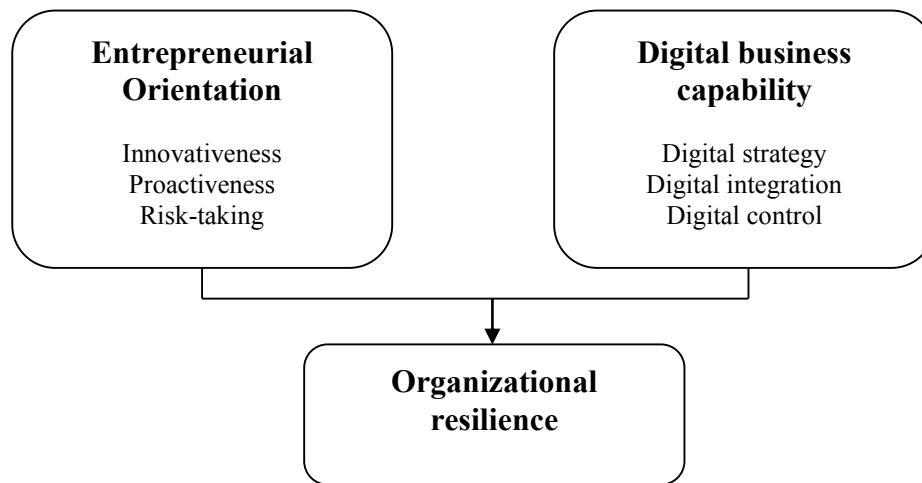


Figure 1. The research framework.

Source: own study.

3. Data and method

This study uses fs/QCA, a configuration approach based on set theory and fuzzy algebra (Ragin, 2008). The fs/QCA approach examines how the interaction between variables affects the outcome under study. This method is suitable for examining the combined effects of multiple preceding variables to obtain the same outcome (Rihoux, Ragin, 2008; Kwiotkowska, 2018). In fs/QCA, both necessary and sufficient conditional relationships can be identified. In this study, the fs/QCA method was used to investigate the complex causal mechanisms between entrepreneurial orientation and digital business capability and organizational resilience. In fs/QCA, configuration theory is used to perform a comparative analysis between cases, in addition, the method provides an exploration of which conditional configuration elements produce the expected outcome (in this study, high organizational resilience). It should be emphasized that the fs/QCA method combines the advantages of qualitative and quantitative research, thanks to which it not only solves the problem of generalization inherent in the qualitative analysis of several cases but to some extent compensates for the lack of qualitative changes and analysis of phenomena inherent in purely quantitative analysis on large research samples.

The data was collected through a survey from a list of 167 manufacturing, small and medium-sized (SMEs) Polish companies, 36 of which completed the survey. Industry sectors included: manufacture of computers, electronic and optical products: 28.1%, furniture

manufacturing: 20.2%, manufacture of motor vehicles, trailers and semi-trailers: 16.3%, manufacture of electrical equipment: 35.4%. Participants in the study were members of top management, including CEOs (46%) digital executives (28%) and manufacturing directors (26%) in manufacturing SMEs. The survey was conducted from March 2022 to June 2022. In line with previous studies (e.g. Krishnan, Scullion, 2017), SMEs were defined as companies with fewer than 250 employees. The sample was obtained by emailing, and calling business owners and asking them to participate in a survey. After making sure that the respondent is the appropriate representative of the company and indicating the company-level variables (company age, company size, industry), the respondent answered the questions regarding the appropriate variables shown in random order. Finally, certain personal details (e.g. gender, age) were requested after the anonymity of the response.

A five-point Likert scale was used for all scale items ranging from 1 (strongly disagree) to 5 (strongly agree). The individual reliability of each construct was greater than the minimum acceptable Cronbach's α of 0.7, indicating high reliability (Nunally, Bernstein 1994). The research assumes that organizational resilience not only copes with the shock of a discontinuous crisis and enables recovery from it, but also has the capacity to adapt to normal risks. Five elements were used to measure organizational resilience based on Marcucci et al. (2021) i.e.: financial liquidity, project portfolio and brand image, risk management, organizational solutions that enable social relationships (e.g., collaborative teamwork, creative problem solving, and soft skills development), and information sharing by supply chain partners.

The scale developed by Wielgos et al. (2021) was used to explore digital business capability within three complementary dimensions: digital strategy, digital integration and digital control. Each of the three dimensions contains a set of indicators. The digital strategy includes three elements such as "Our digital strategy opens up completely new opportunities to create value for our customers". The digital integration consists of five elements, for example: "Our company is increasingly digitally connected with customers, suppliers and partners". The digital control includes three elements, one of which is "Our company has concrete specifications for the implementation of digital business transformation".

Entrepreneurial orientation was measured using items based on several previous studies in this area (e.g. Hughes, Moragna, 2007; Covin, Wales, 2019; Kwiotkowska, Gębczyńska, 2019; Bauweraerts et al., 2021). Innovativeness, proactiveness and risk-taking, each of these three dimensions were measured by three items, for example innovativeness: "We actively introduce improvements and innovations in our business", proactiveness: "We always try to take the initiative in every situation (e.g. against competitors, in projects when working with others) and risk-taking: "People in our business are encouraged to take calculated risks with new ideas".

4. Results

In fs/QCA, it is important to check if any single condition is necessary for organizational resilience before carrying out a proper analysis. In a necessity analysis, a causal condition is considered necessary for an outcome if the consistency score exceeds 0.90 (Ragin, 2008). The fs/QCA 3.0 software was used in this study. Table 1 shows the results of this analysis. For high organizational resilience, the consistency coefficients for all conditions were below 0.9, which indicates that no single condition is necessary for organizational resilience (Ragin, 2008; Schneider, Wagemann, 2012).

Table 1.

Necessity test of single conditions using the QCA method

Condition	High organizational resilience	
	Consistency	Coverage
Innovativeness	0.6706	0.5871
~Innovativeness	0.6316	0.6633
Proactiveness	0.6608	0.5707
~ Proactiveness	0.6339	0.6841
Risk-taking	0.6649	0.5566
~ Risk-taking	0.6035	0.6716
Digital strategy	0.6757	0.6479
~Digital strategy	0.6339	0.6401
Digital integration	0.6324	0.5455
~Digital integration	0.6211	0.6159
Digital control	0.6235	0.6713
~Digital control	0.6801	0.7085

Note. ~ logical negation - the absence of conditions. Source: own study.

In the case of fuzzy set variables, it is necessary to apply theoretical and contextual knowledge to determine the most appropriate thresholds for full membership and non-membership in defined sets (Douglas et al., 2020; Kwiotkowska, 2022). In this study, a direct calibration method was used to calibrate the relevant antecedent conditions and outcomes as fuzzy membership outcomes. The data was calibrated by setting the fully-in and fully-out cut-off points to be \pm one standard deviation from the mean value. For all conditions and the outcome, the cut-off point was set to the mean for each variable. The results are shown in Table 2. The reason we used this approach is that the average reflects the average level of firms and the standard deviation reflects the variation between firms.

Table 2.
Variable calibration

Antecedent and outcome	Full membership	Cross-over point	Full non-membership
Innovativeness	4.868	3.852	2.836
Proactiveness	4.838	3.817	2.789
Risk-taking	4.845	3.852	2.847
Digital strategy	4.628	3.789	2.947
Digital integration	4.764	3.741	2.717
Digital control	4.736	3.764	2.791
Organizational resilience	4.766	3.805	2.845

Source: own study.

In the next step, a truth table was created consisting of 2^k lines (“k” is the number of conditions), where each line represents a possible configuration of conditions. In the qualitative comparative analysis process, it is suggested to set a benchmark for consistency 0.75 and above (e.g. Covin et al. 2016). This study established 0.9 as the consistency threshold and 2 as the number of allowed cases. The results are shown in Table 3.

Table 3.
Configurations of high organizational resilience

Causal condition	High organizational resilience		
	C1	C2	C3
Innovativeness (IN)			●
Proactiveness (PR)	●	●	●
Risk-taking (RT)	⊖	●	⊖
Digital strategy (DS)	●	●	
Digital integration (DI)	●	●	●
Digital control (DC)	●		●
Raw coverage	0.19	0.15	0.18
Unique coverage	0.06	0.03	0.10
Consistency	0.92	0.95	0.93
Overall solution coverage	0.57		
Overall solution consistency	0.91		

Note. ● – core causal conditions (present); ● - peripheral casual condition (present); ⊖ - core causal condition (absent); ⊖ - peripheral casual condition (absent); blank spaces indicate “do not care”.

Source: own study.

In this study, three configurations achieved high organizational resilience. In line with the group naming process (Furnari et al., 2020), the first configuration (C1) was named as a digital-driven group, the second configuration (C2) as being driven by digital and entrepreneurial orientation, the third (C3) as entrepreneurial orientation-driven. A detailed explanation of these three configurations follows.

In table 3, a total of three, first-order configurations are shown, which are adequate for achieving high organizational resilience because they had high consistency and coverage (0.91, 0.57). From the above table, it is clear that there were three configurations to achieving high organizational resilience.

The first configuration (C1) is digital-driven: **DC * DI * DS * ~RT * P**. The core conditions in this configuration, the presence of digital control together with digital integration emphasize the strong links with digital and indicate that digital transformation is an important factor of high organizational resilience. In turn, in the case of the third configuration (C3), dominated by entrepreneurial orientation: **IN * PR * ~RT * DI * DC**, empirical research has shown that entrepreneurial orientation can promote organizational resilience, while the combination of innovativeness and proactiveness leads to high organizational resilience, especially when risk-taking is absent. The coverage is 0.1, which is much higher than the other two types, indicating good versatility of this solution. The last configuration, configuration two (C2) driven by digital and entrepreneurial orientation: **PR * RT * DS * DI**, indicates that different combinations of the dimensions of entrepreneurial orientation and the dimensions of digital business capability can also lead to high organizational resilience. This configuration shows that the combination of proactiveness and digital strategy as core conditions with risk-taking and digital integration as peripheral conditions can result in high organizational resilience.

After the study, to ensure the robustness of the findings, the case frequency thresholds were adjusted from two to three and four and we re-examined the grouping of entrepreneurial orientation and digital business capability with high organizational resilience. The results showed no significant changes in the obtained results. Successively, the consistency threshold was lowered to 0.8, which, however, did not affect the still three supported configurations. Overall, the change in parameters did not result in significant differences in the number, composition, consistency and coverage of the configurations, and the results can be considered robust.

5. Discussion and contributions

This study looked at the impact of entrepreneurial orientation on organizational resilience in a digital context, which has not been found in the previous literature and is an attempt to fill the empirical research gap in this area (Duchek, 2020; Linnenluecke, 2017). A research framework was constructed based on the strategic entrepreneurship theory and it was shown that an entrepreneurial orientation, as well as digital business capability, leads to high organizational resilience. The research used fs/QCA to show how equifinal configurations of entrepreneurial orientation dimensions and digital business capability dimensions are related to high organizational resilience. As research shows, neither the dimensions of entrepreneurial orientation: innovativeness, proactiveness and risk-taking nor the dimensions of digital business capability: digital strategy, digital integration and digital control alone create the necessary conditions for high organizational resilience. The results show that high organizational resilience can be achieved with different combinations of entrepreneurial orientation

dimensions and digital business capability dimensions. Three configurations with high organizational resilience have been identified: digital-driven (C1), digital and entrepreneurial orientation-driven (C2) and entrepreneurial orientation-driven (C3).

As observed in the study, there is some substitution between entrepreneurial orientation and digital business capability in two configurations leading to a high level of organizational resilience (configurations C1 and C3). These alternative solutions indicate that under certain conditions a high level of resistance can be achieved by different pathways which, however, lead simultaneously to the same outcome. These results also confirm previous reports that entrepreneurial orientation is manifested in the development of a strategy focused on early warning signals about environmental changes (Lee et al., 2013). On the other hand, in the context of digitization, the best way is to combine digitization with the knowledge, behavior and business of companies (Ye et al., 2022), which requires shaping the capability to apply, integrate and control digital technology and combine digitization with business (Wielgos et al., 2021). Moreover, as indicated by the results of the conducted research, there is also a concurrent solution driven by both proactiveness and digital strategy (C2 configuration), which also leading to high organizational resilience. This, in turn, confirms previous reports that companies with a high entrepreneurial orientation are more conducive to promoting the development of digital business capability (Ritala et al., 2021).

These results significantly expand the scope of research conducted so far, confirming the agreement that it is necessary to extend research around organizational resilience (e.g. Williams et al., 2017; Malik, Garg, 2020). The conducted analyzes show that organizational resilience is determined by the interaction between both entrepreneurial orientation and digital business capability, rather than by any single condition. In this regard, this study overcomes some of the limitations of previous research on entrepreneurial orientation and digitalization and their impact on organizational resilience (e.g. Zhang et al., 2021).

The study used fs/QCA, thanks to which it was possible to overcome the difficulties of classical research methods, as well as to show the conditional relationship within configurations leading to a high level of organizational resilience. This method widens the choice of test methods and provides a new approach to testing small and medium-sized samples for organizational resilience.

This study provides an important reference for enterprises to improve their organizational resilience in the context of digital transformation. Both entrepreneurial orientation and digital business capability have been found to promote organizational resilience. With the increase in the complexity of the environment, the tougher competition, acceleration of technological changes, organizational resilience becomes more and more important, in deciding about the survival of the enterprise. Developing resilience requires an appropriate resource base, building strong networks and actively engaging in learning from experience. Enterprises should encourage employees to cultivate an entrepreneurial orientation. Managers should break the routine, focus on a culture that is appropriate for the organization, and spread the spirit of

entrepreneurship so that it is possible to quickly adapt to changes in the environment and face any difficulties. They should make every effort to create a shared vision between individuals and improve the creativity of employees. Moreover, companies should actively introduce digital technologies. For example, Big Data can be used to make more accurate decisions and improve supply chain integration (Wielgos et al., 2021). A variety of digital supply chain technologies enable the realization of intelligent deliveries, full visualization and efficient flows. Cloud computing powers online and offline integration, mobile payments and digital marketing. Managers need to adapt their skills and remain positive about emerging technologies. They should also use digital technology in their organizational processes and value chain, and develop digital business capability in a continuous learning process. Entrepreneurs must be aware that a complex environment is an objective phenomenon that requires continuous improvement of skills, resource finding, knowledge and improvisation to cope with any difficulties and survive.

As with other studies, this one has some limitations that may form the basis of future analysis. The research focused only on the impact of selected orientations and abilities on organizational resilience. Meanwhile, it is possible to study the impact of decision-making logic, and other strategic orientations, such as market orientation or other variables, leading to a wider understanding of organizational resilience in the future. Likewise, the digital business capability is only one aspect of the dynamic capability of firms in the digital context. In the future, therefore, other digital options such as the degree of digital transformation and big data analytics can be explored. The analysis was carried out on a small research sample of Polish manufacturing SMEs. To deepen the research and generalize the results, it is possible to enlarge the research sample with a larger number of entities from various industries and regions.

References

1. Ates, A., Bititci, U.S. (2011). Change process: a key enabler to building resilient SMEs. *International Journal of Production Research*, 49(18), 5601-5618.
2. Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
3. Bauweraerts, J., Pongelli, C., Sciascia, S., Mazzola, P., Minichilli, A. (2021). Transforming entrepreneurial orientation into performance in family SMEs: are nonfamily CEOs better than family CEOs? *Journal of small business management*, 1-32.
4. Belhadi, A., Kamble, S., Jabbour, C.J.C., Gunasekaran, A., Ndubisi, N.O., Venkatesh, M. (2021). Manufacturing and service supply chain resilience to the COVID-19 outbreak: lessons learned from the automobile and airline industries. *Technological Forecasting and Social Change*, 163(2), 120447.

5. Branicki, L.J., Sullivan-Taylor, B., Livschitz, S.R. (2018). How entrepreneurial resilience generates resilient SMEs. *International Journal of Entrepreneurial Behaviour and Research*, 24(7), 1244-1263.
6. Bresciani, S., Huarng, K.H., Malhotra, A., Ferraris, A. (2021). Digital transformation as a springboard for product, process and business model innovation. *Journal of Business Research*, 128(1), 204-210.
7. Chewning, L.V., Lai, C.H., Doerfel, M.L. (2013). Organizational resilience and using information and communication technologies to rebuild communication structures. *Management Communication Quarterly*, 27, 237-263.
8. Covin, J.G., Wales, W.J. (2019). Crafting high-impact entrepreneurial orientation research: some suggested guidelines. *Entrepreneurship Theory and Practice*, 43(1), 3-18.
9. Covin, J.G., Eggers, F., Kraus, S., Cheng, C.-F., Chang, M.-L. (2016). Marketing-related resources and radical innovativeness in family and non-family firms: a configurational approach. *Journal of Business Research*, 69(12), 5620-5627.
10. Covin, J.G., Green, K.M., Slevin, D.P. (2006). Strategic process effects on the entrepreneurial orientation–sales growth rate relationship. *Entrepreneurship Theory and Practice*, 30(1), 57-81.
11. Dahles, H., Susilowati, T.P. (2015). Business resilience in times of growth and crisis. *Annals of Tourism Research*, 51, 34-50.
12. Douglas, E.J., Shepherd, D.A., Prentice, C. (2020). Using fuzzy-set qualitative comparative analysis for a finer-grained understanding of entrepreneurship. *Journal of Business Venturing*, 35(1), 105970.
13. Duchek, S. (2020). Organizational resilience: A capability-based conceptualization. *Business Research*, 13, 215-246.
14. Easterby-Smith, M., Prieto, I.M. (2008). Dynamic capabilities and knowledge management: an integrative role for learning? *British Journal of Management*, 19(3), 235-249.
15. Ferreira, J.M., Fernandes, C.I., Ferreira, F.A.F. (2019). To be or not to be digital, that is the question: Firm innovation and performance. *Journal of Business Research*, 101(8), 583-590.
16. Freeman, S.F., Hirschhorn, L., Triad, M.H. (2003). *Moral purpose and organizational resilience: Sandler O'Neill & Partners*. Proceedings of the Academy of Management, Briarcliff Manor, NY, USA, 1-6 August.
17. Furnari, S., Crilly, D., Misangyi, V.F., Greckhamer, T., Fiss, P.C., Aguilera, R. (2020). Capturing causal complexity: Heuristics for configurational theorizing. *Academy Management Review*, 46, 778-799.
18. Hadjielias, E., Christofi, M., Tarba, S. (2022). Contextualizing small business resilience during the COVID-19 pandemic: evidence from small business owner-managers. *Small Business Economics*, 1-30.

19. Helfat, C.E., Raubitschek, R.S. (2018). Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems. *Research Policy*, 47(8), 1391-1399.
20. Hughes, M., Morgan, R.E. (2007). Deconstructing the relationship between entrepreneurial orientation and business performance at the embryonic stage of firm growth. *Industrial Marketing Management*, 36(5), 651-661.
21. Hult, G.T.M., Snow, C.C., Kandemir, D. (2003). The role of entrepreneurship in building cultural competitiveness in different organizational types. *Journal of Management*, 29(3), 401-426.
22. Kantur, D., Iseri-Say, A. (2012). Organizational resilience: A conceptual integrative framework. *Journal of Management Organization*, 18, 762-773.
23. Khan, A., Khan, N., Shafiq, M. (2021). The Economic Impact of COVID-19 from a Global Perspective. *Contemporary Economics*, 15, 64-76.
24. Krishnan, T.N., Scullion, H. (2017). Talent management and dynamic view of talent in small and medium enterprises. *Human Resource Management Review*, 27(3), 431-441.
25. Kwiotkowska, A. (2018). Barriers to the development of spin-offs. A fuzzy-set-theoretic approach. *Operations Research and Decisions*, 28(4), 31-46.
26. Kwiotkowska, A. (2022). Organizational capabilities and social entrepreneurship: a fuzzy-set approach. *European Research Studies Journal*, 25(1), 272-285.
27. Kwiotkowska, A., Gębczyńska, M. (2019). Configurations of entrepreneurial, technological, and market orientations and new ventures performance. *Humanities and Social Sciences Reviews*, 7(4), 1218-1223.
28. Lee, A.V., Vargo, J., Seville, E. (2013). Developing a tool to measure and compare organizations' resilience. *Natural Hazards Review*, 14(1), 29-41.
29. Lee, S.M., Trimi, S. (2021). Convergence innovation in the digital age and in the COVID-19 pandemic crisis. *Journal of Business Research*, 123(2), 14-22.
30. Lengnick-Hall, C.A., Beck, T.E. (2003). *Beyond Bouncing Back: The Concept of Organizational Resilience*. Proceedings of the National Academy of Management Meetings, Seattle, WA, USA.
31. Linnenluecke, M.K. (2017). Resilience in business and management research: a review of influential publications and a research agenda. *International Journal of Management Reviews*, 19(1), 4-30.
32. Malik, P., Garg, P. (2020). Learning organization and work engagement: the mediating role of employee resilience. *International Journal of Human Resource Management*, 31(8), 1071-1094.
33. Marcucci, G., Antomarioni, S., Ciarapica, F.E., Bevilacqua, M. (2021). The impact of operations and IT-related industry 4.0 key technologies on organizational resilience. *Production Planning and Control*, 1-15.

34. Martínez-Caro, E., Cegarra-Navarro, J.G., Alfonso-Ruiz, F.J. (2020). Digital technologies and firm performance: The role of digital organizational culture. *Technological Forecasting and Social Change*, 154, Article 119962.
35. Martinez-Conesa, I., Soto-Acosta, P., Carayannis, E.G. (2017). On the path towards open innovation: assessing the role of knowledge management capability and environmental dynamism in SMEs. *Journal of Knowledge Management*, 21(3), 553-570.
36. Moenkemeyer, G., Hoegl, M., Weiss, M. (2012). Innovator resilience potential: a process perspective of individual resilience as influenced by innovation project termination. *Human Relations*, 65(5), 627-655.
37. Nasiri, M., Saunila, M., Ukko, J., Rantala, T., Rantanen, H. (2020). Shaping digital innovation via digital related capabilities. *Information Systems Frontiers*, 1-18.
38. Nunally, J.C., Bernstein, I.H. (1994). *Psychological theory*. New York: McGraw-Hill.
39. Proksch, D., Rosin, A.F., Stubner, S., Pinkwart, A. (2021). The influence of a digital strategy on the digitalization of new ventures: the mediating effect of digital capabilities and a digital culture. *Journal of Small Business Management*, 1-29.
40. Ragin, C.C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*. Chicago: University of Chicago Press.
41. Ravasi, D., Turati, C. (2005). Exploring entrepreneurial learning: a comparative study of technology development projects. *Journal of Business Venturing*, 20(1), 137-164.
42. Rihoux, B., Ragin, C.C. (2008). *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*. Sage Publications: Thousand Oaks, CA, USA.
43. Ritala, P., Baiyere, A., Hughes, M., Kraus, S. (2021), Digital strategy implementation: the role of individual entrepreneurial orientation and relational capital. *Technological Forecasting and Social Change*, 171(10), 120961.
44. Santoro, G., Bertoldi, B., Giachino, C., Candelo, E. (2020). Exploring the relationship between entrepreneurial resilience and success: the moderating role of stakeholders' engagement. *Journal of Business Research*, 119(14), 142-150.
45. Schneider, C.Q., Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis*. Cambridge University Press.
46. Soluk, J., Kammerlander, N., Massis, A.D. (2021). Exogenous shocks and the adaptive capacity of family firms: exploring behavioral changes and digital technologies in the COVID-19 pandemic. *R&D Management*, 51(4), 364-380.
47. Teece, D.J., Pisano, G.P., Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
48. Torres, A.P., Marshall, M.I., Sydnor, S. (2019). Does social capital pay off? The case of small business resilience after hurricane Katrina. *Journal Contingencies and Crisis Management*, 27, 168-181.

49. Vaznyte, E., Andries, P. (2019). Entrepreneurial orientation and start-ups' external financing. *Journal of Business Venturing*, 34(3), 439-458.
50. Weick, K.E., Sutcliffe, K.M., Obstfeld, D. (1999). Organizing for high reliability: Processes of collective mindfulness. *Research in Organizational Behavior*, 21, 13-81.
51. Wielgos, D.M., Homburg, C., Kuehnl, C. (2021). Digital business capability: its impact on firm and customer performance. *Journal of the Academy of Marketing Science*, 49(4), 762-789.
52. Williams, T.A., Gruber, D.A., Sutcliffe, K.M., Shepherd, D.A., Zhao, E.Y. (2017). Organizational response to adversity: Fusing crisis management and resilience research streams. *Academy of Management Annals*, 11, 733-769.
53. Ye, D., Liu, M.J., Luo, J., Yannopoulou, N. (2022), How to achieve swift resilience: the role of digital innovation enabled mindfulness. *Information Systems Frontiers*.
54. Yeow, A., Soh, C., Hansen, R. (2017). Aligning with new digital strategy: a dynamic capabilities approach. *Journal of Strategic Information Systems*, 27(1), 43-58.
55. Zahra, S.A., Covin, J.G. (1995). Contextual influences on the corporate entrepreneurship performance relationship: a longitudinal analysis. *Journal of Business Venturing*, 10(1), 43-58.
56. Zhang, J., Long, J., von Schaewen, A.M.E. (2021). How Does Digital Transformation Improve Organizational Resilience? —Findings from PLS-SEM and fsQCA. *Sustainability*, 13, 11487.
57. Zhou, K.Z., Li, C.B. (2012). How knowledge affects radical innovation: knowledge base, market knowledge acquisition, and internal knowledge sharing. *Strategic Management Journal*, 33(9), 1090-1102.

ASSESSING THE EFFECTIVENESS OF THE IMPLICATIONS OF SELECTED SOCIAL POLICY INSTRUMENTS IN THE MANAGEMENT OF THE ELECTROMOBILITY DEVELOPMENT PROCESS IN POLAND

Wojciech LEWICKI

Department of Regional and European Studies, Faculty of Economics, West Pomeranian University of Technology in Szczecin; Wojciech.Lewicki@zut.edu.pl, ORCID: 0000-0002-8959-8410

Purpose: The aim of the article is to try to answer the question which of the social policy instruments can convince the society to adopt transport solutions based on the concept of electromobility to the greatest extent.

Design/methodology/approach: The considerations are social research, a research experiment in the form of a method (CAWI) was used, which was used to verify the role of selected instruments in the process of the announced transformation of social mobility. In the research area, the focus was on the assessment of possible changes in shopping preferences and transport mobility in terms of selected social policy instruments. Economic, legal and informational instruments were analysed.

Findings: The author indicates that the process of managing the development of electromobility should be implemented with the help of properly selected social policy instruments and go hand in hand with the changes taking place within an increasingly aware society.

Research limitations/implications: The presented survey research was carried out on a specific research sample of approximately 1,000 respondents. Certainly, in the near future there will be a need for much broader analyzes and research, in particular with regard to changes in the income of citizens, planned reforms of social programs and projected increases in the prices of energy resources.

Practical implications: The research results are the first approach to indicate to the government administration which social policy tools have the greatest impact on the process of managing the development of electromobility in Poland.

Social implications: Research shows that there are links between economic, social and environmental issues in the management of the electromobility development process in Poland.

Originality/value: The experimental research approach may be helpful in assessing the effectiveness of the implications of selected social policy instruments in the management of the electromobility development process in Poland.

Keywords: management, instruments, social policy, electromobility, development, market research.

Category of the paper: Research paper.

1. Introduction

As the available literature indicates, the key impulse for the development of electromobility was the document adopted by the European Commission called the European Economic Recovery Plan. The basic assumption of the project was to redefine pan-European standards in the field of social mobility, as well as to create the basis for the use of electric vehicles and the infrastructure supporting them in practice within 12 selected European countries. Although Poland was not among this group, the conclusions of the summary report were optimistic and prompted the Polish authorities to treat the topic of electromobility as the transport of the future seriously (Tucki et al., 2019). The idea of developing electromobility was included in February 2017 in the so-called Strategy for Responsible Development (Drożdż, 2019). However, the government's comprehensive strategy in this area was included in the Electromobility Development Program adopted a month later (Electromobility, 2017).

In most cases, electromobility is associated with reducing noise and CO₂ emissions into the atmosphere, and thus improving the living conditions and health of the society (Chudy, Mazurek, 2019; Shi et al., 2019; Hajian, Kashani, 2021). Considering that in the available literature, social policy is defined as the purposeful activity of the state, local government entities, trade unions and other organizations, aimed at improving the general working and living conditions of wide strata of the population, as well as socio-cultural relations that lead to the optimal satisfaction of social and individual populations (Auleytner, 2012; Firlit-Fesnak, Szytko-Skoczny, 2017; Kurzynowski, 2011). Observations of the market reality indicate that the discussion on electromobility omit aspects related to the role of social policy instruments in the process of transformation of current transport preferences. The very instruments of social policy are all tools and means that influence the behavior of citizens to whom it addresses its programs, as well as those who are performers or create the social environment in which given programs are implemented (Rysz-Kowalczyk et al., 2002).

The typology of social policy instruments referred to in the available literature refers to i.a. to the resources available to various social policy entities (Firlit-Fesnak, Szytko-Skoczny, 2017). With regard to the idea of developing electromobility in Poland, it is defined by appropriate instruments, e.g. of an economic nature, e.g. subsidies for the purchase of a new electric car, legal, e.g. the possibility of driving a vehicle into zones excluded from traffic, or information campaigns promoting the purchase and operation of electric vehicles. Observations of the mobility transformation processes in other countries indicate that these instruments have a significant impact on the decisions made by the demand side, i.e. potential consumers. The author shares the opinion of other researchers (Cansino, Sánchez-Braza, Sanz-Díaz, 2018; Barbarossa et al., 2015) that their proper selection, especially in the current period of socio-economic uncertainty in the form of, for example, high prices of energy resources, may significantly influence purchasing decisions. On the one hand, we can expect further

reduction of unnecessary expenses in the opinion of the society and focusing on maintaining the current liquidity of households, i.e. repayment of basic liabilities and not the purchase of an electric vehicle. On the other hand, individual social groups and individuals may attach even greater importance to the relationship between ecological and economic issues. Adhering to the principle that in order to protect the environment, costs must be incurred in order for the benefits to appear later (Sofi et al., 2020).

Modern researchers emphasize that generating demand for electromobility goes hand in hand with changes taking place within society (Liao et al., 2016; Jochem et al., 2018; Larson et al., 2014). The main stream of social policy are social issues, i.e. phenomena and circumstances that create a state of social tension, threatening the wider community and causing deformations in the entire social development (Auleytner, 2012). In the scientific discussion on the behavior of society, there is therefore a noticeable increase in interest in the issues of electromobility, especially in the context of contemporary disputes regarding the possible benefits and risks associated with the development of electromobility in relation to individual countries, regions or even cities (Rezvani et al., 2015; Aksen, 2012; Barbarossa et al., 2015).

The analysis of the available literature on the subject showed that there is a lack of research on the impact of social policy instruments on the development of electromobility. In particular, publications relating to the demand side and societies of Central and Eastern Europe. Where plans for the development of electromobility encountered a serious problem in the form of lack of social acceptance. In addition, the presented research may be helpful in identifying the benefits and threats perceived by the society, related to the implementation of the Electromobility Development Plan in Poland. At the same time, constituting the basis for the verification of the current adopted strategy in the field of applied social policy instruments in this area.

Therefore, this article has many important practical implications, both political and economic. Considering that the aim of the research is to gain extensive knowledge on the impact of social policy instruments on the development of electromobility in Poland. The article was organized as follows. Chapter 2 contains a detailed description of the purpose, scope and research method used in response to the research questions. Chapter 3 describes the results of experimental studies and their interpretation. In turn, Chapter 4 discusses the results and presents conclusions - pointing to their limitations in the perspective of the research conducted so far, and indicates future directions of research in relation to the issue of the impact of social policy on the development of electromobility in Poland.

2. Materials and methods

2.1. Conceptual assumption

The aim of the entire research project was to obtain knowledge on the impact of social policy instruments on the development of electromobility in Poland. The description of the selected issue refers only to the recipients of social policy, i.e. the demand side. In the research area, the focus was on the assessment of possible changes in shopping preferences and transport mobility in terms of selected social policy instruments. Economic, legal and informational instruments were analysed. The questions focused on issues relating to, among others: to the possible benefits and threats related to the development of electromobility and the instruments used in the area of social policy. Following this line of reflection, an attempt was made to answer the following research questions:

- What benefits and threats does the development of electromobility bring to society in the opinion of the respondent?
- Which of the economic instruments in the area of social policy can have the greatest impact on the development of electromobility in Poland?
- Which of the legal instruments in the area of social policy can have the greatest impact on the development of electromobility?
- Which of the information instruments in the area of social policy can have the greatest impact on the development of electromobility in Poland?

2.2. Sampling method

In the context of the changing nature of the electromobility processes taking place in Poland and all the social effects of these changes that are still undetermined, affirmative actions have been taken in the field of the correct selection of people for research. The survey was addressed only to citizens who correctly verified the essence of electromobility and the nature of social policy. Therefore, the criterion of awareness was the main factor determining the participation of a given person in the study - potential respondents were initially verified if they met this condition. During the survey, the vast majority of respondents confirmed such a role and gave the correct answer to the first two questions asked for this purpose.

The selection of respondents for the study was carried out among the communities of citizens living in metropolitan areas. Where the effects of the development of electromobility processes are most noticeable. So is the awareness of the social policy instruments used in this regard. There was no division based on: age, occupation, education or gender. With one proviso that the respondents were only people who already owned a conventionally powered vehicle. Due to the diversity of respondents, one research course was conducted using one communication channel - the Internet. The time frame of the research was defined in the period

from January to December 2021. The research sample included 1341 respondents. Therefore, the adopted strategy involved recognizing a sample of 1000 interviews as sufficient for the adopted analysis scheme and made it possible to answer the research questions posed.

2.3. Description of the tool

The CAWI method (interviews conducted over the Internet) was used as part of the study. The questionnaire form enabling its completion was sent electronically and was made available on the appropriate website of the university. The survey was anonymous, which allowed the respondents to freely express their opinions. The layout of the presented results is reflected in the completed questionnaires. A group of survey questions was devoted to the issues of public awareness of the processes related to the development of electromobility and the impact of social policy instruments on this process.

2.4. Analysis scheme

During the research, 1389 completed answer sheets were obtained (1000 were accepted for analysis) in electronic form through a questionnaire sent via the Internet. The survey contained 10 questions related to the plans for the development of electromobility in Poland (an analysis of the answers to 4 of them is included in the article below). In the adopted scheme, the questions asked concerned noticeable changes in min. in terms of benefits and risks related to the development of electromobility and the assessment of the instruments used to increase interest in solutions based on the idea of electromobility, including the perception of electric vehicles. In the further part, the study consists of substantive notes and charts containing the results of answers to the questions contained in the form sheets. After entering the answers into a spreadsheet, the obtained data was subjected to statistical and substantive analysis. In order to increase the readability of the answers obtained, the results were presented in the simplest form (percentage values) in individual figures from 1 to 4. Due to the fact that all questions were single-choice, the percentage distribution always added up to 100%.

Technical notes on the method of data presentation are placed in the titles and footers of figures. Since respondents were not required to answer all questions in the survey, the number of valid answers varied from question to question, which did not affect the final result, as numerical and percentage losses were not significant. The layout of all analyzes was subordinated to the objectives of the study.

3. Results

At the first stage of the research, what benefits and threats, in the opinion of the respondent, does the development of electromobility bring to the Polish society?

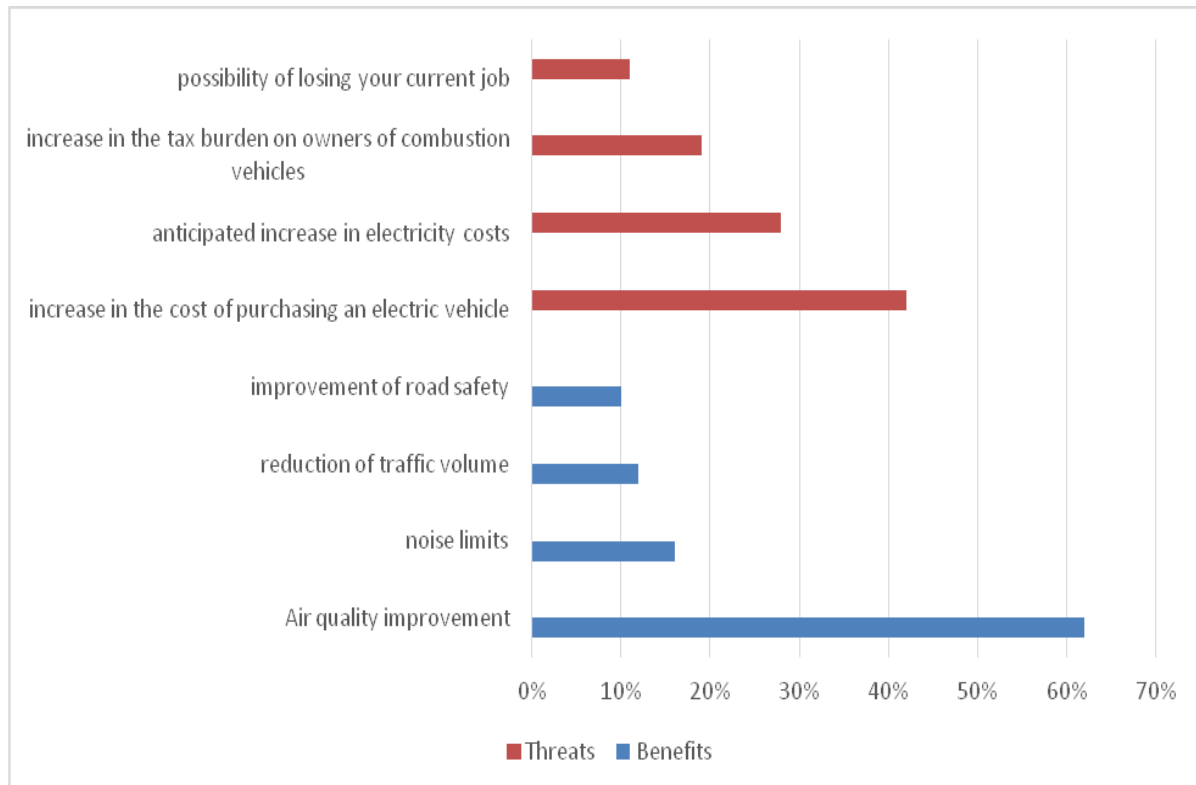


Figure 1. Benefits and threats to the development of electromobility for society.

Source: own study.

The analysis of the obtained response results shows that over 62% of respondents see benefits in the form of improved air quality in the development of electromobility. 16% indicate noise reduction. Another 12% for reducing traffic congestion and 10% for improving road safety. However, in the case of threats, over 42% indicated the fear of an increase in the cost of purchasing an electric vehicle, and thus the effect of transport exclusion. Another 28% for the expected increase in electricity costs. 19% for an increase in tax burdens on owners of internal combustion vehicles. 11% to the possibility of losing your current job.

At the next stage, the respondents were asked to indicate which of the economic instruments in the area of social policy may have the greatest impact on the development of electromobility in Poland?

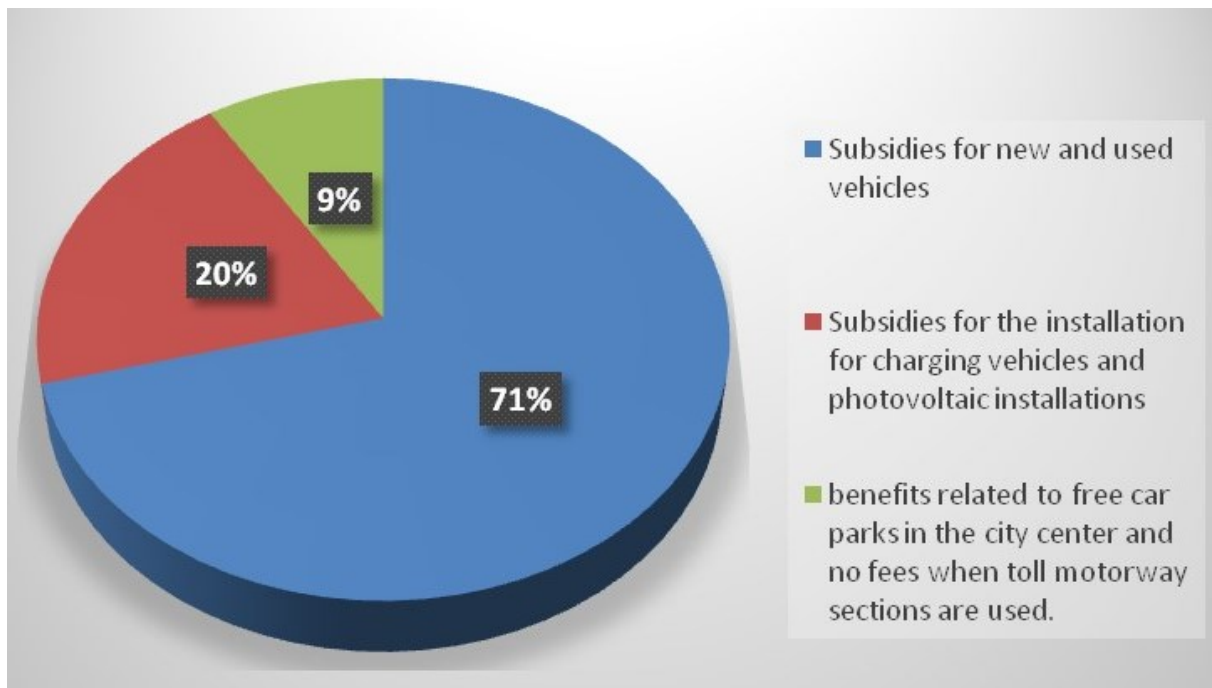


Figure 2. Which of the economic instruments in the area of social policy can have the greatest impact on the development of electromobility in Poland?

Source: own study.

The research shows that, according to 71% of respondents, the most effective tool is direct subsidies for the purchase of a new and used electric vehicle. Another 20% indicated direct subsidies to the installation for charging vehicles and photovoltaic installations. On the other hand, 9% of respondents pointed to the benefits of free parking in the city center and no fees when using toll motorway sections.

At the next stage of the research, respondents were asked to indicate which of the legal instruments in the area of social policy, in their opinion, may have the greatest impact on the development of electromobility processes.

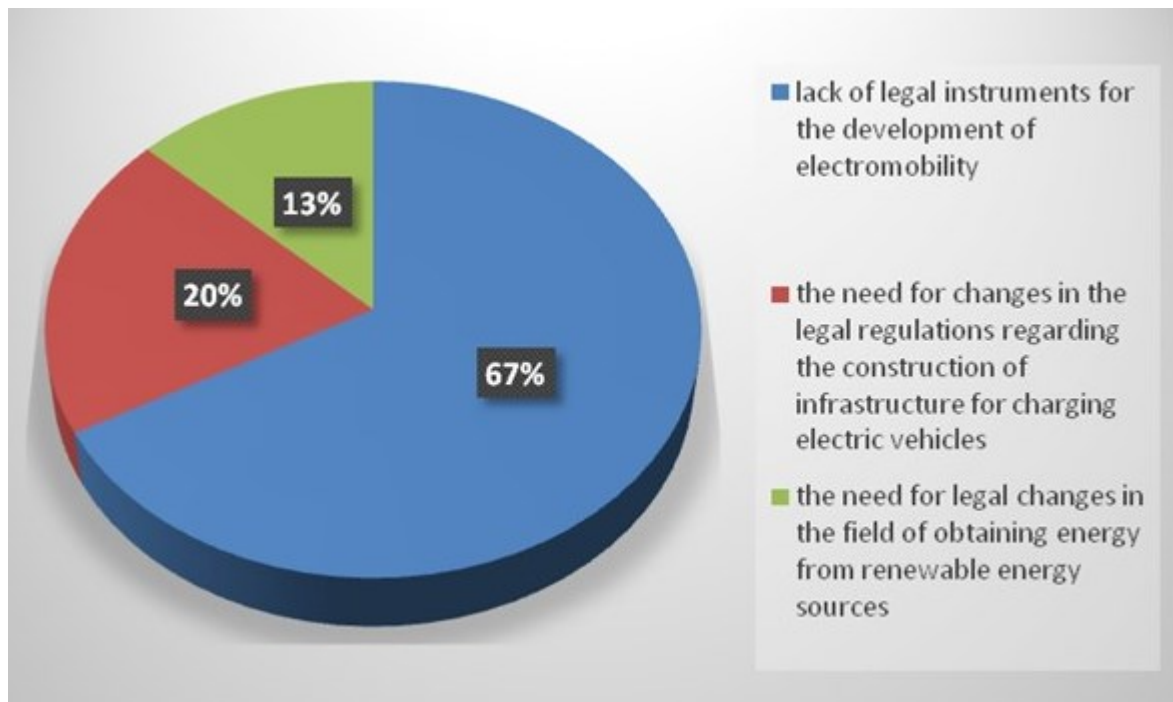


Figure 3. Which of the legal instruments in the area of social policy can have the greatest impact on the development of electromobility processes?

Source: own study.

The results of the answers obtained showed that 67% of the respondents pointed to the lack of legal instruments in the field of electromobility development. On the other hand, 20% emphasized the need for changes in the legal regulations regarding the construction of infrastructure for charging electric vehicles. The remaining 13% indicated the need for legal changes in the field of obtaining energy from renewable energy sources. At the last stage of the research, the respondents were asked to verify which of the information instruments in the area of social policy could have the greatest impact on the development of electromobility in Poland?

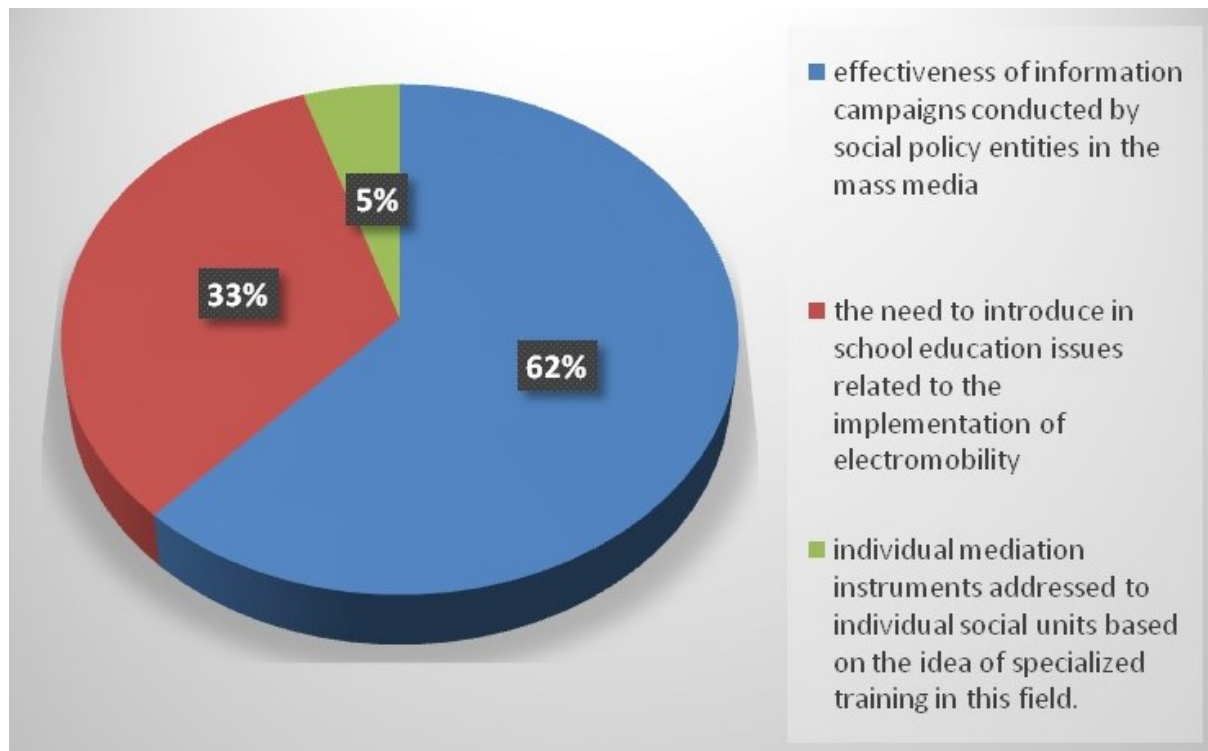


Figure 4. Which of the information instruments in the area of social policy can have the greatest impact on the development of electromobility in Poland?

Source: own study.

The analysis of the results of the responses shows that, in the opinion of 62% of the respondents, the most effective tool is information campaigns conducted by social policy entities in the mass media. In addition, 33% of respondents indicated the need to introduce issues related to the implementation of electromobility in school education. Only 5% pointed to instruments of individual mediation addressed to individual social units, based on the idea of specialized training in this area.

4. Discussion and Conclusions

As the literature on the subject indicates, the fundamental idea of sustainable development is such economic growth that increases social cohesion by limiting the undesirable impact of production and consumption, while not leading to the degradation of the natural environment (Wackernagel, Hanscom, Lin, 2017). Care for the natural environment should be manifested primarily by changing the consumption model, which will be more environmentally friendly, as well as by adopting a method of resource management in which the impact on the environment does not exceed its capacity for self-realization (Vasin, Gamidullaeva, Rostovskaya, 2017). One of these areas and challenges in social policy are changes in social mobility (Williams, 2020) through the gradual replacement of internal combustion engines with

electric ones (Attias, 2017). According to many researchers, maintaining climate neutrality in this area is an extremely important goal for the future of economic development, environmental protection and improving the quality of life (Małek et al., 2020; Brückmann, Bernauer, 2020). The available literature emphasizes that electric vehicles are primarily a smart social choice consisting in a compromise in terms of the idea of sustainable road transport and environmental protection (Barbarossa et al., 2017).

However, as the observations of the market reality indicate, the pace of development of electromobility processes in Poland is not fully satisfactory. Achieving the assumed plan of 1 million electric cars by 2025 seems unrealistic. In practice, the implementation of this plan through social policy instruments is associated with a number of challenges related to changes in social awareness and a socially and ecologically just transformation of preferences in the field of transport mobility. The author of the research believes that several important factors contributed to the apparent lack of change in society. It should be emphasized that, as other researchers indicate, in the era of uncertainty regarding one's own financial situation, the phenomenon of greater control of household expenses is noticeable (Sofi et al., 2020). Thus, the purchase of a new car is postponed in time. Even if such a decision is made, the current import of vehicles with conventional drive from the European Union makes the purchase of a new electric vehicle unprofitable or highly cost-intensive, despite the instruments used in the form of subsidies. Considering that the value for money ratio is the most important factor influencing the purchasing decision (Kotler, 2011). In addition, as one of the researchers emphasizes, the purchasing decision is influenced by a parameter in the form of product usability (Edvardsson et al., 2013). Currently, when using a fully electric car, you still need to plan your route carefully in advance, as the availability of the charging network is significantly limited. This is another of the challenges in the field of social policy - relating to, inter alia, to the idea of common goods (Hantrais, 2017). According to the researcher, it is not without significance that the information instruments of social policy focus on the benefits associated with the purchase of an electric vehicle in the form of the possibility of receiving subsidies or no fees for using city car parks and road infrastructure in the form of motorways. Leaving aside, however, the issues of promoting public transport and cycling, or promoting walking travel.

In terms of benefits and threats to society in terms of the development of electromobility, the author's research showed that, in the opinion of the respondents, the greatest benefit is the improvement of air quality. This fact was indicated by over 62% of respondents. Available reports and studies on electromobility research confirm this thinking trend (ICCT, 2020), which is associated with the belief that electric vehicles do not emit substances harmful to the environment. However, in the case of threats, as many as 42% pointed to the risk of an increase in the purchase price of an electric vehicle and the phenomenon of transport exclusion. According to the author of the research, this state of affairs is influenced by a noticeable increase in the purchase prices of new and used vehicles. According to experts, an average increase of 13% compared to previous years. Therefore, in the opinion of the respondents, the introduction

of the new technology paradoxically contributed to the increase in the prices of new vehicles. In addition, an important concern in the opinion of the respondents, indicated by 28%, is the expected increase in electricity prices. In this matter, the author shares the opinion of other researchers (Della Porta, Portos, 2020) that generating demand for electromobility should be implemented with the help of properly selected social policy instruments and go hand in hand with changes taking place within an increasingly aware society.

With regard to economic instruments in the area of social policy, which may have the greatest impact on the development of electromobility in Poland, the demand side pointed to direct subsidies for the purchase of a new as well as a used electric vehicle. The role of this instrument was indicated by as many as 71% of the respondents. As recent publications indicate, this problem has been noticed by the entities responsible for social policy and advanced work is underway on changes to the My Electrician program to include subsidies for used vehicles. Another postulate put forward by 20% of respondents is direct subsidies to the installation for charging vehicles and photovoltaic installations. In this matter, legislative changes are also underway on the program supporting the launch of an economic instrument for the development of charging stations for electric vehicles. Based on the results presented above, the author agrees with the thesis promoted by other researchers (Kley et al., 2011) that not only the purchase of a vehicle at an attractive price can convince to change transport habits, but also low costs of charging and operating the vehicle.

As far as information instruments in the area of social policy are concerned, 82% of respondents consider social campaigns to be the most effective. Another important element indicated by the respondents is the need to introduce the basics of knowledge about electromobility to school education. The author of the research puts forward the thesis that the implementation of this solution may lead to a change in shopping preferences and transformation of mobility, in particular with regard to the young generation.

On the other hand, the issue of the influence of legal instruments remains in dispute with other authors. According to other researchers, despite many barriers and the economic crisis, in their opinion, electromobility is developing dynamically and will continue to develop, as its expansion has been based on very solid foundations, such as EU, national and regional legal standards (Tucki et al., 2019, 2020). The author of the research, however, is of a different opinion, which is partly indicated by the presented research results. Over 67% of respondents pointed to the lack of legal instruments for the development of electromobility. Therefore, in the author's opinion, an important step should be the introduction of appropriate legal regulations in the area of road transport based on the polluter pays principle.

In conclusion, the author supports the postulate of other researchers that the popularization of zero-emission transport depends on the quick and decisive actions of the state authorities, among others. active social policy (Rietmann, Lieven, 2019). However, the selection of economic, legal or informational instruments must be supported by a thorough analysis and an approach that takes into account the current socio-economic situation. The approach of

countries such as the Netherlands or Sweden, which in the process of developing electromobility, has applied four models of social policy based on the idea of anticipation, distribution, integration, ad hoc intervention, seems to be right. Taking such well-thought-out actions proves a firm approach to social policy and the development of electromobility. The consequence of activity in this matter was a change in social preferences in the form of resignation from the purchase of a vehicle with a conventional drive in favor of a vehicle with an electric drive. In 2021, in these countries, 25% of all newly registered vehicles had an electric or hybrid drive (ACEA 2022). However, these changes would not be possible without increasing public awareness of the links between economic, social and environmental issues.

The presented research focused on assessing the impact of social policy instruments on the development of electromobility in Poland. Against the background of academic considerations, the question should be answered whether the current economic, legal or information instruments have contributed to the increased interest of the public in electromobility. In the opinion of the researcher, yes. However, in today's market reality they are insufficient and it is necessary to redefine them to meet the real needs of society. Awareness of this state of affairs can help both the authorities and environmental circles in creating a coherent vision of changes in the field of transport needs, where social and ecological justice will actually - and not only declared - go hand in hand. However, the question remains which of the social policy instruments has the greatest impact on the development of electromobility in Poland.

This document uses data from a survey on a specific research sample of approximately 1000 respondents. Certainly, in the near future there will be a need for much broader analyzes and research, in particular with regard to changes in the income of citizens, planned reforms of social programs and projected increases in the prices of energy resources. In addition, further research on this topic should focus on aspects related to the analysis of potential benefits and risks related to changes in the field of electromobility in relation to an individual social unit. The future element of further research in this matter should also be the forecast and analysis of the expected changes in the labor market, resulting from the resignation from conventional engines in favor of low-emission ones.

Summing up the presented research on the impact of social policy instruments on the development of electromobility in Poland, by trying to answer which of the instruments has the greatest impact on the increase in interest in transport solutions based on the idea of electromobility, they do not fully exhaust the essence of the issue. They are only an incentive for further research in this matter. Certainly, this topic requires further analysis. In order to understand both the essence of the impact of social policy on the electromobility development plan and the role that individual social policy instruments play in this process. Therefore, such analyzes will be the subject of future work in order to determine and identify key factors for the implementation of the Electromobility Development Plan in Poland.

References

1. ACEA (2022). *Report Vehicles in Use Europe*. Brussels, Belgium: European Automobile Manufacturers Association (ACEA).
2. Ahmadi, P. (2019). Environmental impacts and behavioral drivers of deep decarbonization for transportation through electric vehicles. *Journal of Cleaner Production*, No. 225, pp. 1209-1219, doi:10.1016/J.JCLEPRO.2019.03.334.
3. Attias, D. (2017). *The Automobile Revolution*, no. 25. Cham: Springer International Publishing, pp. 45-46.
4. Auleytner, J. (2012). *Problemy polityki społecznej w Polsce i na świecie*. Warszawa: Elipsa, p. 218.
5. Axsen, J., Kurani, K.S. (2012). Inter-personal influence within car buyer's social networks: applying five perspectives to plug-in hybrid vehicle drivers'. *Environment and Planning A*, Vol. 44, Iss. 5, pp.1047-1065, doi.org/10.1068/a43221x.
6. Barbarossa, C.P., De Pelsmacker, I., Moons, W. (2017). Personal values, green self-identity and electric car adoption. *Ecological Economics*, Vol. 140, pp. 190-200, DOI: 10.1016/j.ecolecon.2017.05.015.
7. Barbarossa, C.S.C., Beckmann, P., De Pelsmacker, I., Moons, W., Gwozdz, A. (2015). A self-identity based model of electric car adoption intention: across-cultural comparative study'. *Journal of Environmental Psychology*, Vol. 42, pp. 149-160, doi.org/10.1016/j.jenvp.2015.04.001/.
8. Brückmann, G., Bernauer, T. (2020). What drives public support for policies to enhance electric vehicle adoption. *Environmental Research Letters*, 15, 094002, DOI: 10.1088/1748-9326/ab90a5.
9. Cansino, J.M., Sánchez-Braza, A., Sanz-Díaz (2018). Policy Instruments to Promote Electro-Mobility in the EU28: A Comprehensive Review. *Sustainability*, Vol. 10, No. 7, 2507. doi.org/10.3390/su10072507.
10. Chudy, A., Mazurek, P.A. (2019). Electromobility—the Importance of Power Quality and Environmental Sustainability. *Journal of Ecological Engineering*, Vol. 20, pp. 15-23, doi.org/10.12911/22998993/112713.
11. Della Porta, D., Portos, M. (2022). Social movements in times of inequalities: Struggling against austerity in Europe. *Structural Change and Economic Dynamics*, Vol. 53, pp. 116-126, DOI: 10.1016/j.strueco.2020.01.011.
12. Drożdż, W. (2019). The development of electromobility in Poland. *Virtual Economics*, 2(2), pp. 61-69, 10.34021/ve.2019.02.02(4).
13. Edvardsson, B., Tronvoll, B., Gruber, T. (2013). Expanding understanding of service exchange and value co-creation: a social construction approach *Academy of Marketing Science*, Vol. 39, Iss. 2, pp. 327-339, doi.org/10.1007/s11747-010-0200-y.

14. Electromobility Development Plan in Poland (2017). *Energy for the Future*. Warsaw: Ministry of Energy, <https://www.gov.pl/attachment/e4658a6d-6fd5-4fb3-a3d3-325446ba9029>, 27.06.2022.
15. Firlit-Fesnak, G., Szytko-Skoczny, M. (ed.) (2017). *Polityka Społeczna*. Warszawa: PWE, p. 85.
16. Hajian, M., Kashani, S.J. (2021). Evolution of the concept of sustainability. From Brundtland Report to sustainable development goals. In: C.M. Hussain, J. Velasco-Muñoz (Eds.), *Sustainable Resource Management* (pp. 1-24). Oxford-Cambridge, UK: Elsevier.
17. Hantrais, L. (2017). *Social policy in the European Union*. Bloomsbury Publishing.
18. ICCT (2020). *European vehicle market statistics*. Pocketbook 2019/20. Berlin: International Council on Clean Transportation.
19. Jochem, P., Vilchez, J.J., Ensslen, A., Schäuble, J., Fichtner, W. (2018). Methods for forecasting the market penetration of electric drivetrains in the passenger car market. *Transport. Reviews*, Vol. 38, pp. 322-348, doi.org/10.1080/01441647.2017.1326538.
20. Kley, F., Lerch, C., Dallinger, D. (2011). New business models for electric cars—a holistic approach. *Energy Policy*, Vol. 39, Iss. 6, pp. 3392-3403, doi.org/10.1016/j.enpol.2011.03.036.
21. Kotler, P. (2011). Reinventing marketing to manage the environmental imperative. *Journal of Marketing*, Vol. 75, Iss. 6, pp. 132-135. doi.org/10.1509/jmkg.75.4.132.
22. Kurzynowski, A. (2003). *Polityka społeczna*. Warszawa: Szkoła Główna Handlowa.
23. Larson, P.D., Viáfara, J., Parsons, R.V., Elias, A. (2014). Consumer attitudes about electric cars: pricing analysis and policy implications. *Transportation Research Part A: Policy and Practice*, Vol. 69, pp. 299-314, DOI: 10.1016/j.tra.2014.09.002.
24. Liao, F., Molin, E., Van Wee, B. (2016). Consumer preferences for electric vehicles: A literature review. *Transport. Reviews*, Vol. 37, pp. 252-275, doi.org/10.1080/01441647.2016.1230794.
25. Małek, A., Caban, J., Wojciechowski, Ł. (2020). Charging electric cars as a way to increase the use of energy produced from RES. *Open Engineering*, Vol. 10, Iss. 1, pp. 98-104. doi.org/10.1515/eng-2020-0009.
26. Rezvani, Z., Jansson, J., Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda'. *Transportation. Research, Part D*, Vol. 34, pp. 122-136, doi.org/10.1016/j.trd.2014.10.010.
27. Rietmann, N., Lieven, T. (2019). How policy measures succeeded to promote electric mobility - Worldwide review and outlook. *Journal of Cleaner Production*, Vol. 206, pp. 66-75, doi.org/10.1016/j.jclepro.2018.09.121.
28. Rysz-Kowalczyk, B. (ed.) (2002). *Leksykon polityki społecznej*. Warszawa: ASPRA-JR.
29. Sendek-Matysiak, E., Pyza, D., Łosiewicz, Z., Lewicki, W. (2022). Total Cost of Ownership of Light Commercial Electrical Vehicles in City Logistics. *Energies*, Vol. 15, Iss. 22, p. 8392, doi.org/10.3390/en15228392.

30. Shi, L., Han, L., Yang, F., Gao, L. (2019). The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects. *Sustainability, Vol. 11*, p. 7158, doi.org/10.3390/su11247158.
31. Sofi, S.A., Mir, F.A., Baba, M.M. (2020). Cognition and affect in consumer decision making: Conceptualization and validation of added constructs in modified instrument'. *Future Business Journal, Vol. 6*, pp. 1-20. doi.org/10.1186/s43093-020-00036-7.
32. Tucki, K., Orynycz, O., Mitoraj-Wojtanek, M. (2020). Perspectives for Mitigation of CO₂ Emission due to Development of Electromobility in Several Countries'. *Energies, Vol. 13, Iss. 16*, p. 4127, doi.org/10.3390/en13164127.
33. Tucki, K., Orynycz, O., Wasiak, A., Świć, A., Dybaś, W. (2019). Capacity market implementation in Poland: Analysis of a survey on consequences for the electricity market and for energy management'. *Energies, Vol. 12, Iss. 5*, p. 839, doi.org/10.3390/en12050839.
34. Vasin, S.M., Gamidullaeva, L.A., Rostovskaya, T.K. (2017). The challenge of Social Innovation: Approaches and Key Mechanisms of Development. *European Research Studies Journal, vol. XX, iss. 2B*, pp. 25-45.
35. Wackernagel, M., Hanscom, L., Lin, D. (2017). Making the Sustainable Development Goals Consistent with Sustainability. *Frontiers in Energy Research, Vol, 5 Iss. 18*, doi.org/10.3389/fenrg.2017.00018.
36. Wappelhorst, S., Pniewska, I. (2020). *Emerging Electric Passenger Car Markets in Europe: Can Poland Lead the Way? Working Paper 2020-2019*. San Francisco, CA, USA: International Council on Clean Transportation.
37. Williams, B. (2020). Social policy. In: *James Callaghan: an underrated Prime Minister?* (pp. 143-162). Hull: Biteback.

DIFFERENTIATION OF CLIMATE AND ENERGY POLICY IN THE COUNTRIES OF THE EUROPEAN UNION

Lidia LUTY¹, Monika ZIOŁO^{2*}

¹ University of Agriculture in Krakow; lidia.luty@urk.edu.pl, ORCID: 0000-0001-8250-8331

² University of Agriculture in Krakow; monika.ziolo@urk.edu.pl, ORCID: 0000-0003-0884-4083

* Correspondence author

Purpose: The energy policy of the European Union focuses mainly on three areas: renewable energy, reducing the emission of harmful pollutants, in particular CO₂, and increasing the efficiency of electricity used. Sustainable energy management, in turn, is undoubtedly associated with the increased use of renewable energy sources ensuring energy security as well as the diversification of energy supplies that support and improve the quality of the environment. The aim of the article is to present the diversity of the European Union countries in terms of actions taken in the field of energy policy resulting from climate and energy goals.

Design/methodology/approach: On the basis of the objectives of the energy policy presented in the EU directives, indicators describing the activities of the Member States in this respect were selected. Then, they were subjected to substantive and statistical verification, leaving 6 variables. The tool of Multidimensional Statistical Analysis, which is a synthetic measure, was used to develop a synthetic measure of the level of achievement of the goals of the climate and energy policy. Two types of analyses were used: static for international comparisons between the European Union countries, conducted for 2021, and dynamic, for the years 2011-2021.

Findings: The most favourable situation in terms of activities aimed at reducing emissions of harmful substances and improving the energy efficiency of countries can be observed in the hitherto leaders of Sweden and Finland. Together with Denmark, these countries have set very ambitious national targets for achieving a share of at least 50% from renewable energy in gross final energy consumption. All countries have increased their energy productivity index. Bulgaria, Italy and Slovakia have made the greatest reductions in pollutant emissions. In the interests of energy independence, countries are trying to increase energy production from domestic resources. The greatest improvements in this field were made in Ireland, Latvia, Portugal and Finland. The division into three groups of countries implementing the energy and climate policy introduced by the EU showed that the indicators that differentiate countries to the greatest extent, among the group of selected variables, are greenhouse gas emissions and the energy dependency ratio.

Keywords: energy and climate policy, EU countries, synthetic measure.

Category of the paper: Research paper.

1. Introduction

The energy sector is recognized by the Member States as a strategic sector of the economy, in which, above all, national interests subject to government regulations are of key importance. Nevertheless, the continuous increase in energy consumption and thus the need to invest in obtaining energy fuels abroad and their transport resulted in the need to introduce Community law (European Union Law, 2002). The main goal of the European energy policy is to take measures aimed at creating an integrated energy market and ensuring the security of energy supplies and a stable energy sector. This provision is particularly important in the context of problems with the purchase of energy resources caused primarily by the dependence of many countries on imports. These problems have been significantly aggravated by the recent war in Ukraine.

2. EU climate and energy policy

The problem of energy security has a global scope, therefore the provisions on energy security were also included in the goals of the United Nations Sustainable Development Agenda, which indicated the need to ensure access to "affordable, reliable, sustainable and modern energy" for all. This goal is to be achieved through "increasing the share of renewable energy in global energy consumption" and "promoting investments in energy infrastructure and clean energy technologies" (Wąs et al., 2020). Actions taken in this area are to increase the effectiveness of the fight against the progressive degradation of the environment and the increasing emission of greenhouse gases, which are a serious threat, increasing pollution and causing unfavourable climate changes (Mahjabeen, Chughtai, Simonetti, 2020).

In order to stop further deterioration of the environment, the UNFCCC (United Nations Framework Convention on Climate Change) was implemented, which describes the basic framework for global cooperation on this issue. This document was supplemented by the provisions of the 2030 Agenda, the Kyoto protocols (1997) and the Copenhagen agreements (2009). The measures included in the climate and energy package were updated on July 14, 2021, when the European Commission announced the "Fit for 55" legislative package. The aim of the package is to reduce greenhouse gas emissions in EU Member States by 55% by 2030 compared to 1990. The aforementioned directives indicate actions aimed at solving the problem of the deteriorating quality of the environment caused, among others, by the use of traditional fossil fuels (Li, 2005).

For the needs of the Member States, the European Union has developed a strategy aimed at fulfilling international obligations in the fight against unfavourable climate change as well as implementing the idea of sustainable energy (Energy Union Package, 2015). This strategy is being implemented gradually, in three main stages, through the implementation of the program objectives set in each of the stages (Gokgoz, Guvercin, 2018), (Chalvatzis, Ioannidis, 2017).

Focusing on the sustainable development strategy, it emphasises the need to promote a modern way of life taking into account appropriate environmental policies and philosophies that will counteract past practices of non-prospective exploitation of the earth's resources (Musiał, Ziolo, Luty, Musiał, 2021).

The "20-20-20 package" included the following goals that the EU intended to achieve by 2020:

- 20% reduction in greenhouse gas emissions compared to 1990 levels, which was achieved by reducing emissions by 24%,
- 20% of energy obtained from renewable sources; this target was exceeded with the value of 22.1% in 2020,
- 20% improvement in energy efficiency, which meant savings in energy consumption compared to forecasts (Directive 2009/29/EC, 2009).

In 2020, EU primary energy consumption fell to 1236 million tonnes of oil equivalent (Mtoe), 5.8% above the 2020 target. Final energy consumption reached 907 Mtoe: exceeding the efficiency target by 5.4%.

2030 Green Book states:

- 40% reduction in greenhouse gas emissions compared with 1990 levels,
- 32% of energy obtained from renewable sources,
- 32.5% improvement in energy efficiency (Green Paper, 2013).

This means that by 2030, consumption in the EU countries should not exceed 1128 Mtoe in the case of basic energy and 846 Mtoe in the final energy. In 2020, 9.6% was short of the 2030 target, which means that efforts to improve efficiency must continue in the years to come. In the case of final energy consumption, the distance in 2020 from the target for 2030 was 7.2%.

The "Low Carbon Economy 2050" goal is to achieve EU climate neutrality by 2050 (A Clean Planet for all..., 2018).

The greenhouse gas emissions factor tracks the evolution of emissions for the Kyoto greenhouse gas basket when the EU has committed to reducing them. By 2020, gas emissions have decreased in the vast majority (22) of the EU Member States. The leader in these activities is Sweden, which reached the level of 20.6% compared to 1990. Romania, Estonia and Lithuania reduced the negative environmental impact by more than half. In Poland, the emission of harmful gases was reduced by 20.1%. By contrast, emissions increased in three EU Member States: Austria, Cyprus and Ireland (Key figures on Europe, 2021).

The Paris Agreement (2015) was of key importance for the implementation of the second objective, relating to the development of renewable energy sources in the European Union countries. Its main goals include combating climate change and supporting the development of the economy in order to achieve more sustainable development and lower greenhouse gas emissions. The main postulate of this agreement is to maintain the temperature at a level from 1.5 to 2°C higher than in the pre-industrial period. This agreement, after it entered into force in 2016, has been ratified by 187 countries. The signatories are obliged to prepare their NDC (National Determined Contribution), in which they will present ways to reduce GHG emissions and methods of monitoring the progress of its implementation. In connection with these findings, the EU has adopted a plan under the 2030 Framework for Climate and Energy (European Commission, 2022), which envisages the creation of a sustainable energy system. The elements of the plan include:

- improving energy efficiency;
- ensuring access to affordable energy for all consumers;
- increasing energy independence, which is important in the light of the information that in 2019, 55% of energy consumed in EU countries was produced from raw materials from outside the EU;
- introducing a fully integrated common energy market (Energy Union);
- becoming a world leader in obtaining energy from renewable sources.

Therefore, it is planned that renewable energy sources will play an important role in the future energy system of the EU.

3. Materials and Methods

The statistical material used in the study came from the Eurostat and World Bank databases. In the process of creating a synthetic measure for assessing the level of achieving the goals of climate and energy policy, the tool of Multidimensional Statistical Analysis, which is a synthetic measure, was used. In the first stage of the research, the characteristics describing the studied phenomenon were selected using the Sustainable Development Goals indicators (Table 1), and their character was determined (S - stimulant set, D - destimulant set). The time range of the research covers the years 2011-2020, with the exception of the indicator for which the last analysed year is 2019. Two countries were omitted from the analysis: Cyprus and Malta due to the lack of complete data. The changes in the indicators were found by determining the measures of the dynamics of the phenomena.

Table 1.
Selected variables for the analysis

Area	Variable	Item
Energy	Energy productivity [euro per kilogram of oil equivalent (KGOE)]	W_1
	Energy imports dependency [Percentage]	W_2
	Share of renewable energy in gross final energy consumption [Percentage]	W_3
Climate	Share of environmental taxes in total tax revenues [Percentage]	W_4
	Net greenhouse gas emissions [Index, 1990=100]	W_5
	Exposure to air pollution by particulate matter [$\mu\text{g}/\text{m}^3$]	W_6

Source: own study on Eurostat.

All the variables in the studied group of objects meet the basic criterion for selecting variables to describe a complex phenomenon (Table 2), i.e. they are not quasi-constant variables (Nermed, 2017).

Table 2.
Numerical characteristics of the indicators in the years

Item	2011				2020			
	<i>max</i>	<i>min</i>	<i>Me</i>	<i>CV</i>	<i>max</i>	<i>min</i>	<i>Me</i>	<i>CV</i>
W_1	12.55	2.03	5.83	0.22	22.61	2.47	6.77	0.19
W_2	97.29	-5.97	53.91	0.25	92.46	10.50	56.33	0.20
W_3	47.63	1.85	13.18	0.23	60.12	10.71	21.75	0.19
W_4	10.56	4.43	7.56	0.15	9.89	3.62	6.81	0.17
W_5	161.50	25.60	86.20	0.18	147.60	20.60	73.20	0.18
W_6	41.30	6.90	17.30	0.18	19.60	4.80	11.80	0.19

Me: Median; *CV*: Coefficient of Variation.

Source: Own study based on Eurostat.

All the variables showed average differentiation as indicated by the values of the coefficients of variation. The volatility indicators describing the energy policy decreased in 2020 as compared to 2011. This indicates that countries with traditional energy policies with a low share of renewable sources in energy production and low productivity are getting closer to the group of the best countries. In the case of climate policy, the volatility indices have slightly increased (W_4 and W_6) or have not changed (W_5), which may indicate a widening distance between countries. It should be emphasized that the median of indicator 3 increased significantly from 13.18% to 21.75%. The decrease in the median for indicators 5 and 6 should be assessed positively.

In the second stage, the indicators were normalized, according to the formula (Walesiak, 2014; Kukuła, Luty, 2015):

$$z_{ij} = \begin{cases} \frac{\max_i w_{ij} - w_{ij}}{\max_i w_{ij} - \min_i w_{ij}}, & W_j \in D \\ \frac{w_{ij} - \min_i w_{ij}}{\max_i w_{ij} - \min_i w_{ij}}, & W_j \in S \end{cases} \quad (1)$$

where: w_{ij}, z_{ij} - the actual and standardized values for the implementation of the indicators, respectively W_j for i country, such as: $z_{ij} \in [0, 1]$.

In the third stage, the values of the synthetic variable Q_i were determined according to the formula:

$$Q_i = \frac{1}{j} \sum_j z_{ij} \quad (2)$$

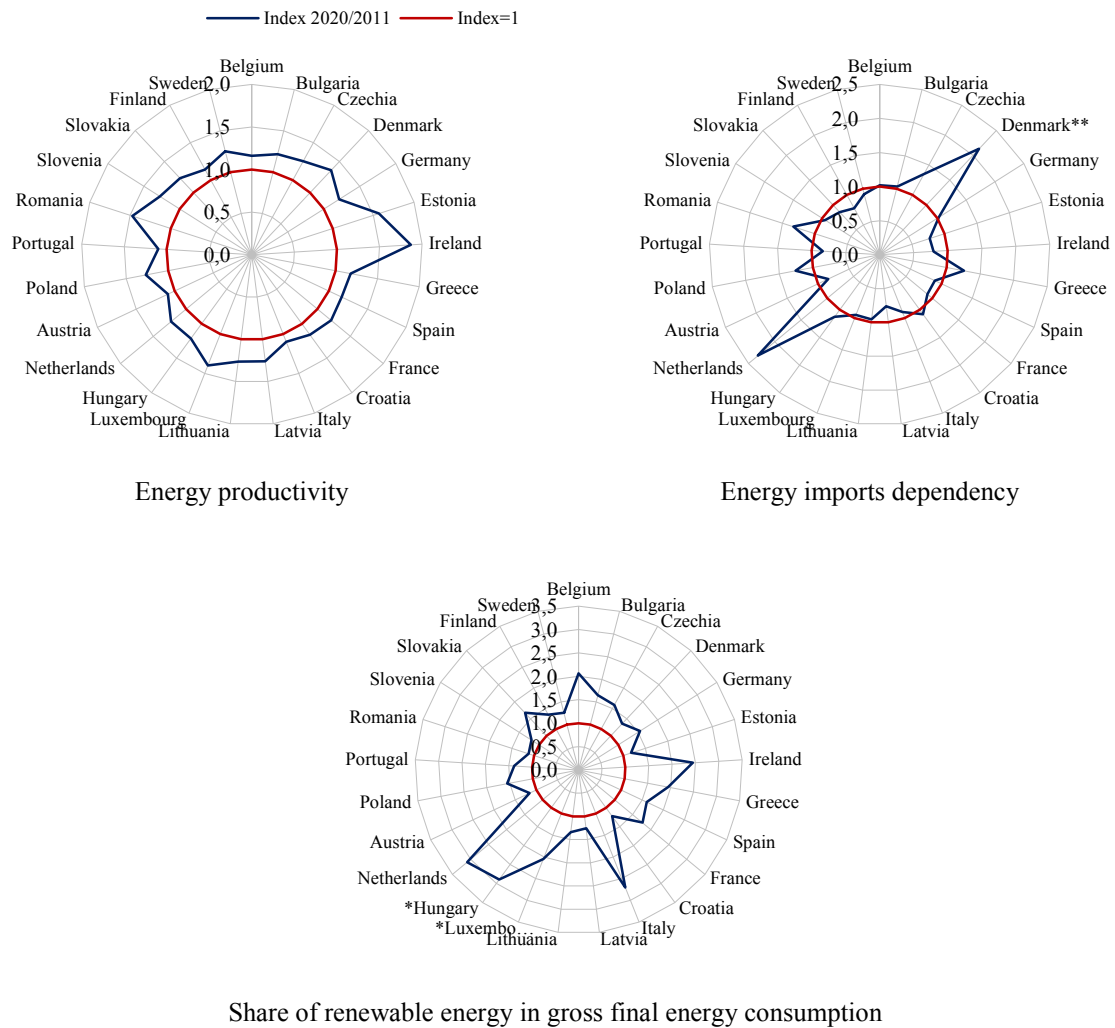
where: Q_i - the level of implementation of the goals of the climate and energy policy and the country, $Q_i \in [0, 1]$.

The highest Q_i value indicates the best object.

The analysis of the correlation relationship between the selected rankings was carried out using the Spearman's rank correlation coefficient. The Student's t-test was used to verify it.

4. Results

In 2020, all EU countries increased the size of economic productivity, i.e. the value of goods produced per unit of gross available energy, compared to 2011 (Figure 1). The biggest changes took place in the Irish economy, where productivity increased by EUR 10.25 per kilogram of oil equivalent (KGOE). Large productivity gains were also observed in Denmark, Luxembourg, Sweden and Romania, but were not as significant as in Ireland.



* value doubled.

Figure 1. Changes from 2011 to 2020 in the adopted EU indicators on the level of energy achievement. Source: Own study based on Eurostat.

The dependence on imported energy raw materials is of particular importance in assessing the energy policies of the Member States. In 2020, the figure for the EU as a whole was 57.5%, meaning that the use of imported materials provided almost three-fifths of the available energy. The most important fuel sources in the EU's energy mix in 2020 were mainly crude oil and petroleum products (34.5% of all fuels) and natural gas (23.7% of all fuels). Dependence on imports of crude oil, the primary raw material for the petrochemical industry and the production of fuels used in transport, was the highest among all fuels and only slightly decreased from 94.04% in 2011 to 93.10% in 2020. The second highest rate of import dependency, at 57.49% in 2020, was recorded for natural gas used as a fuel for electricity generation and heating. The share of a country's total energy needs covered by imports from other countries is and has been highly variable across the group of countries analysed. In 2020, the problem of the economy's dependence on imports of energy resources was significant especially in Greece (81%), Belgium (78%), Ireland (71%), Italy (73%) and Lithuania (74%) (Figure 2).

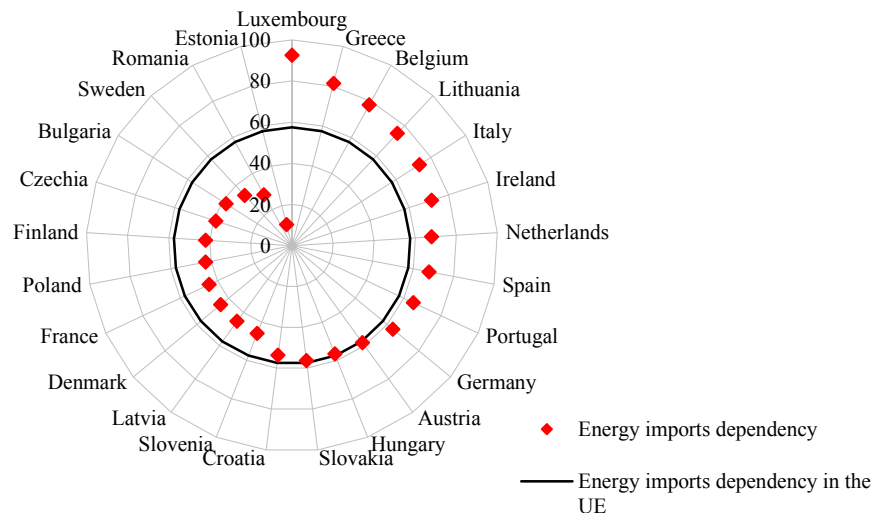


Figure 2. Energy imports dependency (%) in European Union countries in the year 2020.

Source: Own study based on Eurostat.

Largely independent countries include Estonia (10.5%), Romania (28.2%) and Sweden (33.5%). Over the decade (2011-2020), sixteen countries have reduced their energy dependence. Ireland, Latvia, Portugal and Finland have increased the proportion of energy produced from domestic resources to the greatest extent. In contrast, Denmark, the Netherlands, Romania and Poland increased the amount of imported energy resources.

All countries exceeded the goals of the climate and energy policy with regard to the share of energy from renewable sources in the total energy consumption. The most progress has been made in Finland, Sweden and Greece. Hungary, Romania and Slovenia were the least active in this respect.

In 2020, almost all countries exceeded the climate and energy policy targets for the share of renewable energy in total energy consumption (Figure 3).

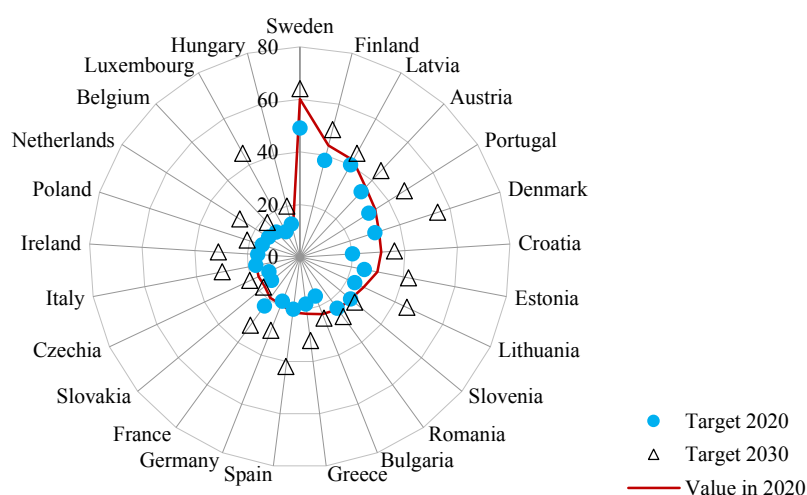


Figure 3. Share of renewable energy in gross final energy consumption in EU countries in 2020 and targets for 2020 and 2030.

Source: Own study based on Eurostat.

Only three countries have set national 2030 targets for the share of renewable energy in gross final energy consumption of at least 50% and these are Sweden (64%), Denmark (55%) and Finland (50%). The share of renewables in EU energy consumption in 2020 was 22.1%, which means that the 2020 target was exceeded by 2.1 percentage points. In 2011, the share of RES in the EU's energy mix was only 13.2%. The undisputed EU leader in terms of the share of renewables in gross energy consumption was Sweden (60.1%), followed by Finland (43.8%), Latvia (42.1%) and Denmark (31, 7%) (Figure 3). At the other extreme in 2019 were: The Netherlands, where the share was only 13.9%, as well as Belgium (13.0%), Malta (10.7%) and Luxembourg (11.7%). Poland (16.1%) was among the countries that set a target below the EU average. The greatest progress between 2011 and 2020 in increasing the share of renewables in energy consumption was made in Finland, Sweden and Greece. The least active in this respect were Hungary, Romania and Slovenia.

Revenue from environmental taxes comes mainly from four types of taxes: energy taxes (approximately three-quarters of the total), transport taxes (approximately one fifth of the total), and taxes on pollution and resources (approximately 4% of the total). In the European Union countries, a decrease in revenues from environmental taxes can be observed, which may indicate an improving situation and limiting the number of harmful factors. Countries where the environmental fee has increased are Greece, Croatia, Romania and France (Figure 4).

In terms of measures to improve the quality of the climate in the area of reducing greenhouse gas emissions, very good results were also observed, as only 4 countries in 2020 exceeded the emission level from 1990. Total domestic greenhouse gas emissions calculated in accordance with the "Kyoto Basket" methodology, i.e. including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and the so-called F-gases from all sectors have steadily decreased. With regard to 2011, only Latvia and Lithuania increased gas emissions, while in other countries the measures taken brought the desired effect.

The annual average concentration of particulate matter is especially important for health as it can cause inflammation and worsen the health of people suffering from heart and lung diseases. Fine particles (PM_{2.5}) with a diameter of less than 2.5 micrometres pose a particular risk as they can be more toxic. Countries have made significant progress in reducing pollution from these particles. All member states have reduced the presence of harmful substances in the air. The most favourable changes occurred in Bulgaria, Italy, Hungary and Slovakia.

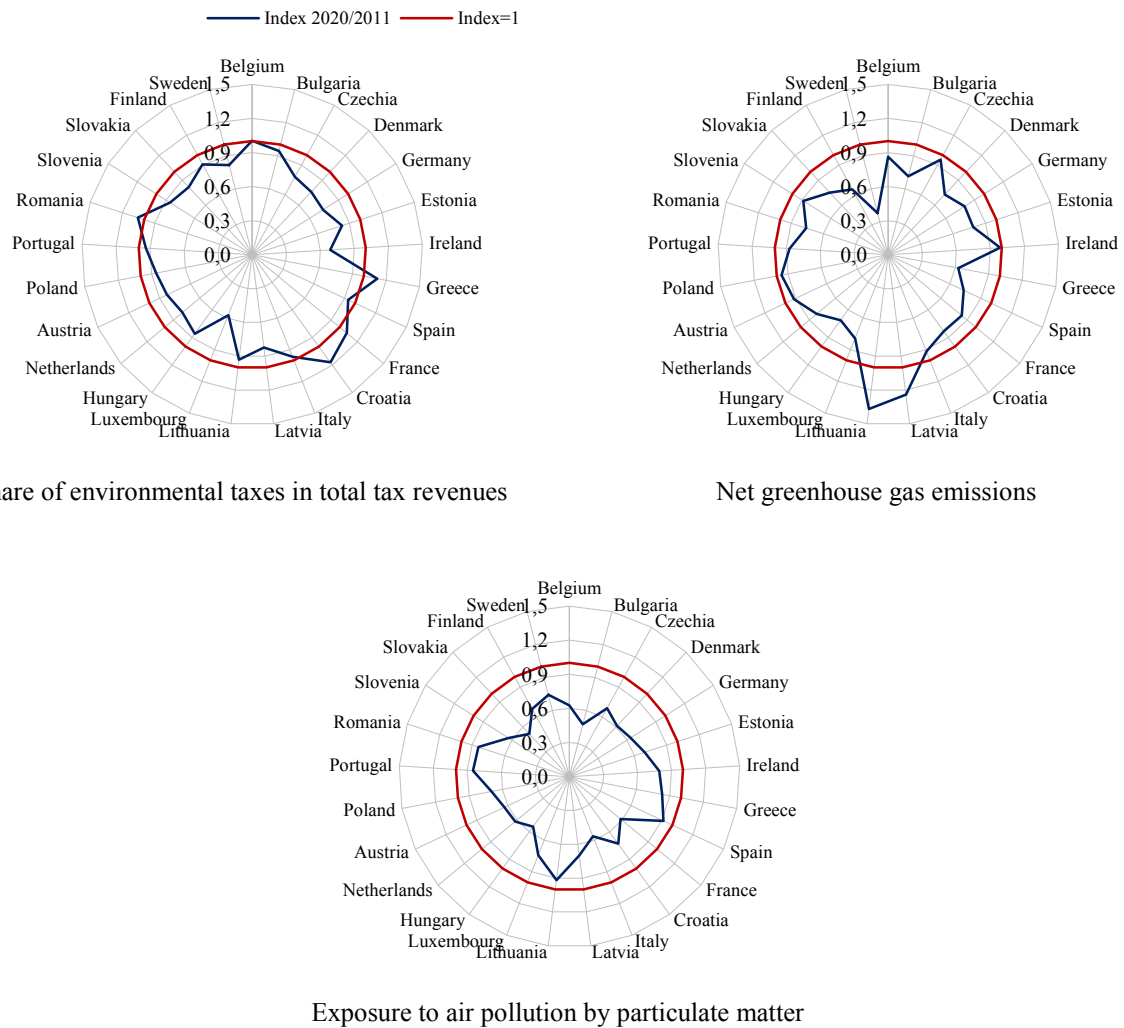


Figure 4. Changes from 2011 to 2020 in the adopted EU indicators on the level climate goals.

Source: Own study based on Eurostat.

Taking into account the aggregated energy targets, most countries in 2020 retained their positions from the 2011 ranking (Figure 5). The greatest progress was made in Ireland, Bulgaria and Latvia, while relatively slow improvement compared to other countries was recorded in the Netherlands, Greece and Croatia.

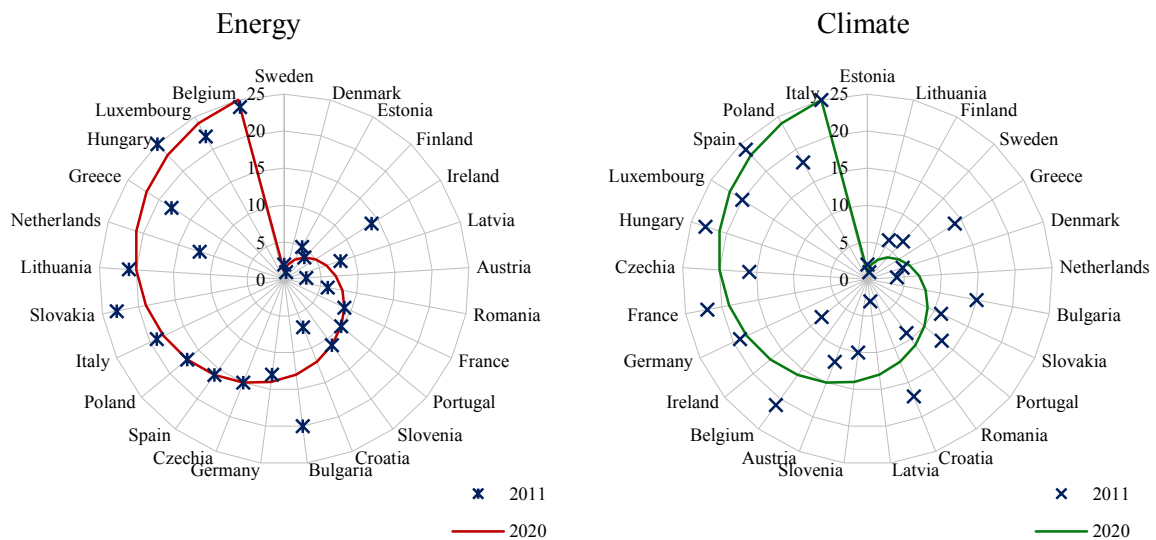


Figure 5. Ranks of EU countries in terms of the level of achievement of energy and climate goals in 2020 and 2011.

Source: Own study based on Eurostat.

For climate targets, the greatest improvement in ranking compared to 2011 can be seen for Greece, Bulgaria and Croatia. On the other hand, the most significant decreases took place in the case of Latvia, Ireland and Poland. It is worth paying attention to the fact that a frequent case is the simultaneous improvement in the ranking of climate targets and deterioration for energy purposes, and vice versa, which is well illustrated by the examples of Greece, Croatia, Ireland and Latvia. This may mean that states tend to place greater emphasis on the implementation of a specific group of goals related to EU policy, ignoring the latter.

The correlation coefficients between the positions of countries in achieving energy goals and the positions of implementing climate policy in 2011 and 2020 are respectively 0.505 (p value < 0.05) and 0.378 (non-significant).

5. Conclusions

Energy and climate policy is of particular importance in the modern world. EU countries are making efforts to improve energy efficiency and reduce air pollution. The consequence of actions taken by most countries is the improvement of indicators concerning energy and climate policy. The European Union places great emphasis on obtaining energy from environmentally friendly raw materials. The clear leaders in the EU when it comes to the share of renewable energy sources in gross energy consumption in 2020 were Sweden, Finland, Latvia and Denmark. Only three countries have national targets for the share of renewable energy in gross final energy consumption of at least 50% and these are Sweden, Denmark and Finland.

Countries are trying to use the generated energy more efficiently, hence energy productivity increases in all analysed countries.

Bulgaria, Italy and Slovakia have introduced the most effective measures to reduce the occurrence of harmful substances in the air. Most countries except Latvia and Lithuania have reduced their greenhouse gas emissions. Revenues from taxes on environmental protection decreased in 2020 compared to 2011. More than half of the countries have reduced their energy dependence. In particular, production of energy from domestic resources was increased by Ireland, Latvia, Portugal and Finland. In turn, Denmark, the Netherlands, Romania and Poland increased the volume of imported energy resources.

All Member States have reduced the occurrence of harmful substances in the air. The division into the third group of countries implementing the energy and climate policy introduced by the EU showed that the indicators that differentiate countries to the greatest extent are greenhouse gas emissions and the energy dependency ratio.

References

1. Barcz, J. (ed.) (2002). *Prawo Unii Europejskiej. Prawo materialne i polityki*. Warszawa: PiPG.
2. Chalvatzis, K.J., Ioannidis, A. (2017). Energy supply security in the EU: Benchmarking diversity and dependence of primary energy. *Applied Energy, Iss. 207*.
3. Commission Communication COM(2018)773. A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (2018).
4. Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (2009).
5. Elavarasan, R.M., Afridhis, S., Vijayaraghavan, R.R., Subramaniam, U., Nurunnabi, M. (2020). SWOT analysis: A framework for comprehensive evaluation of drivers and barriers for renewable energy development in significant countries. *Energy Reports, Iss. 6*, pp. 1838-1864. Available online <https://doi.org/10.1016/j.egy.>
6. Energy Union Package -Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: A framework strategy for a resilient Energy Union with a forward-looking climate change policy, (2015), COM 80 final, European Commission.
7. European Commission. Communication from the commission to the European parliament, the Council, the European economic and social committee and the committee of the regions.

- A policy framework for climate and energy in the period from 2020 to 2030. (2013)
Available online <https://eur-lex.europa.eu>.
8. Eurostat. Retrieved from: <https://ec.europa.eu/eurostat>, 15.09.2022.
 9. Gokgoz, F., Guvercin, M.T. (2018). Energy security and renewable energy efficiency in EU. *Renewable and Sustainable Energy Reviews*, Iss. 96.
 10. *Key figures on Europe* (2021). Luxembourg: Publications Office of the European Union.
 11. Kukula, K., Luty, L. (2015). Propozycja procedury wspomagającej wybór metody porządkowania liniowego. *Przegląd Statystyczny*, Vol. LXII, Iss. 2, pp. 219-231.
 12. Li, X. (2005). Diversification and localization of energy systems for sustainable development and energy security. *Energy Policy*, Vol. 33, Iss. 17, pp. 2237-2243.
 13. Mahjabeen Shah, S.Z.A., Chughtai, S., Simonetti, B. (2020). Renewable energy, institutional stability, environment and economic growth nexus of D-8 countries. *Energy Strategy Reviews*, Vol. 29, Iss. 100484. Available online <https://doi.org/10.1016/j.esr.2020.100484>.
 14. Musiał, W., Ziolo, M., Luty, L., Musiał, K. (2021). Energy Policy of European Union Member States in the Context of Renewable Energy Sources Development. *Energies*, Vol. 14, Iss. 10, 2864. <https://doi.org/10.3390/en14102864>.
 15. Nations, U. (2015). *Paris agreement*. Conference of the Parties to the United Nations Framework Convention on Climate Change.
 16. Nermend, K. (2017). *Metody analizy wielokryterialnej we wspomaganiu decyzji*. Warszawa: PWN.
 17. Walesiak, M. (2014). Przegląd formuł normalizacji wartości zmiennych oraz ich własności w statystycznej analizie wielowymiarowej. *Przegląd Statystyczny*, Iss. 4, pp. 363-372.
 18. Wąs, A., Sulewski, P., Krupin, V., Popadynets, N., Malak-Rawlikowska, A., Szymańska, M., Skorokhod, I., Wysokiński, M. (2020). The Potential of Agricultural Biogas Production in Ukraine—Impact on GHG Emissions and Energy Production. *Energies*, Vol. 13, pp. 5755-5774. Available online <https://doi.org/10.3390/en13215755>.
 19. *World Development Indicators*. Retrieved from: <http://www.worldbank.org/data/onlinedatabases/onlinedatabases.htm>, 22.09.2022.
 20. Zielona Księga. Ramy polityki w zakresie klimatu i energii do roku 2030. Green Paper A 2030, *framework for climate and energy policies/COM/2013/0169* final (2013).

REVIEW OF MOTIVATION THEORY AND THE METHODS FOR ITS IMPLEMENTATION IN MINING INDUSTRY

Aneta MICHALAK^{1*}, Michał ZOCHOREK²

¹ Silesian University of Technology, Faculty of Organization and Management; aneta.michalak@polsl.pl,
ORCID: 0000-0002-0935-6674

² Jastrzębska Spółka Węglowa SA, miczoc1991@gmail.com, ORCID: 0000-0001-7103-314X

* Correspondence author

Purpose: The aim of this article is to present a review of selected motivation theories and indicating their components implemented in a mining industry enterprise.

Design/methodology/approach: The article is cognitive in nature and the basic research method is the analysis of literature on the subject. Literature studies include the analysis of domestic and foreign literature. The article also uses a case study based on the analysis of internal documentation of a selected mining enterprise.

Findings: The analysis of the literature performed shows that the theory of motivation has undergone a significant evolution. Contemporary motivation systems should draw from all theories, which will allow us to construct a comprehensive and diverse motivation systems.

Research limitations/implications: The survey research presented in the article is theoretical in its nature and may contribute to further empirical research.

Practical implications: The practical implications of the conducted research make it possible to use them to build motivation systems in enterprises.

Originality/value: The literature review regarding the subject indicates the need for a comprehensive approach to building a motivation system in an enterprise.

Keywords: motivation theories, motivation.

Category of the paper: General review.

1. Introduction

One of the most important components of effective human resource management in an enterprise is motivating employees. The essence of motivating is to stimulate and maintain the internal strength to act. Motivation is an inherently individual problem concerning a specific employee (Kopertyńska, 2009). The term "motivation" comes from the Latin words motus, which signifies mental activity, running, movement, as well as moveo meaning stimulating to action, encouraging someone to do something, influencing someone. The literature on this

subject defines the concept of motivation in many ways. One can meet the definition that motivation includes all the driving forces that stimulate an individual to make a choice, take an action, or remain ready to act (Jasiński, 2001). According to S. Borkowska, motivation is the internal state of a person with an attributive dimension, being a characteristic of every human being, however the process of motivating has an action-related and functional dimension, consisting in a conscious and intentional influence on the motive of people's behaviour by creating means and the possibility of implementing their value systems, expectations to achieve goals (Borkowska, 1985). In general, it is the intention to do something to achieve something.

In the past, views and understanding of motivation were changing. Initially, the focus was only on remuneration. Such an approach to motivation is presented by Adam Smith in his book "The Wealth of Nations". In his opinion, salaries/wages should reflect the differences in qualifications and talents of employees, while the market was to be the main regulator of their amounts. Basically, however, in the past it was believed that workers' wages should be as low as possible, but high enough to support and raise another generation of workers.

The Human Relations school was the initiator of greater interest in the dignity aspects of human work and non-material motivators. The warfare in the second half of the 20th century, as well as the rivalry between the two economic systems at that time, meant that decent pays and working conditions, and thus raising the standard of living, were treated as an important factor indicating the superiority of liberal democracy over communism (Penc, 2000). Other equally important factors influencing the change in the approach to the subject of motivation included, among others, the development of globalisation and the relocation of production.

Particularly intensive development of research on the issue of motivation began in the 1950s. At that time, several globally popular theories of motivation emerged, which became the basis for many modern concepts in the field of motivation (Karaś, 2003). In the short development period of management science, three main concepts of human in the organisation emerged (Sikorski, 2004). The concept of "economic man" was present in the nineteenth and twentieth centuries, during the development of "scientific management". According to the concept, a man is one of the organisation components, but differs from other resources in that he works for money and seeks to maximise his/her benefits. The employee, according to the concept, is willing to put additional effort into work, if he/she expects to get benefits associated with it. The concept of "economic man" found fertile ground, born as a result of fascination, monotony and mass functioning of mechanical devices. The ubiquitous adoration of efficiency has pushed all non-economic human needs into the background. The concept of "social man" emerged as a result of the famous Hawthorne experiment in the 1910s. The result of the research was to indicate that social working conditions, strongly related to the sense of belonging to a group, as well as the sense of personal bond with its members, are much more important than physical working conditions. It was then that the humanistic trend in the science of management

was born, known as "human relations", which indicated that economic stimuli became not the only stimuli affecting the employee. Economic reforms made it necessary to rebuild the motivation system, being its central element. The main economic goals and priorities of the 1980s were to increase production, restore the market balance, eliminate waste, improve management efficiency, and optimise the use of material and human resources. This could only be achieved if both people and companies were interested in their implementation (Kabaj, 1984).

The concept of "self-actualised man", also known as the concept of "total man", began to spread in the context of changes, mainly in the environment of enterprises, caused by the market globalisation and a significant increase in competition. Innovation and the speed of adaptation to new conditions became more important than ever. This concept assumes that the employee should satisfy all the basic types of needs – including self-actualisation and development. Recognising the knowledge and the need to update it on a continuous basis is the most essential feature of the information civilisation era, regardless of the industry.

2. Classification of motivation theory

The ways of motivating, or shaping motivation, have evolved along with the exploring of the human nature complexities. Representatives of various sciences dealt with this research: philosophy, theology, psychology, and management sociology. The research dealt with human labour, people's attitude towards it, motivation and work management. Scientific achievements in the field of motivating initiated the process of arranging and classifying the existing concepts of motivation. Over the centuries, many different theories of motivation have been developed. The most important of them include:

- A) economic man or the theory of motivation in the traditional sense by F.W. Taylor,
- B) theories formed within the framework of the social system school, which can be classified in terms of subjects as:
 - theories of content (needs) – the essence of this doctrine is an attempt to find an answer to the question what motivates the employee, and thus emphasising the importance of needs as the basic motives for action. The most popular theories in this category were created by A. Maslow, F. Herzberg, C.P. Alderfer, D. McGregor;
 - process theories – in this case, the focus is both on motives and on the processes of choosing the direction and the pattern of behaviour. When applying these theories, one should answer the question: how to motivate effectively? One of the most popular theories of this type are expectation theories created by L.W. Porter, E. Lawler, V.H. Vroom and justice created by J.S. Adams;

- C) reinforcement theories – according to these theories, changes in individual behaviour result from reinforcements and experiences from the past – created by B.F. Skinner (Kopertyńska, 2009).

3. Traditional motivation theory

Created by F.W. Taylor is a traditional approach to motivation based on the assumptions of the scientific organisation school. This section of research was determined by the analysis of interpersonal relations prevailing in the feudal system, where the manager had power, while the subordinate was forced to perform his duties. Motivation at that time was based on the use of appropriate physical, mental and administrative coercive measures. However, the result of such treatment of employees is usually reluctance or even hostility towards the superior. Over time, these methods began to be abandoned. The overused punishments started losing its popularity being replaced by other means of motivation, such as rewards, incentives, and persuasion. The subordinate was treated as an equal partner. According to the F.W. Taylor theory, money is the most effective motivator. His research was based on the idea of the economic man (*homo economicus*). They showed that the employee would perform such activities that would result in higher remuneration. If the supervisor determines that the person will receive a higher salary when he/she achieves better productivity, it should be expected that his actions will be aimed at achieving this goal (Benedikt, 2003). The F.W. Taylor theory has many critics who claim that it is difficult to determine the real impact of material incentives due to their association with working conditions, the nature of work or attitudes at work, which also have a significant impact on employee motivation (Beech, McKenna, 1999).

4. Needs-based theories

The A. Maslow's hierarchy of needs theory was focused on the human. Maslow hypothesised that in actions man aims to satisfy a set of needs arranged in a hierarchical structure. The A. Maslow's theory was inspired by the achievements of E. Mayo's school of social relations (Moczyłowska, 2008). After the basic (physiological) needs are satisfied, the needs of a higher order should be also satisfied. However, it should be noted, that as long as the urgent need is not met, it remains a strong motivator. According to Maslow's theory, there are five groups of needs, arranged on five levels:

1. Physiological needs – these are basic matters necessary to survive and function in terms of biology. Within an organisation, they can include wages/salaries, lighting, sanitary facilities, temperature.
2. Safety needs – these are the needs for a stable mental and emotional environment. It is about ensuring safety, protection, justice and the elimination of threats. Examples of safety needs that can be satisfied by an organisation include: company housing, sickness benefits, pension and disability programmes, continuity of employment.
3. The needs of belonging – these are the needs related to the relationship with others, corresponding to the need for love and acceptance by the surrounding people. Failure to meet these needs can lead to feelings of rejection and alienation, as well as withdrawal and loneliness. This undoubtedly affects the functioning of the employee in the workplace and workplace efficiency.
4. The needs of recognition – this need manifests itself within a group of colleagues. It gives a sense of importance in the group and the public recognition of achievements. It can be divided into external, i.e. recognition in the eyes of others, and internal – a positive image of yourself in your own eyes. The examples of satisfying the need for recognition in an organisation include: company car, own office, position, job title.
5. The need for self-actualisation – unlike other needs, this one is related to the need for human development. At this level, people focus on fully actualising their own potential. Full satisfaction can be achieved by fulfilling their personal ambitions. In contrast to other needs, this one is never satisfied. We refer to it as the process of continuous improvement and development. Examples of fulfilling the need for self-actualisation within an organisation include: participation in management, autonomy at work.

In addition to the above needs the A. Maslow's theory also includes some additional needs that cannot be observed in all people. These are the needs for knowledge, understanding, curiosity or the needs for aesthetics. They are associated with the need for self-actualisation (Sekula, 2008).

The A. Maslow's theory is not universal. In fact, individual human needs are shaped by many factors, such as profession, life situation, education. The limits of satisfying these needs depend on social and cultural phenomena. For example, employees being dependent in the performance of their professional tasks or with low education often limit themselves to meeting basic needs.

The F. Herzberg's theory is based, just like the previous ones, on needs as the basic action motivators. There are two groups of motivators in this theory (Sikora, 2000):

- A) external (hygienic) factors – apply to the working environment, company policy and working conditions. They include i.a.:
 - quality of supervision,
 - work safety,

- interpersonal relations,
- pay.

Their improvement does not contribute to an increase in work motivation. They only allow to eliminate dissatisfaction.

- B) internal (motivating) factors – they apply to the work content. Such elements as an interesting job, the possibility of promotion, responsibility, recognition, the possibility of personal development, and power contribute to an increase in job satisfaction, which in turn leads to an increase in employee efficiency.

The C.P. Alderfer theory is a modified A. Maslow's theory. According to Alderfer, the hierarchical classification of needs reflects the complexity of human behaviour. The perception of human needs is a continuous and dynamic process. According to him, a person can have many needs at the same time, so he divided the needs according to the time they are felt into:

- short-time,
- long-term,
- occasional.

The model assumes that the lack of constant satisfaction of development needs frequently results in such employee reactions as: frustration, reluctance to work, fluctuation, which in turn may lead to the so-called burnout syndrome. The C.P. Alderfer's theory says that motivation is a function of need intensity classified into the following groups, corresponding to Maslow's hierarchy:

- the needs of existence – these include, for example, the need to satisfy hunger and thirst, but also the needs related to pay, additional benefits and working conditions. The defined needs correspond to the physiological and safety needs defined in the Maslow model;
- needs of relatedness – they correspond to the needs of belonging in Maslow's theory, assuming that people are not self-sufficient individuals, but must engage in relationships with other people. We can distinguish the needs of acceptance, understanding, confirmation, influence, affiliation;
- personal “growth” needs – are related to self-actualisation and recognition for the employee (Kozłowski, 2022).

Summary

The conducted research provides an important conclusion for the management. Namely, money is seen by workers (both regular workers and managers) as the most important motivator. Meanwhile, the salary motivators used in the surveyed company were poorly assessed by employees.

Remuneration provides employees with decent living, thus fulfilling the economic wage function. Unfortunately, it does not fully fulfil the motivational function. This situation is partly due to the economic crisis which, in particular, has affected the coal sector. The payments of bonuses granted in accordance with the corporate collective labour agreement, i.e. the St. Barbara's Day award, the fourteenth salary and the coal allowance, are temporarily suspended. Pays for working on public holidays and overtime bonuses have also been reduced. These actions have significantly lowered the morale of employees, and the existing role of the pay as the main motivator is disturbed. This is by no means the only reason for low motivation level. The increase in wages and salaries does not compensate for the high inflation rate with which most countries, including the Polish economy, are struggling. Little or no increase in remuneration under these conditions not only has no stimulating effect on motivation, but also reduces it effectively. Satisfaction with the amount of earnings was declared by 35% of the respondents, such a small number of satisfied employees means that the wage/salary is below the expected value, therefore it has a motivation reducing effect. The employee needs to be aware of the relationship between the amount and work quality (contribution) and the pay received, so if the remuneration system is complex, incomprehensible by employees and does not allow to provide fair compensation, it is psychologically useless, which means that it motivates employees ineffectively. The conducted research shows that the wage/salary system in the mining enterprise under survey is illegible. The company should consider changing or updating the current remuneration system. Managerial staff, despite the fact that they know how to effectively motivate their subordinates, do not have many tools to do it effectively. Some of them believe that the current remuneration system does not work at all as a motivating factor. The pay structure should be restructured in such a way to differentiate the level of the awards granted and adjust them to employees' specific expectations, desires and aspirations, as well as to the goals and expectations shown by the organisation. The tools and forms of motivating should not be uniform, but rather diversified, at least for the profile of employment groups and decision-making levels. Motivating should be positive in nature, i.e. only the better than average or even the best results should be rewarded. Such motivation favours the release of initiatives and entrepreneurship, encourages the improvement of work results, and also facilitates maintaining various amounts and the frequency of bonuses, which increases their motivational power, as well as facilitates the economical and effective use of limited funds allocated for work remuneration. The impact of the employee on the rewarded work effect should be visible, because, as employees themselves say, "bonuses are well worth the try". Please note that in all environments, especially in the working-class environments, pay is the basic and even the most important means of motivation, because it create conditions for improving the quality of life and enriching its content in leisure time, at the same time increasing the financial status of the employee and his family. This statement is confirmed by the results of surveys for both employee groups.

5. Theory based on relations and human characteristics

The D. McGregor's X and Y theory is an attempt to define the relationship between employees and their superiors in a situation of intensive industrial development. This concept is based on two opposing views regarding human nature (Sekuła, 2008).

The first view – the X theory says that workers do not like work, are lazy, reluctant to take any responsibility, have problems solving problems and they want to be managed. They have to be forced or bribed to work. In this case, managers behave like tyrants, treating employees in an inhumane way, using them up to the limit. This theory used to support the classic approach to people management, where human actions are initiated to avoid punishment. Such an approach results in the inhibition of employees' development and enables manipulating them. Motivating employees is limited to meeting their physiological and safety needs. Most commonly, it is linked with a threat of depriving people the possibility of meeting these needs.

The second view – theory Y was created because the first concept was considered questionable by many psychologists. They believed that people were more active when not under the regime, showed greater interest in work, and that work was even necessary for them to develop. According to the Y theory, employees set themselves ambitious goals and have a desire to satisfy the higher order needs. No control is required then. An organisation that uses this approach places less emphasis on control and tries to ensure that employees are able to use their potential. Employees are given greater rights, but it is also associated with higher expectations placed on them. In such organisations the atmosphere of impossibility is practically absent, while appears a desire to act and pride in achievements.

The theory of achievements, created by J.W. Atkinson, tries to find an answer to the question of what individual human characteristics may influence his/her motivation to work. Atkinson has concluded that a person pursues a goal because it results from his belief in success, the incentive to achieve the goal, and the strength of the underlying motive or need. He identified the basic features of people with a high need for achievement, among which he distinguished (Boski, 1980):

- willingness to take responsibility for the tasks performed,
- using help only when it is really necessary and only with the most competent people,
- setting ambitious, but realistic goals by taking well-calculated risks,
- willingness to know the assessment of the goal achievement, regardless of whether it will be positive or negative.

People with such characteristics are honest, open-minded, focused on current tasks and financially interested, as long as it is a form of recognition of their success or information about their effectiveness. They usually become successful entrepreneurs, while honesty and focus on the most important issues make them attractive candidates for top management positions.

On the other hand, little interest in colleagues may reduce their effectiveness in dealing with people and managing them (Glick, Tarczyńska, 1999).

Further development of this theory was carried out by D. McClelland and H.A. Murray who, in addition to the need for achievement, distinguished (Moczyłowska, 2008):

- the need for power – in people with a high need for power, the features of controlling, managing and influencing others, maintaining the leadership position in the group,
- the need to belong – people with this need show a strong desire to win the recognition of others. They submit to the requests of people they respect or care about. They have a sincere interest in the feelings of others.

6. The theory of justice, expectations and reinforcements

The theory of justice, created by J.S. Adams assumes that a person should be fairly rewarded for the work performed. An employee often compares the amount of his earnings to other employees, which in the event of any deviations, leads to tensions. In this theory, distributive justice is distinguished, which means that the ratio of remuneration to employee costs should be proportional to other employees (Sekula, 2008).

The theory of expectations, created by E.C. Tolman and K. Lewin in the 1930s, where motivation is understood as the desired results of an action, as well as the expectations that the results will be achieved (Sekula, 2008). Motivation in this case is a function of the subjective value of each performance level and the subjective chance that a given level of intensity will lead to that level of performance. So, it can be said that motivation is linked with a certain level of intensity. The subjective value of a given level of performance depends on the subjective value of the results expected and the perception of relations, as well as to what extent a given level of task performance leads to specific results.

The theory of reinforcement was created by B.F. Skinner, stating that individual human behaviour is conditioned by previous experiences. People's behaviour depends on their past experiences, so some behaviours are associated with positive effects, while others with negative effects (Oleksyn, 2001). Based on this, the so-called law of effect has been created. It says that behaviour providing pleasant consequences is likely to be repeated, while behaviour associated with unpleasant consequences, will be abandoned. According to this Skinner theory, human behaviour is controlled by the social environment, but not all the determining factors have their source in the environment, but may have a genetic background. Translating the reinforcement theory into the context of organisation, it can be said that the change in employee behaviour focuses on the compensation policies and expressing recognition that facilitates employees to acquire work habits bringing satisfaction and achieve organisational goals.

Skinner's rules for modifying behaviour confirm the common knowledge that the most effective way to extinguish undesirable behaviours is the simultaneous use of negative reinforcements and providing the positive reinforcement of desired behaviours. Seemingly contrary to popular beliefs, a scheme of effective punishment has been created to become a tool to quickly extinguish undesirable behaviour. Two different reinforcement schemes cover the learning phase and the phase of manifesting the already learned behaviours that the rewards-holder wants to maintain in the individual (Woźniak, 2012).

7. Employee motivation in practice, based on the example of a selected mining industry enterprise

The evolution of the motivation theory has transformed the modern employee motivation programme into an extensive system, containing almost all the elements that individual theories addressed over the centuries. One of the industries widely recognised as having the most extensive employee motivation systems is the mining sector. In this sector there are numerous and quite complex documents regulating miners' wage matters, in particular, collective labour agreements. They were used as basis to create many remuneration components for employees in this industry. Motivation systems in the mining sector are not based solely on remuneration motivators. They are becoming more and more complex and use tools other than just salaries/wages. The examples include:

- supporting employees in personal development in accordance with their predispositions and abilities, e.g. by raising qualifications,
- participation in the management process, e.g. appointing members of the management board and supervisory board acting on behalf of employees,
- cafeteria-systems related to medical care, insurance package, rest subsidies and physical development.

A selected mining company was analysed as a case study of the contemporary motivation system. The company being the research subject was established in the early 1990s. Initially, it consisted of seven mines, now only four has remained. The company employs over 20 thousand employees, including over 17,000 underground workers (miners).

The company's policy is mainly based on activities aimed at improving employees through providing appropriate trainings and courses, thanks to which they become qualified specialists. In addition, the company enables employees to gain new professional experience by changing the workplace within the company structure. The versatility of the areas for implemented processes allows employees to change their career path without having to change the employer.

The company's website shows that every effort is made to ensure that, through the development of skills, employees can show a high level of motivation, efficiency and fully utilise their potential, while the tasks they perform support the company's business goals. The company's management board declares that employees, their knowledge, skills and competence are the company's greatest value, therefore it tries to provide everyone with optimal conditions for professional and personal development. Relations within the company are based on mutual respect, trust, openness and operation transparency as well as providing reliable information. An important aspect of the company's policy is to provide work safety for employees, ensured by maintaining the highest and most modern standards of risk protection and the high technical level of mines' equipment.

As in the case of the entire mining industry, the company meets the requirements of the Collective Labour Agreement. It says that the remuneration offered to employees takes into account, first of all, the value of the workplace where the employee is employed, including:

- qualifications and responsibility,
- the complexity and variety of work,
- the degree of risk, nuisance and physical effort that occurs at a given position,
- the impact of decisions made in a given position on the Company's operations.

In addition, the amount of remuneration depends on:

- individual qualifications, skills and professional experience of the employee, and manual abilities,
- the employee's performance at work,
- employee's contribution to the Company's results,
- compliance with health and safety regulations and care for their own safety and other colleagues.

Employees covered by the Agreement are subject to a temporary – bonus-based compensation system. This form of remuneration includes the following components: basic salary, bonus, bonus depending on the length of service (seniority allowance). In addition, employees are paid functional bonuses such as: brigade foreman, ward paramedic, employee instructor for the newly hired.

For each work hour in harmful, arduous and dangerous conditions, the employee is entitled to a bonus depending on the degree to which a given job position is assigned. Health hazards, particular harms and risks occurring in the work environment are divided into several degrees depending on the position.

Regardless of the basic remuneration components, employees who meet certain criteria are entitled to:

- awards for the Miner's Day (St Barbara's Day), the so-called "Barbórka",
- an additional annual award, the so-called fourteenth salary,
- coal allowance in cash,

- jubilee awards,
- one-time severance pay for employment termination resulting from the acquisition of an old-age or disability pension rights.

In addition, in the Company structures there is an incentive bonus aimed at motivating employees to work effectively and rewarding efforts made in order to obtain the best possible results. The incentive bonus is granted for exceeding the tasks related to the implementation of mining and face works, meeting the deadline for reinforcement or abandonment, and performing additional underground tasks. The incentive bonus may apply only to mine workers employed underground in blue-collar and non-worker positions (supervisors), performing their work in strictly defined places, in accordance with the internal plant regulations. For managerial staff supervising several works, the incentive bonus is determined as the arithmetic mean of the percentage of the bonus obtained by workers in the supervised departments and mining plant areas. Per each percentage of exceeding the task, employees receive an incentive bonus calculated as the product of the job rate and the bonus percentage in the amount of 1.2% for each day's work on working days at the positions covered by the incentive bonus. The maximum bonus amount is limited to 24%.

8. Summary

Nowadays, motivating employees is a very important component necessary to achieve the objectives of a specific organisation. The literature analysis covering the theory of motivation shows that over the years these theories have changed due to human needs. Contemporary motivation systems draw from each of the presented theories, constituting an extensive and diversified set of motivators. According to the traditional Taylor's theory of motivation, money is the basic component of the motivation system used in the enterprise under analysis. In addition to the basic salary, employees receive cash bonuses, allowances and financial rewards. The motivation system takes into account many components addressed by Maslow, Herzberg and Alderfer in their theory of needs. However, it can be noticed that in the system of employee motivation instruments created in the company under analysis the main emphasis is placed on financial factors. It seems that the motivation system in a mining enterprise should draw more from the achievement theory or the reinforcement theory.

References

1. Beech, N., McKenna, E. (1999). *Zarządzanie zasobami ludzkimi*. Warszawa: Felberg Sja.
2. Benedikt, A. (2003). *Motywowanie pracowników w sytuacjach kryzysowych*. Wrocław: Astrum.
3. Borkowska, S. (1985). *System motywowania w przedsiębiorstwie*. Warszawa: PWN.
4. Boski, P. (1980). *Potrzeba osiągnięć jako psychologiczny czynnik rozwoju społeczno-ekonomicznego*. In: J. Reykowski (ed.), *Osobowość a społeczne zachowanie się ludzi*. Warszawa.
5. Glick, A., Tarczyńska, M. (1999). *Motywowanie pracowników*. Warszawa: PWE.
6. Jasiński, Z. (2001). *Motywowanie w przedsiębiorstwie*. Warszawa: Placet.
7. Kabaj, M. (1984). *System motywacji i płac w reformie gospodarczej*. Warszawa: PWE.
8. Karaś, R. (2003). *Teorie motywacji w zarządzaniu*. Poznań: Wydawnictwo Akademii Ekonomicznej w Poznaniu.
9. Kopertyńska, M.W. (2009). *Motywowanie pracowników. Teoria i praktyka*. Warszawa: Placet.
10. Kozłowski, W. (2022). *Motywowanie pracowników w organizacji*. Warszawa: CeDeWu.
11. Moczydłowska, J. (2008). *Zarządzanie kompetencjami zawodowymi a motywowanie pracowników*. Warszawa: Difin.
12. Oleksyn, T. (2001). *Praca i płaca w zarządzaniu*. Warszawa: Międzynarodowa Szkoła Menedżerów.
13. Penc, J. (2000). *Motywowanie w zarządzaniu*. Kraków: Wydawnictwo Profesjonalnej Szkoły Biznesu.
14. Sekuła, Z. (2008). *Motywowanie do pracy. Teoria i instrumenty*. Warszawa: PWE.
15. Sikora, J. (2000). *Motywowanie pracowników*. Bydgoszcz: Oficyna Wydawnicza Ośrodka Postępu Organizacyjnego.
16. Sikorski, C. (2004). *Motywacja jako wymiana - modele relacji między pracownikiem a organizacją*. Warszawa: Difin.
17. Woźniak, J. (2012). *Współczesne systemy motywacyjne*. Warszawa: PWN.

**SALARY MOTIVATORS FROM THE PERSPECTIVE
OF UNDERGROUND MINE WORKERS EMPLOYED
IN BLUE-COLLAR AND MANAGERIAL POSITIONS
IN A SELECTED MINING ENTERPRISE**

Aneta MICHALAK^{1*}, Michał ZOCHOREK²

¹ Silesian University of Technology, Faculty of Organization and Management; aneta.michalak@polsl.pl,
ORCID: 0000-0002-0935-6674

² Jastrzębska Spółka Węglowa SA, miczoc1991@gmail.com, ORCID: 0000-0001-7103-314X

* Correspondence author

Purpose: The aim of the article is to analyse the salary motivators used in the mining industry enterprise and to assess their reception by underground workers employed in blue-collar and managerial positions.

Design/methodology/approach: The article is cognitive in its nature. The basic research methods include the subject literature analysis and survey research. Literature studies include the analysis of domestic and foreign literature. The survey research was conducted on a sample of 4,000 employees by obtaining the survey return of 8.75%.

Findings: The conducted research provides an important conclusion for the management. Namely, money is seen by workers (both regular workers and managers) as the most important motivator. Meanwhile, the salary motivators used in the surveyed company were poorly assessed by employees.

Research limitations/implications: The survey research presented in the article may contribute to further empirical research.

Practical implications: The practical implications of the conducted research make it possible to use them to rebuild motivation systems in enterprises.

Originality/value: The research results indicate the need for a comprehensive reconstruction of the motivation system in enterprises.

Keywords: salaries/wages, motivation, motivation tools, salary motivators, salary incentives.

Category of the paper: General review, Research paper.

1. Introduction

For years researchers and practitioners have been wondering over the cause and determination of human activity, as well as the ways and tools of stimulating and controlling it. The current state of knowledge does not allow us to predict all human behaviour, the richness and diversity of which make motivation suitable for a wide range and interpretation (Kozioł, 2002, p. 26).

There are many definitions of motivation available in literature. In general, "motivation consists in influencing employees by using various forms and means to make their behaviour consistent with the will of the manager and to channel them to carry out the tasks set before them" (Jasiński, 2007, p. 20). Another definition has been created by L.R. Bittel, who believes that "motivation is the inner state of mind and body, dreams, wishes, needs and what a person is guided by, which prompts a person to take actions" (Bittel, 1998, p. 164). Motivation can also be a management process involving affecting the behaviour of employees, taking into account the knowledge of what causes such and not other human behaviour (Kozłowski, 2009, p. 12). It is worth noting that motivating is an individual process for each person, because each person is different and shows different criteria for achieving their needs that would motivate them. In spite of this, some general theories about motivation have been developed throughout history. They have been changing due to changes in human needs. It can be noticed that even the first of them addressed the problem of remuneration as the basic factor motivating the employee. The development of organisation management sciences is inextricably linked with the development of social sciences. Their origins date back to the eighteenth and nineteenth centuries, mainly in the United States, England, France and Germany. Along with the industry development, it became necessary to improve the organisation of work process, increase efficiency and finally the skills of managing people: their motivation and effectiveness. Looking at the organisations that are operating today, it is impossible not to point out the path the researchers dealing with this field have travelled from the 17th century to the present day (Niekarcz, 2011, p. 11). In the 18th century, Adam Smith, in his book "The Wealth of Nations", presented a model according to which the pay should reflect the differences in qualifications and talents of employees, while the market should be the main regulator of its amount. For the next two centuries it was trendy to believe that workers' wages should be as low as possible, but high enough to support and raise an offspring, a potential worker candidate.

As time went by, there was a shift to greater interest in the dignity of human work and non-material motivators, but remuneration has always held one of the most important positions among all of them. The warfare in the 20th century, as well as the rivalry between the two economic systems at that time, meant that decent pays and working conditions, and thus raising the standard of living, were treated as an important factor indicating the superiority of liberal democracy over communism (Penc, 2000). J.S. Adams in the theory of justice assumes that

a person should be fairly rewarded for the work performed. Fair remuneration here refers to the ratio of remuneration to employee costs. The ratio of these two values should be the same for other employees (Sekuła, 2008). Along with the development of the scientific management school, which was the first to address the subject of motivation in a special way, there has been a significant qualitative change in the motivation systems. The main goal of the school was to significantly increase labour productivity. In the school of scientific management, the area related to work organisation and ergonomics was one of the most important subjects of interest. Nevertheless, the main discipline was wage formation. Once, the concept of "economic incentives" was very popular, as they were supposed to eliminate the disadvantages of a centralised and prescriptive system, boost their efficiency and effectiveness, manage the economy, and influence people's attitudes. They were also designed to increase the efficiency and effectiveness of employees. They were supposed to stimulate the initiative and inventiveness of progress (Kabaj, 1984, p. 5).

Over time, work became less physically and psychologically demanding, and many of the phenomena in the field of motivation of that time are also used today, and first of all:

- work dimensioning and evaluation,
- making remuneration dependent on the results of work,
- task-based remuneration system,
- bonus form of work,
- simultaneously applied negative and positive impact,
- assistance provided by instructors,
- competitive remuneration in relation to market pays,
- diagnosing factors of low work efficiency, using reliable methods, techniques and tools,
- eliminating redundant and repetitive work,
- -scheduling work and initiating scientific time management.

2. Pay motivation tools

The remuneration system is the basic tool for influencing employees and as such a tool should fulfil an income, cost (from the organisational point of view), motivational and social functions (Niekarcz, 2011, p. 75). The sense of using the motivational function is to match the interests of employees and those who motivate, i.e., usually the enterprise management. Remuneration is the main tool for motivating employees to work, although their role is not the same for all socio-professional groups. A skilful payroll management can significantly contribute to the increase in efficiency and dynamic company development Borkowska, 2006, p. 19). In the labour law related literature remuneration is defined as a cash benefit being

an equivalent paid for the type, quantity and quality of work performed by an employee. Legal regulations as well as the judicature related to the remuneration regulation provide a number of legal measures and principles whose task is to create mechanisms to protect this declaration (Juchowicz, Rostkowski, Werner, Wasilewski, Kinowska, Kimla-Walenda, Zając-Pałdyna, Kostrzewa, 2020).

When motivating employees, many different factors should be taken into account. However, managers often do not have a complete freedom in decision-making. Their motivation systems depend on external and internal determinants. Examples of motivation system determinants include:

- employee skills and the quality of cooperation provided,
- competences and the division of roles for human resource management entities,
- expectations of owners, managers, employees and trade unions,
- organisation position and its financial capacity,
- organisation identity and culture,
- the presence or absence of trade unions,
- quality and results of collective bargaining,
- labour law, taxes,
- other external influences such as technological progress, science, competition, economic situation or the grey economy.

In general, motivators can be divided into material and non-material (Wachowiak, 2002). The division is clear, but not precise, because the non-material motivators are linked with the costs incurred by the employer. An example of such a motivator is, for example, your own office, which gives the employee prestige, while having no material dimension, but for the employer it can turn out to be very expensive.

Moving on, material motivators can be divided into cash, monetary value related, benefits in kind and other company-financed or co-financed benefits. Most commonly, the basis of the motivation system are material motivators. Motivators are frequently both material and non-material. An example could be a job promotion. It provides satisfaction to the promoted person, increases their prestige, and is also often associated with a higher pay. The motivators shown are the components of incentive measures as opposed to coercive measures. They have a large motivational load, based mainly on awards. The rules for granting them should be simple and understandable for all employees. Incentive can be most easily tailored to the individual needs and expectations of workers in small businesses. In medium and large enterprises, solutions often dominate, which cause dissatisfaction of employees with high ambitions and potentials (Kozłowski, 2009, p. 31).

The shape of motivation systems is frequently determined by such factors as: legal status, financial capacity of the organisation, preferences and beliefs of managers, employee expectations, location of the organisation and local traditions, as well as the age profile of employees and many others.

The most commonly used salary/wage motivators include:

- adequately high base salary and the possibility of increasing it – the strength of the motivational impact is very large,
- the possibility of a wage increase without changing the job nature and position – the strength of the motivational impact is very high, when it is related to the assessment of results, and smaller with automatic increases,
- an increase in salary related to a job promotion – the strength of the motivational impact is very high,
- bonuses, awards, allowances – the strength of the motivational impact is very high or high depending on the attractiveness versus effects. It also depends on the motivation system, whether it is effectively implemented and consistently applied,
- profit sharing and participation – it can have a very strong motivational effect depending on the amounts and solutions. Quite widely used in the enterprise sector.

In addition, frequently used pay motivators featuring a high motivational power are bonuses for overtime work, including bonuses for work on Sundays and public holidays. Many organisations also use motivators with a very low motivational impact, including:

- seniority bonuses – they encourage employees to be loyal and work for a specific organization,
- jubilee awards – they are important only in the pre-retirement period,
- night allowances – they are ineffective because the rates of these allowances are usually too low to compensate for the particular inconvenience of working at night,
- allowances for working in harmful and particularly arduous and dangerous conditions – these allowances are quite controversial, because instead of counteracting harmful and dangerous working conditions by providing appropriate technical and organisational measures, employers try to resort to illusory problem solving by paying such allowances. They are not a full equivalent for damage to health, shorter life and deteriorating its quality. However, in some industries, such as mining, workers often decide to work in harmful and dangerous working conditions. The main motivator here, however, is not the allowance for working in harmful conditions, but other strong motivating factors.

Pay plays an important role as a psychological factor. Good remuneration creates conditions for improving the quality of employee life and their families, which is an important driving factor stimulating human activities in the process of meeting needs and aspirations. Living at the level of higher needs means greater fitness, better health, richer inner life and stronger motivation for success (Kozłowski, 2009, p. 101).

3. Survey research - assumptions

The survey research was aimed at verifying the way of receiving basic pay incentives that affect underground mine workers. These include, first of all, remuneration as the basic driving force of human actions, which is an important instrument for stimulating affirmative attitudes and production behaviour of employees in any organisation. In addition to the basic pay in the mining industry, there are a number of other wage incentives. In order to investigate the motivational function of remuneration and other wage incentives from the perspective of workers employed in blue-collar and non-blue-collar (managerial) positions, the survey research was conducted. The research was carried out in a mining industry enterprise. Selecting the mining industry is due to the fact that it is a strategic industry for the economy, largely influenced by the state and characterised by an extensive system of money motivators. Most of the motivation system pay components used in the mining enterprises result from the provisions established by the Collective Labour Agreements.

The enterprise under survey is a company employing over 20,000 people. Employees, of which underground workers (that is working underground) amount to over 17,000 people. The company runs four mines. All mines within the company's structures pursue a uniform motivation policy. The study of the basic motivation effectiveness, which is remuneration, was carried out in one of the mines that make up the company's structure. The research tool was an anonymous survey addressed to workers employed underground in a selected mine in blue-collar and non-worker (managerial) positions. The content of the survey varied depending on which of the above two groups of employees it was addressed to. The mine employs over 4000 people underground and the survey was addressed to all the employees, 350 surveys were received in response.

The surveys addressed to blue-collar employees differed from the surveys addressed to employees in non-manual worker (managerial) positions. This allowed us to look at the same problems from two different perspectives and compare the way a specific problem was perceived by the worker and the manager.

Both survey versions contained phrases that had to be answered by marking one of the answers:

- 1 – I strongly disagree.
- 2 – I rather disagree.
- 3 – I rather agree.
- 4 – I definitely agree.

Survey questions addressed to workers in blue-collar positions are included in Table 1, while questions for employees in non-manual (managerial) positions are presented in Table 2.

Table 1.

Research questions of the survey addressed to mine workers employed in blue-collar positions

Answer by putting X in the appropriate box	1	2	3	4
I feel satisfied with the amount of my earnings.				
I am remunerated adequately to the effects of my work.				
I am underpaid in relation to the rest of the staff.				
I understand well the principles of remuneration within the organization.				
The principles of remuneration within our organisation are well defined and understandable.				
The remuneration system effectively motivates me to work.				
The bonus is well worth the effort.				
In my opinion the bonuses are distributed fairly.				
My salary ensures a decent living.				
The remuneration system effectively increases people's involvement.				
I understand very well how my bonus is linked to the results of my work.				

Source: own work.

Table 2.

Research questions of the survey addressed to mine non-manual workers (employed in managerial positions)

Answer by putting X in the appropriate box	1	2	3	4
I believe that my subordinates are well paid for the work they do.				
An employee in the early period of professional activity should be motivated by a financial promotion related reward.				
I can motivate others to work well.				
Employees are remunerated in accordance with their contribution.				
I understand well the principles of remuneration within the organisation.				
The principles of remuneration within our organisation are well defined and understandable.				
The bonus programme has a positive effect on teamwork and cooperation.				
Employees try harder knowing that they will receive a bonus for a well done job.				
In my opinion the bonuses are distributed fairly.				
The remuneration system effectively increases people's involvement.				

In the second part of the survey, a direct open question was asked. The following question was addressed to workers in blue-collar positions: *Arrange the motivating factors according to the most effective ones* (development opportunity, money, distinction, promotion opportunity, other material goods).

The following question was addressed to workers in managerial positions: *What do you think motivates employees most? Arrange the motivating factors from the most effective ones* (development opportunity, money, distinction, promotion opportunity, other what?).

4. Research results

The survey research was aimed at verifying the way of receiving basic pay incentives that affect underground mine workers. The reception of pay motivators by underground workers, broken down into blue-collar and non-manual positions, is shown in Figure 1.

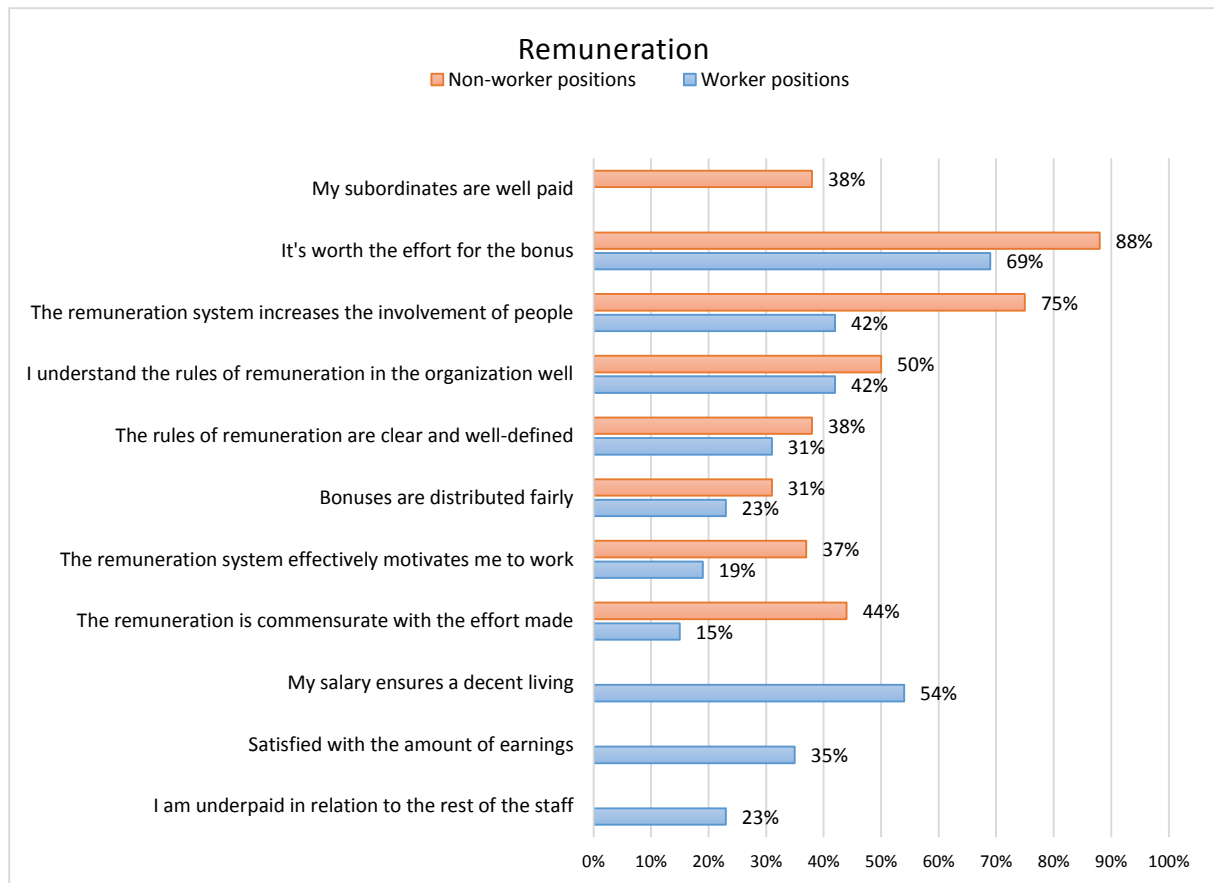


Figure 1. Reception of pay motivators by employees.

Source: own work.

Figure 1 shows the percentage of employees who agree with the specific statement. Slightly more than half of the surveyed blue-collar workers believe that the money they receive for the work they do ensures decent living. Only 35% of respondents working in blue-collar positions feel satisfied with their salary. Their superiors have a similar opinion, only 38% of them say that subordinates are well paid.

The biggest differences in opinion between the two groups of employees can be noticed for the question whether the remuneration is adequate to the effort made. Here, only 15% of workers from the group of blue-collar workers agree with this statement, while almost half of their superiors claim that workers are remunerated adequately to the effort they put in.

Big differences in the answers are also visible for the statement that the remuneration system motivates the employee to work. 19% of blue-collar workers and 37% of non-manual workers agree with this statement. The differentiation of answers in particular groups of employees to the question of whether the remuneration system increases employee engagement looks similar.

Remuneration, as a motivator, was not generally positively assessed by employees. Most employees do not feel motivated by the remuneration they receive, and they do not understand the principles of establishing remuneration. In the opinion of employees, only the bonus-based system makes it possible to increase their involvement.

Such an unfavourable perception of wage/salary motivators in the enterprise under survey should be superimposed onto the answers obtained in the second part of the survey. In the open question, both blue-collar workers and managers were asked to arrange the motivating factors according to their importance. In the first place among the surveyed workers, money was most often chosen as the best motivating factor. This group of employees indicated the possibility of development in second place, and the award and the possibility of promotion in third place. When asked about the same, management staff clearly indicated money as the most effective motivator, and some of them indicated that it was the only motivating factor for employees. The possibility of promotion was most frequently indicated in second place, while the third place was taken by the employee distinction.

5. Summary

The conducted research provides an important conclusion for the management. Namely, money is seen by workers (both regular workers and managers) as the most important motivator. Meanwhile, the salary motivators used in the surveyed company were poorly assessed by employees.

Remuneration provides employees with decent living, thus fulfilling the economic wage function. Unfortunately, it does not fully fulfil the motivational function. This situation is partly due to the economic crisis which, in particular, has affected the coal sector. The payments of bonuses granted in accordance with the corporate collective labour agreement, i.e. the St. Barbara's Day award, the fourteenth salary and the coal allowance, are temporarily suspended. Pays for working on public holidays and overtime bonuses have also been reduced. These actions have significantly lowered the morale of employees, and the existing role of the pay as the main motivator is disturbed. This is by no means the only reason for low motivation level. The increase in wages and salaries does not compensate for the high inflation rate with which most countries, including the Polish economy, are struggling. Little or no increase in remuneration under these conditions not only has no stimulating effect on motivation, but also reduces it effectively. Satisfaction with the amount of earnings was declared by 35% of the respondents, such a small number of satisfied employees means that the wage/salary is below the expected value, therefore it has a motivation reducing effect. The employee needs to be aware of the relationship between the amount and work quality (contribution) and the pay received, so if the remuneration system is complex, incomprehensible by employees and does

not allow to provide fair compensation, it is psychologically useless, which means that it motivates employees ineffectively. The conducted research shows that the wage/salary system in the mining enterprise under survey is illegible. The company should consider changing or updating the current remuneration system. Managerial staff, despite the fact that they know how to effectively motivate their subordinates, do not have many tools to do it effectively. Some of them believe that the current remuneration system does not work at all as a motivating factor. The pay structure should be restructured in such a way to differentiate the level of the awards granted and adjust them to employees' specific expectations, desires and aspirations, as well as to the goals and expectations shown by the organisation. The tools and forms of motivating should not be uniform, but rather diversified, at least for the profile of employment groups and decision-making levels. Motivating should be positive in nature, i.e. only the better than average or even the best results should be rewarded. Such motivation favours the release of initiatives and entrepreneurship, encourages the improvement of work results, and also facilitates maintaining various amounts and the frequency of bonuses, which increases their motivational power, as well as facilitates the economical and effective use of limited funds allocated for work remuneration. The impact of the employee on the rewarded work effect should be visible, because, as employees themselves say, "bonuses are well worth the try". Please note that in all environments, especially in the working-class environments, pay is the basic and even the most important means of motivation, because it create conditions for improving the quality of life and enriching its content in leisure time, at the same time increasing the financial status of the employee and his family. This statement is confirmed by the results of surveys for both employee groups.

References

1. Bittel, L.R. (1998). *Krótki kurs zarządzania*. Warszawa-Londyn: PWN; McGraw-Hill Company Europe.
2. Borkowska, S. (2006). *Strategie wynagrodzeń*. Kraków: Oficyna Ekonomiczna.
3. Jasiński, Z. (2007). *Motywowanie w przedsiębiorstwie*. Warszawa: Placet.
4. Juchowicz, M, Rostkowski, T., Werner, A., Wasilewski, J., Kinowska, H., Kimla-Walenda, K., Zając-Pałdyna, U., Kostrzewa, A. (2020). *Sprawiedliwe wynagradzanie pracowników z perspektywy prawnej, społecznej i zarządczej*. Warszawa: PWE.
5. Kabaj, M. (1984). *System motywacji i płac w reformie gospodarczej*. Warszawa: PWE.
6. Kozioł, L. (2002). *Motywacja w pracy. Determinanty ekonomiczno-organizacyjne*. Warszawa-Kraków: PWN.
7. Kozłowski, W. (2009). *Zarządzanie motywacją pracowników*. Warszawa: CeDeWu.
8. Niekarcz, Z. (2011). *Psychologia Motywacji w organizacji*. Warszawa: Difin.

-
9. Penc, J. (2000). *Motywowanie w zarządzaniu*. Kraków: Wydawnictwo Profesjonalnej Szkoły Biznesu.
 10. Sekuła, Z. (2008). *Motywowanie do pracy. Teoria i instrumenty*. Warszawa: PWE.
 11. Wachowiak, P. (2002). *Profesjonalny manager*. Warszawa: Difin.

ASSESSMENT OF DIGITAL COMPETENCES OF LUBLIN PROVINCE RESIDENTS IN RELATIONAL TERMS

Elena MIESZAJKINA^{1*}, Paula BOCHEN²

¹ Lublin University of Technology, Faculty of Management, Department of Management;
e.mieszajkina@pollub.pl, ORCID: 0000-0002-3449-4059

² Lublin University of Technology, Faculty of Management; paula.bochen@pollub.edu.pl

* Correspondence author

Purpose: Digital competences in the modern world play a significant role in people's lives. They are vital for building Society 5.0. They are the subject of research by many scholars as well as research organizations and groups. The objective of the article is to present theoretical considerations and results of empirical research on the assessment of digital competences of residents in relational terms.

Design/methodology/approach: The review of documents and diagnostic survey methods were used to achieve the objective. The first method consisted in a critical analysis of the literature on the subject and was used to develop methodological assumptions. The second was employed to conduct the empirical study among the residents of the Lublin Province. The results enabled the frequency of the use of digital competences to be linked with the significance of the individual areas of life.

Findings: The study confirmed that the residents recognize the importance of digital competences in different areas of life and are ready to develop the competences. The frequency of their use is not high and does not differ significantly in relation to age, education and occupational status. Respondents use the competences the most frequently in the most significant area of life – relationships with their loved ones. The competences are used with the lowest frequency in the least significant areas: religion and civic engagement.

Research limitations/implications: The pilot study enabled research assumptions to be verified. The snowball sampling method proved to be effective in the selection of the sample for exploratory purposes. In the prospective basic research, the sample will be selected in such a way as to ensure its representative character. The online survey technique will be replaced by the CATI to reach respondents who do not actively use ICT. The study showed the need for certain changes to be introduced into the research tool.

Practical implications: The research proved the validity of applying a relational model when assessing digital competences of residents. In this approach, instead of the areas of people's lives, they can also be analyzed in relation to organizations taking into account the spheres of the organizations' activity.

Social implications: The results of the study constitute a valuable source of information concerning Society 5.0 and the significance of digital competences. They confirm that the residents use them with low frequency, which indicates the need for systemic actions to be taken in order to enhance them.

Originality/value: The article is based on existing knowledge regarding Society 5.0 and digital competence research models. The originality of the study consists in the use of the relational approach that allows the frequency of their use to be linked with the areas of life significant for respondents.

Keywords: digital competences, Society 5.0, relational model.

Category of the paper: Research paper

1. Introduction

In recent decades, information and communication technologies (ICT) have significantly changed the way people live and the way organizations, societies and economies function and operate. A new type of economy – the digital economy – has developed under the ICT's influence. The specificity of ICT is determined, among others, by the intangible flow of data and information, the progressing automation of work owing to the use of artificial intelligence, and the cooperation of all participants of the socio-economic life in the virtual world, i.e. producers of goods and services, business environment institutions, households, and representatives of authorities.

The digital economy brings significant benefits into all spheres of people's functioning and is becoming a new driving force for the development of civilization. As a result of the ongoing changes, new spheres of social life transfer to the virtual space. This enables work and daily tasks to be performed in a more convenient, cheaper and faster way, frequently without having to leave one's home. Consequently, online shopping, contacts with friends via social networks, the use of e-services offered by state administration, education and health care sectors are becoming natural activities.

Virtually all areas of everyday life are being digitized. In order to find oneself in the dynamically changing digital reality and to actively function in the society, one needs access to modern technologies and the ability to effectively use them (Carretero Gomez et al., 2017; Larsson-Lund, Nyman, 2020; Radomska, 2019). Opportunities to gain both access to and skills in ICT are constantly expanding. However, there are a number of interrelated personal, environmental, and socio-political factors that hinder the digital participation of certain social groups and increase the risk of greater social fragmentation (Meyerhoff Nielsen, 2022; Anrijs et al., 2020).

The COVID-19 pandemic, on the one hand, has exposed and deepened socio-economic and digital divides (Seah, 2020; Van Deursen, 2020; Ulman, Cwiek, 2022). On the other hand, it has become a driving force behind faster digital development (Kudyba, 2020; Nguyen et al., 2021). Social visions regarding the introduction of possible solutions into business, educational, scientific, health, administrative and other aspects have changed. It turned out that a variety of

tasks can be carried out in a safer and simpler way, and more efficiently than before. Therefore, it is necessary to shape digital awareness in the society and help to enhance digital competences.

Digitization not only accelerates the socio-economic development of countries and individual regions, but also improves quality aspects (Nair, 2020; Radomska, 2019; Ulman, Ćwiek, 2022; Śledziowska, Włoch, 2020; Van Bon et al., 2021; Vyas-Doorgapersad, 2022). One of the prerequisites for obtaining such beneficial effects is to enhance digital competences of the society. The level of the competences in Poland, despite the growth in recent years, is low. According to the European Commission's Digital Progress Report 2021, Poland ranks 24th out of 27 EU countries in terms of the human capital of the digital society. Merely 44% of citizens possess fundamental digital skills, compared to the EU average of 56% (Digital Economy Index..., 2021). The present pilot study was conducted in the Lublin Province. Statistically, it is one of the least developed and poorest regions of Poland (Lamański, 2022). Therefore, the question arises concerning how its residents evaluate their digital preparedness? The objective of the present study was to assess in which areas of life and how often digital competences are used.

2. Digital competences in Society 5.0

2.1. Society 5.0

The concept of Society 5.0 emerged in Japan in 2016. The idea aims to create a human-centric society model. A characteristic feature that distinguishes Society 5.0 from the information society is a higher level of convergence of digital reality with the real one, facilitating the embedding of cyberspace in the real world. Such a society is also labeled super-intelligent or creative (Medina-Borja, 2017; Nair et al., 2021; Sá et al., 2021).

One of the assumptions of the concept is to solve social problems from a systemic perspective. Different areas of social life are already interconnected via the Big Data technology, the Internet of Things, and artificial intelligence. ICT will continue to evolve so that systems that have hitherto functioned separately are combined in cyberspace into larger, intelligent systems. This is expected to trigger transformational changes in various structures such as manufacturing, logistics, sales, transport, healthcare, finance and public services. The ways people work and live will also be modified. As a consequence, these changes are to lead to economic growth and improve well-being and the quality of people's lives (Report on the 5th Science..., 2015).

The development of Society 5.0 requires the cooperation of the government, businesses, various public institutions and citizens, who need to actively participate in this process. Digital literacy is critical. This concept evolves over time along with the technological progress.

In a broad sense, it denotes the ability to carry out tasks and solve problems in the digital environment. This means that people are able to find, understand, evaluate and apply information from various sources to solve personal, occupational, social, regional and even global problems. Digital literacy is crucial for the harmonious participation of individuals in a conscious, critical and purposeful manner in all spheres of life as users, as well as creators of digital technologies (Garbellan, 2018; Koppel, Langer, 2020; Milenkova, Lendzhova, 2021; Sá et al., 2021). It is closely connected with the process of digital inclusion of the society. S. Reder presented the path of digital integration, which consists of four key stages. The first stage features people who have never had access to or contact with ICT. The second stage encompasses those that use ICT in such a way as to meet their personal needs. The third stage is digital readiness, i.e. the focus on extending the scope of ICT use. The fourth stage includes people who are constantly developing their ICT skills, adapting to the digital reality with full awareness and intent (Reder, 2015).

The report developed by the Digital Poland Foundation emphasizes that we are witnessing digital evolution, and the world as we know it is constantly changing. One of the conditions for building Society 5.0 is to acquire the competences of the future. The interpenetration of the real world with cyberspace offers the opportunity for many global problems to be solved more effectively, and sustainable development goals to be achieved (Technologia..., 2021).

2.2. Definition of digital competences in normative and relational terms

The definition of the term "digital competences" is fuzzy and is being constantly clarified due to the rapid development of the digital world. Until recently, digital competences were considered highly specialized and held by a narrow group of insiders (Kwiatkowski, 2018). Nowadays, they not only begin to be universal. They become competences determining the effectiveness of human functioning in the contemporary society.

Digital competences can be considered under two approaches – normative (catalog) and relational (Analiza doświadczeń..., 2020). The former is consistent with the functional approach in management, the latter with the systemic approach. In the normative model, the reference point is a specific catalog of competences (knowledge, skills and attitudes). It is unchanging and the same for all. Each item from this catalog can be assessed and applied separately (or not) depending on the situation (Analiza doświadczeń..., 2020; Jasiewicz, 2018). One of them is the use of the Internet and ICT. With this assumption, every person, regardless of age, gender and their life needs, should use the computer and the Internet in a similar fashion. The relational model emphasizes that the Internet and ICT are not used by everyone within the same scope and in the same way. Digital competences are present in all areas of people's lives and facilitate functioning in them. Their appropriate level is one that contributes to the improvement of the quality of life of an individual in an area relevant to the person, and one that takes into account the individual's style of functioning (Analiza doświadczeń..., 2020; Jasiewicz, 2018).

According to the Council of Europe, digital competences constitute one of the eight key competences needed for active functioning in a sustainable society. They include "the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking" (Council Recommendation..., 2018). This constitutes the normative approach.

As part of the Operational Programme Digital Poland 2014-2020, the application of the relational approach described in the Framework Catalog of Digital Competences was offered. Competences are defined as a set of skills, knowledge and attitudes that allow the effective use of digital technologies. Three levels of competences were distinguished: IT, information-related and functional. IT competences are necessary to acquire information-related competences, which in turn support the mastery of functional competences. Each individual acquires and supplements them to meet their own needs and gain benefits in various areas of life (Jasiewicz et al., 2021).

Despite certain differences, these approaches complement each other. Regardless of how digital competences are defined and analyzed, they should be considered much more broadly than digital literacy. The cultural and critical dimensions are closely related to the operational dimension (ELINET, 2022; Joint Research Centre, 2012; Koppel, Langer, 2020). In order to build a digitally-aware society, the language of benefits should be used to show the impact of individual digital competences on all spheres of people's lives.

3. Digital competence and digital literacy research models

Citizens' digital competences are examined at levels ranging from local to global. Studies exploit both normative and relational approaches, depending on the purpose of the work and the intentions of researchers.

In the EU, the DIGCOMP model defining the Digital Competence Framework for Citizens constitutes a reference point for the development and strategic planning of digital competence initiatives. The model presents a description of the competences needed for challenges posed by digitalization in the modern society to be met. Since 2013, when the first version of the model was developed, DIGCOMP 2.0 (2016), and DIGCOMP 2.1 (2017) iterations were developed. In 2022, the DIGCOMP 2.2 framework emerged. It identifies new examples of knowledge, skills and attitudes related to the acquisition of digital competences by citizens. It describes five areas of digital competences at different levels: information and data literacy, communication and cooperation, digital content creation, safety and problem solving.

They encompass a total of 21 framework competences. The first three areas are linear in character and concern competences that can be linked to specific activities and applications. The latter two are more cross-cutting and pertain to all activities carried out using digital tools. Although each area has its own specificity, they are complementary and interrelated. Unlike previous iterations, the DIGCOMP 2.2 model places great emphasis upon the relational model of digital competence acquisition (Vuorikari et al., 2022).

In Poland, the reference point for activities aimed at ensuring and enhancing digital competences is the Framework Catalog of Digital Competences. In line with the relational approach, digital competences are related to the needs of users and benefits they can gain in key areas of life. The catalog lists eight such areas: work and professional development, relationships with loved ones, hobbies and leisure, health, finance, religion and spiritual needs, day to day affairs, civic engagement (Jasiewicz et al., 2021).

The Digital Poland Foundation's research identified strategic challenges Poland faces in six areas: demography, education, economy, infrastructure, climate and environment, and health. In line with the relational approach, in order to solve problems related to the formation of Society 5.0, the development of citizens' digital competences is necessary. In the third edition of the Report, the model of the competence assessment covers eight key areas, the same as the Framework Catalog (Technologie..., 2021).

The above models pertaining to digital competences are exploited on a large scale – in the international and domestic dimension. The literature on the subject also describes models tailored to the needs of individual social groups or spheres, most frequently concerning education at various levels.

H. Jenkins' model makes a premise that digital competences are required to develop such cultural and social competences as play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, transmedia navigation, networking, negotiation (Jenkins et al., 2006).

In his model, D. Bawden distinguished four levels of digital literacy: underpinnings (literacy *per se*, ICT literacy), background knowledge (the world of information, nature of information resources), central competences (reading and understanding digital and non-digital formats, creating and communicating digital information, evaluation of information, knowledge assembly, information literacy, media literacy), attitudes and perspectives (independent learning, moral/social literacy). He emphasized that simply having digital competences is insufficient. They should be embedded in a certain moral, cultural and social framework (Bawden, 2006).

I. Koppel and S. Langer developed the Model of Basic Digital Literacy consisting of three elements: background knowledge (the world of information, nature of information resources), central competences: (information/media literacy, reading/understanding, knowledge assembly, communicating, evaluation, creating, ability to learn how to deal with technological innovation processes), attitudes and perspectives (independent learning, moral/social literacy).

The level of digital competence is determined by human needs and interests, access to equipment and ICT, as well as skills and confidence in their use (Koppel, Langer, 2020).

S. Osuna-Acedo et al. present a holistic model of TRIC (technology + relationship + information + communication) digital literacy. They put emphasis upon the dimension of social, cognitive and emotional relationships, whose enhancement requires ICT (Osuna-Acedo et al., 2018).

When analyzing a number of concepts of digital competences, G. Ptaszek distinguished four main approaches depending on the skills on which the emphasis is placed: technical, information-related, socio-cultural, and holistic which integrate all the listed skills (Ptaszek, 2019).

In conclusion, it can be stated that in the contemporary hybrid reality, approaches dealing with digital competences autonomously have no reason to exist. They are of specific and strategic character as they directly determine the process of acquiring other key competences.

4. Research methodology

The present study exploited a research procedure employing a sequentially ordered number of tasks. A critical analysis of numerous important publications was carried out in two thematic areas: Society 5.0 and digital competences. The results are presented in the first part of the present article. Subsequently, the following research problem was formulated: In which areas of life do the residents of the Lublin Province use their digital competences the most frequently? This geographic area was selected for several reasons. The Lublin Province is the third largest province in Poland. The eastern border with Belarus and Ukraine also marks the eastern border of the European Union. As on 31.12.2021, the number of inhabitants was 2,076.4 thousand, which constituted 5.4% of the Polish population (GUS, 2022). The regional economy faces a number of structural problems, which negatively affects the situation of the local community (Mieszajkina, 2018). In 2021, 90.3% of households had Internet access at home (the average in Poland was 92.4%). The percentage of Internet users was 86.3% (88.9%), and the percentage of people who go online regularly was 80% (83.6%). The provinces of Eastern Poland, including the Lublin Province, are characterized by the lowest rates of ICT use (Społeczeństwo informacyjne..., 2021).

The present research constitutes a pilot study. For that reason, it was carried out on a relatively small scale. The authors' intention was to verify the state of knowledge concerning the surveyed environment and to test the research tool. The main objective was to assess the digital competences of the Lublin Province residents in a relational perspective. The following hypotheses were posed:

H1: The residents recognize the significance of digital competences in different areas of life and are willing to enhance them.

H2: The frequency of using digital competences is not high and varies depending on age, education and professional/industry-related status.

H3: The residents use digital competences the most frequently in those areas of life that are the most significant to them.

In order to achieve the objective of the research and verify the hypotheses, two research methods were employed. In the framework of the document testing method, numerous scientific sources and reports drafted by organizations and research groups regarding digital competences, their components and methods of assessment were analyzed. The results were used to specify the research problem and assumptions and to develop the research tool. The diagnostic survey method, the CAWI approach, served to collect data from respondents. The questionnaire was disseminated online, primarily via social media. Due to the pilot nature of the research, non-probability sampling was performed using the snowball sampling method (Babbie, 2021). Initially, the survey questionnaire was disseminated among respondents representing different age and social groups. After that, they were requested to share links to the form with other people. The questionnaire consisted of a substantive (16 questions) and personal information parts (5 questions). The five-point Likert scale was used as a measure.

The study was conducted in May 2022. The authors received 155 valid questionnaires. Characteristics of the research sample (in % in relation to the total number of respondents):

- gender: women – 71%, men – 29%,
- age: under 18 – 5.2%, 18-25 – 60.5%, 26-35 – 14.8%, 36-49 – 14.2%, over 50 – 5.2%,
- education: primary – 7.1%, vocational – 7.1%, secondary – 46.4%, higher – 39.4%,
- place of residence: village – 31%, city up to 50,000 – 11.6%, city 51-150 thousand – 16.8%, city above 151 thousand – 40.6%,
- occupational status/industry: student – 55.4%, work in industry – 3.9%, work in services – 26.5%, work in commerce – 4.5%, work in education and science – 9.7% (in other listed industries – 0%).

5. Research results and analysis

Given that the survey was conducted online, the respondents were not queried whether they had Internet access and the necessary equipment. However, they were asked whether they used them in their work/studies. The answer was positive for the vast majority of respondents – 97.4%. The answers to further questions were given on the Likert scale where 1 – "to a minimum extent", 5 – "to a maximum extent". The respondents assessed the significance of digital competences: 5 – 70.3%, 4 – 26.5%, 3 – 3.2% (ratings 1 and 2 were

not recorded). Does the Covid-19 pandemic affect their development? The rating of 5 was given by 24.5% of respondents, 4 – 30.3%, 3 – 18.7%, 2 – 12.9%, 1 – 13.5%.

The next question concerned the areas of life that are the most significant to the respondents. Table 1 outlines the results.

Table 1.

The significance of the individual areas of life for the Lublin Province residents (in %)

Area of life	Rating (1 – min, 5 – max)					Weighted average
	1	2	3	4	5	
Health	0	3.2	5.2	22.6	69.0	4.57
Finance	0	3.9	19.4	40.6	36.1	4.09
Day to day affairs	0	3.9	27.1	41.9	27.1	3.92
Relationships with loved ones	0	2.6	3.2	14.8	79.4	4.71
Work and professional development	0	0	12.3	51.6	36.1	4.24
Hobbies and leisure	0.6	4.5	15.5	36.8	42.6	4.16
Education and personal development	0	3.9	7.7	41.3	47.1	4.32
Civic engagement	10.3	21.9	27.1	31.6	9	3.07
Religion	18.1	9.7	16.8	14.2	41.3	3.51

Source: own research.

The hierarchy of the significance of the nine areas of life for the respondents is as follows: 1) relationships with loved ones, 2) health, 3) education and personal development, 4) work and professional development, 5) hobbies and leisure, 6) finance, 7) day to day affairs, 8) religion, 9) civic engagement. In the further part of the study, respondents were requested to indicate the frequency with which they use digital competences in the particular areas of life. For each area, several activities were proposed which the respondents may perform by means of digital tools. Due to the extensive character of information, two activities in each area with the highest average frequency (the average rating is given in brackets) will be listed:

- 1) relationships with loved ones: use of social networks (4.21), use of video chats (3.53),
- 2) health: finding medical facilities (3.86), registering an appointment with a doctor /in a clinic (3.58),
- 3) education and personal development: finding websites containing issues of interest (3.88), using online educational materials on issues of interest (3.64),
- 4) work and professional development: use of ICT in the workplace / place one studies, e.g. cloud solutions, online invoicing (3.38), using tools enabling online professional communication, e.g. Skype, Teams, Etherpad (3.28),
- 5) hobbies and leisure: finding the right form of online entertainment, e.g. games, films, music (4.14), checking the listings and showtimes of cinemas and theaters online (4.05),
- 6) finances: checking the state of one's finances by means of an online account or mobile application (4.6), making bank transfers via an online account or mobile application (4.51),

- 7) day to day affairs: use of the GPS functionality (4.1), use of mobile applications for urban and intercity transport, e.g. checking routes, timetables, purchase of tickets (4.08),
- 8) religion: finding websites devoted to spiritual development (2.51), finding information about groups and communities, contacting them online (2.19),
- 9) civic engagement: using information services with local, national, global coverage (3.38), finding information about legal acts at a local and central level (2.3).

Subsequently, respondents were requested to indicate the areas where their digital competences needed development. Table 2 outlines the results.

Table 2.

Areas of life of the Lublin Province residents where their digital competences require development (in %)

Area	%	Area	%	Area	%
Work and professional development	45.8	Civic engagement	36.8	Hobbies and leisure	16.8
Education and personal development	45.2	Health	25.8	Religion	14.8
Finance	40.0	Day to day affairs	18.1	Relationships with loved ones	7.7

Source: own research.

Among the areas with the strongest need for digital competence enhancement, the respondents mentioned work, education and finance. This is probably due to the fact that the digitization of these areas is the strongest and fastest, and at the same time they are significant for the respondents. The growing role of digital competences in almost all industries and specializations makes them play an increasingly vital role in the labor market. They have become extremely important in education. On the one hand, distance learning has become a necessity during the consecutive phases of the pandemic. On the other hand, it offers new opportunities for education and development of one's interests for people of different ages by means of various learning forms and methods, and with the possibility of selecting a place, time, and at a lower cost. Many finance-related matters are much easier and faster dealt with over the Internet. New forms of digital payments are emerging. In order to settle taxes, to operate a bank account, one needs not only computer and smartphone digital skills, but also knowledge in the field of digital security.

Are respondents ready to improve digital competences? The answers differ depending on whether they are to allocate their own financial resources to this purpose or whether they can benefit from external financing (Tab. 3).

Table 3.

Readiness of the Lublin Province residents to develop digital competences depending on the source of financing (in %)

Funding Source	Definitely not	Rather not	I do not know	Rather yes	Definitely yes
Financing from own resources	6.5	23.2	31	34.8	4.5
Financing from external sources	0.7	9	20	54.2	16.1

Source: own research.

Almost 40% of respondents declare their willingness to enhance the digital competences at their own expense. With the possibility of external financing, the percentage rises to over 70%. One third of the respondents will not invest their own money, while only one in ten will not pursue the improvement of the competences with external financing. Such a high percentage of the undecided is somewhat surprising. As a consequence, a question will be added to the questionnaire for basic research concerning the causes behind the choice of a specific answer.

As stated above, 96.8% of respondents consider digital competences to be very significant or significant (ratings 5 and 4). Moreover, none of the respondents considered them to be invalid and unimportant (scores 1 and 2). At the same time, respondents show a need to improve them in every area of life, which means they are aware of certain deficiencies. They are very likely to take advantage of the opportunity to develop in this area by allocating their own financial resources or (much more willingly) by using external financing. This means that there are no grounds to reject hypothesis 1 stating that the inhabitants of the Lublin Province recognize the significance of digital competences in various areas of life and are ready to develop them.

Are there differences in the use of digital competences depending on the age group? In order to answer this question, average frequencies of use for individual age categories were calculated. The frequency in this question and the following ones was assessed on a five-point Likert scale, where 1 – "never", 5 – "very often". Table 4 outlines the results.

Table 4.

Frequency of digital competence use in the individual areas of life depending on the age of the respondents

Area of life	Age					Weighted average rating
	< 18	18-25	26-35	36-50	> 50	
Health	2.8	3.34	3.65	3.8	3.9	3.45
Finance	2.29	3.4	3.4	3.4	3.81	3.36
Day to day affairs	2.98	3.68	3.9	3.9	3.61	3.70
Relationships with loved ones	4.0	3.85	4.0	3.77	3.9	3.87
Work and professional development	2.18	2.75	3.04	3.19	2.75	2.82
Hobbies and leisure	3.4	3.5	3.6	3.5	3.2	3.49
Education and personal development	3.5	3.5	3.2	3.2	3.1	3.39
Civic engagement	2.1	2.04	2.8	2.8	2.95	2.31
Religion	2.8	3.34	3.65	3.8	3.9	3.45
Average value	2.94	3.14	3.34	3.27	3.26	

Source: own research.

In the areas of "health", "finance", "religion" and "civic engagement", the frequency of digital competence use grows with respondents' age. In the area of "education and personal development" a reverse trend can be observed. In the areas of "day to day affairs" and "work and professional development", there is a growing trend in the first four age groups and a decrease in the case of the oldest group. For the areas of "relationships with loved ones" and "hobbies and leisure", a higher frequency of use occurs in the first three age groups. If all areas are taken into account, the average frequency of digital competence use increases in the first three age groups, and decreases slightly in the next two.

The study also examined whether the frequency of digital competence use is affected by the type of education. Average frequency values for the variable "education" in each of the nine areas of life were calculated (tab. 5).

Table 5.

Frequency of digital competence use in the particular areas of life depending on the education of respondents

Area of life	Education				Weighted average rating
	primary	vocational	secondary	higher	
Health	2.76	3.4	3.39	3.67	3.46
Finance	2.45	4.54	3.85	3.78	3.77
Day to day affairs	3.15	3.78	3.74	3.84	3.74
Relationships with loved ones	4.09	3.27	3.88	3.93	3.87
Work and professional development	2.09	2.58	2.76	3.03	2.81
Hobbies and leisure	3.22	3.15	3.54	3.46	3.46
Education and personal development	3.27	2.82	3.14	3.36	3.21
Civic engagement	2.12	2.06	2.01	2.71	2.30
Religion	3.2	3.2	2.24	2.15	2.26
Average value	2.93	3.20	3.17	3.33	

Source: own research.

Respondents with higher and secondary education use digital competences the most frequently in the areas of "relationships with loved ones", "day to day affairs" and "finance". Respondents with vocational education – in the areas of "finance", "day to day affairs" and "health". As far as respondents with primary education are concerned, these are the areas of "relationships with loved ones", "hobbies and leisure" and "education and personal development". Globally, the digital competences are used the most frequently by respondents with higher education, at a comparable level – by those with secondary and vocational education, and the least frequently – by those with primary education.

Next, the frequency of digital competence use by the Lublin Province residents in the individual areas of life was compared for the variable "occupational status/industry". Table 6 presents the average values for each area of life.

Table 6.

Frequency of digital competence use in the particular areas of life depending on the occupational status/industry respondents represent

Area of life	Employment					Weighted average rating
	pupil / student	work in industry	work in services	work in commerce	work in education and science	
Health	2.76	3.4	3.39	3.67	3.64	3.08
Finance	3.72	3.72	3.31	3.67	3.36	3.57
Day to day affairs	3.6	3.9	3.9	3.8	3.8	3.71
Relationships with loved ones	3.9	4.25	3.87	3.29	3.87	3.88
Work and professional development	2.6	3.3	3.2	2.7	2.9	2.82
Hobbies and leisure	3.44	3.88	3.57	3.39	3.12	3.46
Education and personal development	3.21	3.25	3.32	2.93	3.03	3.21
Civic engagement	3.2	2.89	2.76	2.24	2.53	2.30
Religion	2.33	2.17	2.11	2.39	2.2	2.26
Average value	3.06	3.42	3.27	3.12	3.15	

Source: own research.

In the field of "health", digital competences are used the most frequently by employees representing the fields of commerce, education and science. In the areas of "finance" and "relationships with loved ones" – respondents working in industry and learners. In the area of "religion" – trade workers and learners. In the remaining five areas – those working in industry and services. Representatives of these two fields are also leaders in the frequency of using their digital competences in all areas of life.

Data in Tables 4, 5, and 6 show that the frequency of digital competence use is at an average level. In no area did its weighted average rating exceed 3.88. Respondents indicated ratings 4 and 5 very rarely. In the areas of "relationships with loved ones" and "work and professional development", the frequency of digital competence use is almost the same for all variables: "age", "education" and "occupational status / industry" (differences in the weighted average do not exceed 0.01). The largest discrepancy occurs in the sphere of religion (differences in the weighted average amount to 1.19). There is also a greater variation in the areas of "finance" (0.41), "health" (0.37) and "education and personal development" (0.18). In the remaining areas, the frequencies differ slightly (differences in the weighted average do not exceed 0.04). Therefore, hypothesis 2 can be deemed verified in its entirety in the first part: the frequency of digital competence use is not high, and partly verified in the second part: it varies depending on age, education and occupational status/industry.

In order to verify hypothesis 3, which assumed that the Lublin Province residents use digital competences more frequently in those areas of life that are the most significant to them, rankings were developed for variables "importance of the area of life for respondents" (based on data from Tab. 1) and "frequency of digital competence use" depending on age, education, occupational status/industry (based on data from Tab. 4-6). The results are outlined in Table 7.

Table 7.

Place in the ranking of individual areas of life in relation to the significance of the area and the frequency of digital competence use

Area of life	Position of the area in relation to:			
	significance of the area of life	frequency of digital competence use		
		age	education	occupational status/industry
Relationships with loved ones	1	1	1	1
Health	2	4	4	6
Education and personal development	3	6	6	5
Work and professional development	4	8	7	7
Hobbies and leisure	5	3	4	4
Finance	6	7	2	3
Day to day affairs	7	2	3	2
Religion	8	4	9	9
Civic engagement	9	9	8	8

Source: own research.

The first position in all rankings was occupied by the area of "relationships with loved ones". The two least significant areas for respondents, i.e. "religion" and "civic engagement" in all other rankings also occupy the final position, except for the fourth position for "religion"

for the variable "age". In these three areas, the majority of respondents do not consider the development of digital competences as necessary. The greatest difference in positions in the rankings was recorded in the "day to day affairs" area: in terms of importance, it occupies the seventh position, and in the others, the second and third. This may be due to the fact that the majority of respondents have sufficient digital competences in this area – 18.1% of them declare the need to enhance them. "Education and personal development" and "work and professional development" constitute areas that rank higher in the importance ranking than in the digital competence use rankings. At the same time, in these two areas, over 45% of respondents indicate the need for the digital competence development. The area of "health" also ranks higher in the ranking of importance than in the others. However, only one in four respondents indicate the need to improve their competences in the area. In the basic research, the authors intend to assess whether this results from the residents' preference for traditional contact with the health service, or from the low availability of online medical services or other factors. The areas of "hobbies and leisure" and "finance" rank lower in the importance ranking than in the others, with the exception of the variable "age" for the sphere of finance. The respondents frequently use ICT in the area of "hobbies and leisure", perhaps due to the fact that it does not require any special skills and equipment. This is also confirmed by the fact that few respondents declare the need to enhance digital competences in this area (less than 17%). It is somewhat surprising that the area of "finance" is so insignificant for respondents compared to other areas. Although digital competences in this area are used quite frequently, over 40% of respondents want to develop them. The above considerations allow to conclude that hypothesis 3 was partly confirmed.

6. Conclusions

The present study allows several conclusions to be formulated. One of the most important of those concerns awareness. Over 70% of respondents indicate that digital competences are important in their lives. However, this does not translate into their use in various areas of life. A change in the way one acts commences with a change in one's mindset. Therefore, measures should be taken to enhance the digital awareness of citizens in such a way as to increase the widespread use of ICT in everyday life.

The majority of respondents participating in the study are young people. The survey was conducted online, mainly by means of social media. The small number of older respondents is determined by the fact that the questionnaire could not reach them. They are simply absent online. They are driven by concerns and fear of novelties. Such persons are particularly at the risk of being digitally excluded. Due to their digital handicap, they may fall victim to digital

scamming more frequently. Therefore, taking action to support older people in the development of digital competences seems of vital importance.

When undertaking training initiatives related to the improvement of digital competences of residents, attention should be paid primarily to those areas of life which are the most important for individual social groups. People are more willing to acquire information which bears importance to them. Moreover, acquired competences in one sphere will gradually be used in others. Effective encouragement of full participation in digital reality requires the use of the language of benefits. It is important to show what a person can gain from specific knowledge, skills and digital technology, how it will improve their functioning and make life easier.

Development of Society 5.0 requires not so much broad access to modern ICT as social acceptance of digitization processes and citizens' possession of sufficient digital competences. There is a need for support, appropriate regulations and solutions from public administration and cooperation between the central government, local governments, businesses and non-profit organizations. The digital revolution has brought about changes and thus challenges in people's daily lives. The use of ICT is inevitable. For that reason, digital competences are becoming crucial. Having them facilitates access to knowledge and information needed in all areas of life, supports the implementation of professional, educational and hobby-related goals. They have a significant impact on the development of a knowledge-based economy that is more innovative and competitive.

Individuals should develop holistically. This means that, as in the case of an organization, their lives should be considered in a systemic way. A system is a set of elements among which mutual relations and interactions occur. Each element is connected to the others by a feedback mechanism. In human life, the individual areas of life constitute such elements. Digital competences are the link that ensures their interaction and obtaining synergy effects, and thus the efficiency of the system. In the modern digital reality, they become a prerequisite for full participation in the social and professional life. Because they are subject to constant changes, they require lifelong learning.

References

1. *Analiza doświadczeń oraz identyfikacja dobrych praktyk w obszarze wspierania rozwoju kompetencji cyfrowych w kontekście przygotowania szczegółowych zasad wdrażania programu operacyjnego Polska cyfrowa na lata 2014-2020 oraz koordynacji celu tematycznego. Raport końcowy.* Retrieved from <https://9lib.org/document/4yr1d17q-doswiadczen-identyfikacja-kompetencji-przygotowania-szczegolowych-operacyjnego-koordynacji-tematycznego.html>, 13.09.2020.

2. Anrijs, S., Ponnet, K., De Marez, L. (2020). Development and psychometric properties of the Digital Difficulties Scale (DDS): An instrument to measure who is disadvantaged to fulfill basic needs by experiencing difficulties in using a smartphone or computer. *PLoS ONE*, Vol. 15, No. 5, e0233891, doi: 10.3886/E118021V1.
3. Babbie, E. (2021). *Badania społeczne w praktyce*. Warszawa: PWN.
4. Bawden, D. (2008). Origins and Concepts of Digital Literacy. In: C. Lankshear, M. Knobel (Eds.), *Digital Literacies. Concepts, Policies and Practices* (pp. 17-32). New York: Peter Lang.
5. Carretero Gomez, S., Vuorikari, R., Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Luxembourg: Publications Office of the European Union. Retrieved from <https://publications.jrc.ec.europa.eu/repository/handle/JRC106281>, 15.07.2022, doi: 10.2760/38842.
6. Council Recommendation of 22 May 2018 on key competences for lifelong learning (Text with EEA relevance). (2018). *Official Journal of the European Union C 189/1*, 4.6.2018. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2018.189.01.0001.01.ENG, 10.05.2022.
7. *ELINET (European Literacy Policy Network)*. Retrieved from <http://www.eli-net.eu/about-us/digital-literacy/>, 19.07.2022.
8. Garbellan, S. (2018). *Da Industria 4.0 a Società 5.0: la via del Giappone alla digitalizzazione*. Retrieved from https://www.academia.edu/35809134/Da_Industria_4_0_a_Societ%C3%A0_5_0_La_scelta_del_Giappone, 22.07.2022.
9. Główny Urząd Statystyczny: Ludność w gminach według stanu w dniu 31.12.2021 r. Retrieved from <https://demografia.stat.gov.pl/BazaDemografia/Tables.aspx>, 25.07.2022.
10. *Indeks gospodarki cyfrowej i społeczeństwa cyfrowego (DESI) na 2021 r. Polska*. Retrieved from <https://ec.europa.eu/newsroom/dae/redirection/document/80596>, 19.07.2022.
11. Jasiewicz, J. (2018). Relacyjny model kompetencji cyfrowych i jego implikacje metodologiczne. *Studia Medioznawcze*, Nr 2, pp. 117-128.
12. Jasiewicz, J., Filiciak, M., Mierzecka, A., Śliwowski, K., Klimczuk, A., Kisilowska, M., Tarkowski, A., Zadrozny, J. (2015). *Ramowy katalog kompetencji cyfrowych*. Retrieved from <https://mc.bip.gov.pl/rok-2015/ramowy-katalog-kompetencji-cyfrowych.html>, 22.06.2021.
13. Jenkins, H., Clinton, K., Purushotma, R., Robison A.J., Weigel M. (2006). *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century (Occasional paper on digital media and learning)*. Chicago, Illinois: The John D. and Catherine T. MacArthur Foundation. Retrieved from https://www.macfound.org/media/article_pdfs/JENKINS_WHITE_PAPER.PDF, 20.08.2020.

14. Joint Research Centre, Institute for Prospective Technological Studies, Ferrari, A. (2012). *Digital competence in practice: an analysis of frameworks*. Publications Office. <https://data.europa.eu/doi/10.2791/82116>, 23.07.2022.
15. Koppel, I., Langer, S. (2020). Basic digital literacy – Requirements and elements. *Revista Práxis Educacional, Vol. 16, No. 42*, pp. 326-347.
16. Kudyba, S. (2020). COVID-19 and the acceleration of digital transformation and the future of work. *Information Systems Management, Vol. 37, Iss. 4*, pp. 284-287, doi: 10580530.2020.1818903.
17. Kwiatkowski, S.M. (2018). *Kompetencje przyszłości*. Warszawa: FRSE.
18. Lemański, F. *Warszawa najbogatszym regionem w Polsce. Ściana wschodnia zamyka stawkę*. Retrieved from <https://obserwatorgospodarczy.pl/2022/01/19/najbogatsze-i-najbiedniejsze-wojewodztwa-w-polsce-roznice-sa-wyrazne/>, 18.07.2022.
19. Larsson-Lund, M., Nyman, A. (2020). Occupational challenges in a digital society: A discussion inspiring occupational therapy to cross thresholds and embrace possibilities. *Scandinavian Journal of Occupational Therapy, Vol. 27, No. 8*, pp. 550-535, doi: 10.1080/11038128.2018.1523457.
20. Medina-Borja, A. (2017). Smart human-centered service systems of the future. In: *Future Services & Societal Systems in Society 5.0*. Tokyo, Japan: Center for Research and Development Strategy, Japan Science and Technology Agency, pp. 159-175.
21. Meyerhoff Nielsen, M. (2022). *Monitoring and Measurement of Digital Inclusion: A Critical Analysis of Key Global Frameworks*. Retrieved from <https://scholarspace.manoa.hawaii.edu/items/da2b7a7a-59b1-43b6-8ac4-a2dc5349b8a9>, 16.07.2022.
22. Mieszajkina, E. (2018). *Zarządzanie przedsiębiorcze w małych firmach*. Lublin: Wydawnictwo Politechniki Lubelskiej.
23. Milenkova, V., Lendzhova, V. (2021). Digital Citizenship and Digital Literacy in the Conditions of Social Crisis. *Computers, Vol. 10, Iss. 4*, doi: 10.3390/computers10040040.
24. Nair, M., Pradhan, R.P., Arvin, M.B. (2020). Endogenous dynamics between R&D, ICT and economic growth: Empirical evidence from the OECD countries. *Technology in Society, Vol. 62, Iss. C*, 101315, doi: 1016/j.techsoc.2020.101315Ndubuisi.
25. Nair, M.M., Tyagi, A.K., Sreenath, N. (2021). *The Future with Industry 4.0 at the Core of Society 5.0: Open Issues, Future Opportunities and Challenges*. 2021 International Conference on Computer Communication and Informatics (ICCCI), pp. 1-7, doi: 10.1109/ICCCI50826.2021.9402498.
26. Nguyen, M.H., Hargittai, E., Marler, W. (2021). Digital inequality in communication during a time of physical distancing: the case of COVID-19. *Computers in Human Behavior, Vol. 120*, pp. 1-10, doi: 10.1016/j.chb.2021.106717.
27. Osuna-Acedo, S., Frau-Meigs, D., Marta-Lazo, C. (2018). Educación Mediática y Formación del Profesorado. Educomunicación más allá de la Alfabetización Digital.

- Revista Interuniversitaria de Formación del Profesorado, Vol. 32, Iss. 1, No. 91*, pp. 29-42. Retrieved from <https://dialnet.unirioja.es/servlet/articulo?codigo=6441410>, 25.07.2022.
28. Ptaszek, G. (2019). *Edukacja medialna 3.0. Krytyczne rozumienie mediów cyfrowych w dobie Big Data i algorytmizacji*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
 29. Radomska, E. (2019). Rozwój gospodarki cyfrowej i społeczeństwa cyfrowego w aspekcie dynamicznych zmian w otoczeniu zewnętrznym na przykładzie Wielkiej Brytanii. *Mysł Ekonomiczna i Polityczna, Nr 1(64)*, pp. 113-146, doi: 10.26399/meip.1(64).2019.05/e.radomska.
 30. Reder, S. (2015). *Digital inclusion and digital literacy in the United States: a portrait from PIAAC's Survey of Adult Skills*. Retrieved from https://static1.squarespace.com/static/51bb74b8e4b0139570ddf020/t/551c3e82e4b0d2fed6481f9/1427914370277/Reder_PIAAC.pdf, 21.07.2020.
 31. *Report on the 5th Science and Technology Basic Plan. Council for Science, Technology and Innovation* (2015). Cabinet Office, Government of Japan. Retrieved from https://www8.cao.go.jp/cstp/kihonkeikaku/5basicplan_en.pdf, 22.09.2021.
 32. Sá, M.J., Santos, A.I., Serpa, S., Miguel Ferreira, C. (2021). Digitainability – Digital Competences Post-COVID-19 for a Sustainable Society. *Sustainability, 13*, 9564, doi: 10.3390/su13179564.
 33. Seah, K.M. (2020). COVID-19: Exposing digital poverty in a pandemic. *International Journal of Surgery, Vol. 79*, pp. 127-128, doi: 10.1016/j.ijssu.2020.05.057.
 34. *Spółeczeństwo informacyjne w Polsce w 2021 r.* (2021). Warszawa-Szczecin: Główny Urząd Statystyczny, Urząd Statystyczny w Szczecinie.
 35. Śledziwska, K., Włoch, R. (2020). *Gospodarka cyfrowa. Jak nowe technologie zmieniają świat*. Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.
 36. *Technologia w służbie społeczeństwu. Czy Polacy zostaną społeczeństwem 5.0?* (2021). *Digital Poland. Raport z serii #Tech4Society*. Retrieved from <https://digitalpoland.org/publikacje/pobierz?id=137bd447-2eac-4147-813d-d53369fdd5ec>, 25.07.2022.
 37. Ulman, P., Ćwiek M. (2022). Nierówności w rozwoju cyfrowym w krajach Unii Europejskiej. *Nierówności Społeczne a Wzrost Gospodarczy, Iss. 66*, pp. 33-51, doi: 10.15584/nsawg.2021.2.3.
 38. Van Bon, N. (2021). The Digitalization – Economic Growth Relationship in Developing Countries and the Role of Governance. *Scientific Annals of Economics and Business, Vol. 68, Iss. 4*, pp. 481-493, doi: 10.47743/saeb-2021-0028.
 39. Van Deursen, A.J. (2020). Digital Inequality During a Pandemic: Quantitative Study of Differences in COVID-19–Related Internet Uses and Outcomes Among the General Population. *Journal of Medical Internet Research, Vol. 22, Iss. 8*, e20073, doi: 10.2196/20073.
 40. Vuorikari, R., Kluzer, S., Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens – With new examples of knowledge, skills and attitudes, EUR 31006*

EN. Luxembourg: Publications Office of the European Union, doi: 10.2760/490274, JRC128415.

41. Vyas-Doorgapersad, S. (2022). The Use of Digitalization (ICTs) in Achieving Sustainable Development Goals. *Global Journal of Emerging Market Economies, Vol. 14, Iss. 2*, pp. 265-278, doi.org/10.1177/09749101211067295.

DIGITAL ACTIVITY OF POLISH SMALL ENTERPRISES

Elena MIESZAJKINA^{1*}, Agata MYŚLIWIECKA²

¹ Lublin University of Technology, Faculty of Management, Department of Management;
e.mieszajkina@pollub.pl, ORCID: 0000-0002-3449-4059

² Lublin University of Technology, Faculty of Management, Department of Management;
a.mysliwiecka@pollub.pl, ORCID: 0000-0001-9543-2508

* Correspondence author

Purpose: Digital transformation affects all spheres enterprises operate in regardless of their size and industry. Its impact is analyzed by the representatives of various sciences and business practitioners as well as. The objective of the article is to present theoretical and empirical research on the digital activity of Polish small enterprises.

Design/methodology/approach: Two methods were used to achieve the objective. The method of literature review consisted in the analysis of literature in the field of digitalization and digital transformation. It gave the foundation for the development of methodological assumptions. The diagnostic poll method with the use of the survey technique was employed to conduct the empirical study among Polish small enterprises. The results of the research allowed the organizations' activity to be assessed.

Findings: The study indicated that the digital activity of Polish small enterprises is not satisfactory. Their innovation is low, investment in ICT is sporadic and insufficient. Predominantly, the enterprises implement ICT solutions which do not require expert digital competences. The surveyed companies recognize the benefits of digitalization and its significant impact on opportunities for development. Digitalization is hampered by fears of incurring high costs, necessity of employing IT specialists or supplementing digital competences of the management and employees.

Research limitations/implications: The present study examined the issue of digital activity of small enterprises and enabled the adopted research assumptions to be verified. Prospective research may analyze the digital activity of the surveyed enterprises in terms of age, size and industry groups.

Practical implications: The research allowed practical problems of digitalization of small businesses to be identified. A consecutive round of the study conducted in the following year would be worthwhile in order to analyze the dynamics of digital transformation in this sector.

Originality/value: The originality of the research consists in introducing the concept of digital activity of enterprises and its assessment exclusively in relation to small enterprises, which are the weakest link in the SME sector.

Keywords: small enterprises, digital activity, digital transformation.

Category of the paper: Research paper.

1. Introduction

The digital revolution and related scientific and technical changes are transforming the world of business. They modify the nature and intensity of competition. They become the main driver of innovation and change in the majority of industries and sectors of the economy. They lead to the reorganization of management systems and the creation of digital business models. Technological progress not only contributed to the improvement of internal processes of enterprises, but also stimulated a change in the behavior of various groups of stakeholders that shape the environment and affect their functioning. Businesses need to adapt to the requirements of the digital economy and be highly active in the digital domain. This is a particularly difficult challenge for small business organizations, which as opposed to large businesses, do not have such financial, human and technological resources at their disposal.

The issues of digitalization are discussed by the representatives of various fields of science, such as management, philosophy, sociology, IT, and ecology. According to J.S. Brennen and D. Kreiss, the term digitization denotes "the material process of converting analog streams of information into digital bits". In turn, the authors define the term digitalization as "the way many domains of social life are restructured around digital communication and media infrastructures" (Brennen, Kreiss, 2016). In Polish, both terms have a single word (cyfryzacja) as the equivalent. Additionally, they are frequently used in literature alternately because they are strongly interrelated.

The concept of digital activity, similarly to the issue of digitalization, is not clearly defined. According to the Great Dictionary of the Polish language, the term activity refers to "taking actions of a specific kind and performing them predominantly in a lively, intense way" (Wielki słownik..., 2022). With reference to this definition, we propose to consider digital activity as the involvement of an enterprise in undertaking intensive activities in the field of Internet and ICT use.

Micro, small and medium-sized enterprises constitute the dominant group of economic entities in Poland and the European Union. Additionally, their number has been systematically growing in recent years. In Poland, their share in the total number of enterprises is 99.8%, and reflects the EU average. However, the structure of this sector in Poland diverges from the EU average – there are more micro entities (in Poland 94.9%, EU average 93.0%), while fewer small (4.2% and 5.9%) and medium-sized (0.7% and 0.9%) organizations (PARP, 2022). This may indicate that many micro and small enterprises do not develop and fail to transform into medium and large enterprises (Fundacja Warsaw Enterprise Institute, 2017). This is especially true of small businesses employing 10 to 49. Every year, their number dwindles. They have the smallest share in the generation of GDP and jobs among all groups of enterprises. They are characterized by low innovation. The transition of enterprises from the

small to medium scale is impeded by various barriers of an exogenous and endogenous nature (Mieszajkina, 2020).

Problems related to the development of this group of enterprises in the SME sector became an inspiration for the assessment of how they fare as regards the digital reality. The objective of the present research is to examine the digital activity of Polish small enterprises.

2. Digital activity of small enterprises

There is no single commonly used definition of digital transformation. According to C. Gong and V. Ribiere, the transformation is "a fundamental change process enabled by digital technologies that aims to bring radical improvement and innovation to an entity (e.g., an organization, a business network, an industry, or society) to create value for its stakeholders by strategically leveraging its key resources and capabilities" (Gong, Ribiere, 2021, p. 10). K. Oh et al. (2022) argue that the digital transformation concerns social change activities that are undertaken by the enterprise. This is possible owing to the improvement of the business model by introducing new digital technologies that allow to provide greater value for the customer. When analyzing the essence of digital transformation, special attention should be paid to three aspects of the phenomenon. The first assumes that it is closely related to modern technologies. The second aspect, organizational in nature, concerns the introduction of changes into business models or their replacement with new ones. The third aspect, social, indicates that it is a phenomenon that significantly affects every area of human life (Reis et al., 2018).

The digital activity of an enterprise consists in implementing new and streamlining existing internal processes in such a way that they become based on modern ICT. It often leads to a modification of the business model towards its digitalization. As a consequence, the efficiency of the company's operation is increased and new opportunities for development are generated. In order for the digitalization process to be effective, it is crucial that the social subsystem and organizational culture are remodeled, thus adapting them to the needs of the new reality. The key to success lies in employees and their commitment to the continuous improvement of their digital competences.

M. Oberländer et al. (2020) consider digital competences as a combination of knowledge, skills, abilities and other characteristics of an employee that are required to perform work in a digital environment. They divide them into elementary and specific. The former refer to daily tasks that an employee performs while working: using email and instant messaging, basic Microsoft Office software, etc. The latter concern enterprise-specific tasks and refer to specialized software requiring advanced digital competences at an appropriate level. The lack of adequate digital competences causes increasing difficulties in the performance of work by employees of all areas and levels of management. The involvement in their development will

be greater if the employer facilitates access to appropriate training and courses (Bergson-Shilcock, 2020).

The level of digitalization of small enterprises is affected by several social, technological, economic, environmental, political and legal factors related to values (Gudanowska, Kononiuk, 2020). The strength and direction of impact largely depend on the digital activity of the entity, which in turn is influenced by digital competences possessed by the management and staff. Five levels of digitalization of enterprises can be distinguished (Buchner, Zaniewska, 2016; Mieszajkina, 2020):

1. total digitalization – basic and organizational activities require the application of digital solutions,
2. majority digitalization – ICT is not a prerequisite for maintaining the continuity of basic and operational activities. It is used to increase the efficiency of operations,
3. partial digitalization – digital solutions are exploited to a limited extent in certain areas of operations,
4. fragmentary digitalization – using individual, simple digital tools to simplify certain operations,
5. minimal digitalization – the use of digital tools on a very limited scale, often due to the need to adapt to the requirements of stakeholders.

The Covid-19 pandemic accelerated the digital transformation of not only large but also small businesses. This is evidenced by the data presented in the report titled "European Small and Medium-Sized Enterprises (SMEs)" drafted by Digitally Driven among 5011 SMEs (including 301 from Poland). Since the beginning of the pandemic, 80% of SMEs have increased the use of digital tools. The report distinguishes three groups of enterprises depending on the level of digital tools' use (Digitally Driven, 2021):

- 1) "advanced" companies that prioritize and actively use several digital tools. As a result, they achieve higher business performance and a higher level of transformation, innovation and effectiveness. In Poland, 47% of companies represent this group, while the European average amounts to 42%;
- 2) "insecure" companies behaving in the opposite way when compared to the first group represent 11% in Poland, contrasted by the European average of 18%;
- 3) "developing" enterprises are in the process of shifting from the second group to the first group and are at different stages of digital transformation. In Poland, they account for 42%, while the average in Europe is 40%.

Slightly different data is presented in the report titled "Investments in technologies in the era of the 2022 pandemic. New challenges for SMEs: digitalize or economize?" (Inwestycje w technologie w dobie pandemii 2022. Nowe wyzwania MŚP: cyfryzować czy oszczędzać?), which was delivered by the DigitalPoland Foundation. According to the report, the Polish small business does not fully exploit opportunities emerging from digitalization and new technologies. This is particularly valid for small businesses – they exploit much less ICT than

medium and large enterprises and to a greater extent depart from their western competitors. Their attitude towards digitalization is to economize and to postpone investments in new technologies (DigitalPoland Foundation, 2022).

The above data apply to the entire SME sector. However, small businesses have a lower level of digitalization compared to medium-sized and large ones. This is evidenced by the index of digital intensity proposed by Eurostat. It is calculated on the basis of 12 parameters describing the use of ICT. It is very low and low in the case of 89.6% of small enterprises, 75.4% of medium-sized and 43.3% of large enterprises (CSO, 2021). There are several reasons for such a fact – the need to incur, at times, significant costs associated with IT infrastructure and software, the lack of appropriate competences and employability of IT specialists, the lack of time and ability to remodel existing processes, and apprehension linked with the need to adapt to new legal regulations (Mieszajkina, 2020).

Like never before, small businesses need the ability to exploit opportunities efficiently and avoid risks connected with digitalization. Digital transformation is multidimensional and covers most fields the company and employees operate in. It consists in continuous growth and introduction of adaptive changes related to the constant development of ICT. It frequently requires complete rebuilding or redefinition of intra-organizational processes. Rapid implementation of digital changes can be a key factor determining the success of small businesses.

3. Research methodology

The test procedure applied in the study involves several stages. The starting point was an in-depth review of the literature on the operation of contemporary organizations in the conditions of digital transformation, especially in relation to small businesses. The following research problem was formulated: Do Polish small enterprises fully exploit the potential of the Internet and ICT? The answer to such a question will allow to obtain information necessary to achieve the objective, i.e. the assessment of the digital activity of Polish small enterprises.

The following hypotheses were developed:

- H1: Small businesses do not have an efficient innovation management system, thus investment in ICT is sporadic.
- H2: Small business employees have insufficient advanced digital competences, thus the Internet and ICT are mostly used for mundane, everyday activities.
- H3: Small enterprises use quite a wide range of digital solutions, mainly intended for communication with clients.
- H4: Small businesses recognize the outcomes of using the Internet and ICT. However, they do not achieve them in full due to concerns regarding digitalization.

Appropriate research methods and techniques were selected to achieve the objective and verify the hypotheses. The method of literature review was used to formulate research assumptions and develop the research tool. An in-depth analysis was conducted encompassing numerous scientific sources on digital transformation and digital activity in the SME sector. Subsequently, consultations were carried out with six experts in order to verify the research tool. The experts were managers and IT specialists with practical knowledge in the field of management and ICT. In order to collect data from respondents, the diagnostic survey method and the web survey technique were used. The questionnaire contained 14 questions and consisted of a substantive part (nine questions) and demographics (five questions). The study was executed in April-May 2022. It examined a random sample of enterprises (N = 292) employing from 10 to 49 people. The data were collected by means of the CAWI method. Table 1 presents the structure of the research sample.

Table 1.
Structure of the sample

Specification	Total sample N = 292	Number of persons employed by the organization:			
		10-19 N = 95 (32.5%)	20-29 N = 81 (27.7%)	30-39 N = 58 (19.9%)	40-49 N = 58 (19.9%)
<i>Age of the enterprise (in %)</i>					
15+ years	47.6	14.0	12.3	8.9	12.3
9 – 14 years	27.4	9.6	7.5	5.5	4.8
3 – 8 years	18.8	6.9	5.5	4.8	1.7
Less than 3 years	6.2	2.1	2.4	0.7	1.0
<i>Industry (in %)</i>					
Production	20.2	5.5	7.2	3.4	4.1
Commerce	22.3	8.2	5.8	4.1	4.1
Services	49.3	16.1	12.3	10.6	10.3
Civil Engineering	8.2	2.7	2.4	1.7	1.4
<i>Business location (in %)</i>					
City over 300,000	27.7	12.0	4.8	5.1	5.8
City between 100,000 and 300,000	20.9	5.5	6.2	5.5	3.8
City between 20,000 and 100,000	24.3	8.2	6.9	5.5	3.8
City under 20,000	9.9	3.1	3.1	1.4	2.4
Village	17.1	3.8	6.9	2.4	4.1
<i>Area of operations (in %)</i>					
Local	41.4	15.4	10.6	6.9	8.6
Domestic	42.8	12.3	13.4	10.3	6.9
International	15.8	4.8	3.8	2.7	4.5

Source: own research.

4. Research results and analysis

Digitalization is a multi-faceted process. It requires action to be taken in virtually all areas of the enterprise's operation. This requires focus and time on the part of the management.

In a small business, where the owner frequently performs as the only manager, it is difficult to reconcile the tasks of digitalizing the business with the daily responsibilities of efficient management. The survival and development of a small enterprise are determined by both the attitude of the owner and the employees. The future of the enterprise depends on their involvement in the implementation of various innovative projects. In order to verify hypothesis 1, the respondents were asked two questions: about the approach to innovation, and concerning investments in ICT in their companies. The data are presented in Tables 2 and 3.

Table 2.*Approach to innovation in enterprises (in %)*

Specification	% of enterprises
We did not introduce any innovations in the past two years, we anticipate neither innovation-related activities nor research and development.	22.26
We are technologically ready for innovation, but we do not implement it due to the lack of innovation management skills.	22.95
In the past two years we introduced or attempted to introduce innovations, we are beginning to develop an innovation management system.	29.79
Over the past two years, we systematically implemented an innovative process, in some cases, when implementing innovations, we cooperated with other entities.	17.47
For several years, we have been implementing a strategy based on innovative activity and research and development, we systematically introduce innovations, we cooperate with other entities in the development and implementation of innovations.	7.53

Source: own research.

Table 3.*Investments in ICT in enterprises (in %)*

Specification	% of enterprises
We do not invest in digital technologies because we do not have such needs.	18.84
We recognize the need to invest in digital technologies, but we do not do so for financial reasons, lack of knowledge in this field or for other reasons.	17.12
We scheduled investments in certain digital technologies.	26.37
We invest in digital technologies when we have free funds.	11.64
We invest in key digital technologies by acquiring necessary financial resources (own or external).	16.10
We invest in digital technologies systematically and in a planned manner.	9.93

Source: own research.

Table 2 shows that the level of innovativeness of the surveyed enterprises is low. More than 45% of them did not implement innovations in the past 2 years, and one fifth have not even scheduled such activities. Merely a quarter of entities systematically implement the innovation process in cooperation with other entities. Less than 30% of respondents declare the occasional implementation of innovations and the launch of the development of an innovation management process. This approach translates into the introduction of ICT solutions. Less than 40% of companies invest in ICT in a more or less systematic way. More than 17% of entities recognize such a need, but for various reasons do not pursue it. Additionally, more than 26% are only planning to invest in certain ICTs. It is surprising that almost a fifth of the respondents do not see the need in this respect. A detailed analysis of the responses revealed that the lack of

a systematic approach to innovation management manifested by small enterprises (the first three responses from Table 2) translates into disorganized ICT investment (the first four responses from Table 3). Therefore, hypothesis 1 that small enterprises do not have an efficient innovation management system can be deemed confirmed. As a consequence, investments in ICT are sporadic.

In order to verify hypothesis 2, respondents were asked two questions. The first concerned digital competences of employees: a) in possession, b) requiring enhancement and development, c) not required by the company. Table 4 outlines the compilation of responses. In each block, competences (information-related, communication-related, problem solving, software use, programming) are ranked from simpler to advanced.

Table 4.
Digital competences of employees of enterprises (in %)

Specification	In possession	Requiring development	Not required
Information-related			
Acquisition of information from public administration websites	38.36	43.84	17.81
Operations on files online (cloud solutions)	30.82	44.52	24.66
Search for and analysis of information (about goods/services, markets, etc.)	31.85	47.60	20.55
Communication-related			
Sending/receiving email	53.77	37.67	8.56
Membership in social networks	30.48	43.84	25.68
Online voice/video chats	36.30	45.89	17.81
Problem-solving			
Online banking, sending electronic invoices	42.81	39.73	17.47
Installing software and applications	32.88	44.86	22.26
Changing software settings, including operating system or online security software	26.03	48.29	25.68
Buying and selling online	25.00	43.15	31.85
Using software			
Using Microsoft Office	44.86	43.84	11.30
Using graphics editors, photo, video and audio editors	23.97	47.95	28.08
Programming			
Writing code in a programming language	13.01	40.75	46.23

Source: own research.

A considerable number of enterprises (at the level of 40-50%) declare the possession of simpler digital competences in all blocks. It is worth noting that approx. 40% of the surveyed entities recognize the need to enhance and develop all the digital competences listed in the survey. This is more relevant for more advanced competences: related to changing software settings, using graphics editors, photo, video and audio editing software, and searching for and analyzing information (approximately 48% of respondents report such a need). A significant minority of enterprises do not require their employees to possess specific digital competences (from 9% to 26% for individual competences). The most advanced competences constitute an exception. Programming skills are not required by 46% of enterprises, online sales and the use of graphics software are not required by approx. 30%.

The second question pertained to activities undertaken by means of the Internet and ICT. Respondents rated individual activities on a scale from 1 – we do not use, to 5 – we use constantly. The results are presented in Table 5.

Table 5.

Activities for which enterprises use the Internet and ICT (in %)

Specification	Rating					Weighted average rating
	1	2	3	4	5	
Communication with stakeholders	0.68	3.42	13.70	21.58	60.62	4.38
Search for information	0.68	5.48	22.60	28.77	42.47	4.07
Banking	5.82	4.79	19.86	25.00	44.52	3.98
Customer service	7.53	8.22	25.00	28.42	30.82	3.67
Invoicing	11.64	5.48	23.29	28.77	30.82	3.62
Automatic exchange of data with external entities	9.59	7.19	25.00	33.22	25.00	3.57
Data analysis and processing	9.93	8.90	27.05	28.77	25.34	3.51
Administration	11.30	9.93	27.05	28.08	23.63	3.43
Brand building	14.38	8.22	25.00	29.11	23.29	3.39
Advertising	16.44	7.88	23.63	26.37	25.68	3.37
Remote work	15.75	11.30	23.63	27.05	22.26	3.29
Employee recruitment	21.92	9.93	23.29	27.40	17.47	3.09
Programming	19.86	11.99	27.40	23.29	17.47	3.07
Sales	26.71	8.56	19.52	24.32	20.89	3.04
Image/graphics creation	25.34	10.62	23.29	26.03	14.73	2.94

Source: own research.

Small enterprises predominantly use the Internet and ICT to communicate with stakeholders, search for information and to do online banking (the weighted average rating is approx. 4 and above). These activities do not require any specific digital competences. More complex activities such as image/graphics creation, sales, programming, recruitment, Internet and ICT are used much less frequently (weighted average rating below 3.2). This means that these activities are either pursued using traditional tools or are not carried out at all.

Concerning hypothesis 2 that the employees of small enterprises do not possess sufficient advanced digital competences, the analysis of data presented in Tables 4 and 5 allows the hypothesis to be confirmed. Therefore, it can be argued that the Internet and ICT are usually used for mundane, everyday activities.

Several questions were also used in order to verify hypothesis 3. By responding to the first, the respondents assessed digital solutions used by their enterprises (on a scale from 1 – we do not use, to 5 – we use constantly). The answers are presented in Table 6.

Table 6.
Digital solutions used by enterprises (in %)

Specification	Rating					Weighted average rating
	1	2	3	4	5	
Office software (e.g. Excel, Word, PowerPoint)	3.77	3.77	19.18	28.42	44.86	4.07
Company website	7.19	3.42	22.26	26.71	40.41	3.90
Social media	13.70	7.88	25.34	29.11	23.97	3.42
Electronic document management software	12.67	9.93	28.77	29.11	19.52	3.33
Cloud solutions (e.g. Google Drive, Microsoft OneDrive)	16.10	9.59	26.37	24.32	23.63	3.30
Web meetings (e.g. Teams, Zoom, Skype)	19.52	10.27	23.29	26.71	20.21	3.18
Online business listings (e.g. Google Business Profile)	16.78	11.99	28.08	22.95	20.21	3.18
Internet of Things devices or systems (e.g. smart locks, lighting, cameras, sensors)	24.32	8.90	27.40	23.63	15.75	2.98
Customer Relationship Management Software (CRM)	25.34	9.59	23.97	25.68	15.41	2.96
Software for comprehensive business management (e.g. ERP, Mindmeister, Canvas, Miro)	28.08	9.59	27.05	20.21	15.07	2.85
Analytical tools (e.g. Google Analytics)	26.03	10.27	28.42	23.29	11.99	2.85
Online sales and purchasing (e.g. Allegro, Ceneo, Amazon, Empik)	26.71	13.36	23.63	21.58	14.73	2.84
Sales platform (e.g. Shoper, Shopgold, Sky Shop)	39.73	11.64	21.92	17.12	9.59	2.45

Source: own research.

The most frequently used digital solutions in the ranking are the simplest ones: Office software, company website, social media (weighted average rating at the level of 3.4-4). At the bottom of the hierarchy were the most complex ones – sales platforms, analytical tools, software for comprehensive business management (ratings below 2.9). Only 36 companies from the entire sample (12.3%) use all digital solutions very frequently or constantly, and merely four entities (1.4%) do not use any.

The respondents also offered responses to the question concerning the functions of the enterprise's website (Tab. 7).

Table 7.
Functions of the company website (in %)

Specification	% of enterprises
Presentation of products, goods, services and access to catalogs and price lists	46.92
Information about job vacancies, on-line submission of application documents	27.05
Links to the enterprise's profiles on social media	26.03
Enabling users to order custom made products/services	20.55
After-sales service (consumer support)	19.52
Online ordering or booking	18.15
Checking the status of an online order	17.81
We do not have a website yet	13.70

Source: own research.

More than 86% of small businesses have their own website. Almost half of the surveyed entities (47%) use them to present their offer. Only approx. 20% of them sell via the website.

In addition, the respondents provided information on the use of social media by their enterprises (Tab. 8).

Table 8.*Social media use by the company (in %)*

Specification	% of enterprises
Social networking sites (e.g. Facebook, LinkedIn, Goldenline, Google)	57.19
Services enabling multimedia to be shared (e.g. Youtube, Instagram, Tiktok, Flickr, Slideshare)	26.03
Blogs or microblogs run by the company (e.g. Twitter, Blogger, Tumblr, Present.ly)	15.07
Wiki information exchange tools	12.33
We do not use social media	20.89

Source: own research.

Seventy nine percent of companies use social media. Social networks are the most popular. A little over a quarter of respondents confirm sharing multimedia and running blogs, and slightly over a tenth – the use of Wiki information exchange tools.

Concerning hypothesis 3 that small enterprises use a fairly wide range of digital solutions, mainly intended for communication with customers, Tables 6, 7 and 8 suggest that the hypothesis was verified positively.

Hypothesis 4 was verified on the basis of three questions. First, the respondents assessed outcomes associated with the use of the Internet and ICT by the company (Tab. 9).

Table 9.*Outcomes related to the use of the Internet and ICT by enterprises (in %)*

Specification	Outcome achieved	Outcome intended to be achieved	Digitalization cannot deliver the outcome
Reduction of time devoted to administrative tasks	51.71	35.27	13.01
Improvement of cooperation with business partners and acquisition of new ones	50.00	34.93	15.07
Improvement of company image	48.29	38.70	13.01
Efficiency increase regarding internal processes	46.92	35.27	17.81
Reduction of costs and losses	44.52	37.67	17.81
Increase in the number of clients	44.18	42.12	13.70
Products/services quality improvement	44.18	37.33	18.49
Boost of income	38.70	42.47	18.84
Entrance to new markets	35.62	34.93	29.45

Source: own research.

The vast majority of respondents are aware that owing to digitalization, enterprises obtain or can obtain a variety of outcomes. In approximately half of the surveyed entities, ICT contributed to reducing the time devoted to administrative tasks, improving cooperation and acquiring new business partners, and enhancing the company's image. The respondents also recognize other potential benefits, primarily a boost of income and an increase in the number of clients. Perhaps the desire to exploit these advantages translates into a declaration of readiness to expand the scope of ICT use in the future. It is surprising that almost one third of respondents do not associate digitalization with the opportunity for the company to enter new markets. Moreover, almost one fifth does not link it with an increase in income and an improvement in the quality of products/services.

The respondents were then asked what impact digitalization may have on the future of the company. The answers were rated on a scale from 1 – none, to 5 – very large, decisive. The distribution of answers is as follows: "1" – 1.71% of respondents; "2" – 5.82%, "3" – 27.74%, "4" – 41.1%, "5" – 23.63%. Thus, the respondents largely confirm that digitalization has a significant impact on the future of the business. What, if any, concerns do the respondents have? Table 10 contains data that allow an answer to this question to be obtained. The assessment was made on a scale from 1 – no concerns, to 5 – significant concerns.

Table 10.
Concerns of the company related to digitalization (in %)

Specification	Rating					Weighted average rating
	1	2	3	4	5	
Necessity of acquiring specialists or supplementing knowledge by the management and employees	8.56	10.27	37.67	31.51	11.99	3.28
Incurring high costs	8.56	11.30	38.70	30.48	10.96	3.24
Selection of inappropriate ICT	9.59	12.33	43.84	27.40	6.85	3.10
No expected outcomes	9.59	17.47	40.41	26.03	6.51	3.02
Employee resistance	12.67	18.84	40.07	19.86	8.56	2.93
Employment reduction	14.04	18.84	41.44	17.12	8.56	2.87

Source: own research.

The majority of enterprises are concerned with the need to attract specialists or to supplement knowledge (43.5% of respondents selected ratings "4" and "5") and the need to incur high costs (41.4%). The fewest are concerned with the resistance of employees (28.4%) and reduction of employment (25.7%). The weighted average rating for all items listed in the survey ranges from 2.8-3.3, i.e. it is at a moderate level. This may denote that respondents are aware of certain hindrances associated with digitalization. However, it is unlikely to contribute to a negative attitude towards the process.

The foregoing analyses revealed that hypothesis 4 can be deemed verified in its first part – small enterprises indeed recognize the outcomes associated with the use of the Internet and ICT. However, there are grounds for rejecting the second part of the hypothesis – concerns regarding digitalization are not significant. Due to the fact that approximately half of the surveyed entities did not obtain the outcomes of digitalization, other reasons should be considered. The main obstacle is the shortage of appropriate digital competences, especially among managers. Some optimism is associated with the fact that respondents manifest willingness to develop them and recognize the fact that digitalization is an inevitable process, regardless of the size and profile of the company.

Because the study was conducted during the ebb of the fifth wave of the COVID-19 pandemic, the respondents were requested to assess its impact on the course of digitalization of their enterprises. The distribution of answers is as follows: "stopped" – 1.71%; "slowed down" – 9.93%; "had no impact" – 50.68%; "forced to start" – 22.95%; "accelerated" – 14.73%. This is a very surprising result because most of the research carried out in the SME sector

confirms the fact that digitalization accelerated due to the pandemic (Digitally Dieven, 2021; DigitalPoland Foundation, 2022; PARP, 2022). These differences may be related to the fact that the studies cited above pertained to small and medium-sized enterprises, while the sample examined herein exclusively contains small businesses. In these entities, the digitalization process is slower.

5. Conclusions

The global digital revolution has significantly stimulated the digital activity of organizations of various types and sizes. Minimizing costs, improving efficiency and effectiveness, enhancing the quality of products/services, acquiring new customers, increasing competitiveness – these are only some of the benefits of digitalization. The present study allows a number of conclusions to be formulated. The vast majority of the surveyed small enterprises are just beginning to develop innovation management systems. They are not yet efficient and well-operating, which results in difficulties and delays in the delivery of investments in new technologies. Although the use of the Internet and ICT is declared by the majority of the respondents, they are mainly basic tools, not requiring advanced digital competences. These competences are at a low level and in need of improvement. This is one of the main problems of digitalization in small businesses. There is a lack of funds for investments in ICT and computer equipment, training, hiring highly qualified IT specialists, and for hiring the services of IT and consulting companies. The surveyed enterprises are aware that they may gain certain benefits as a result of digitalization. They have no major concerns and understand that this is an inevitable process.

The study revealed that Polish small enterprises are characterized by relatively low digital activity. This is a worrying phenomenon. If they delay the digital transformation, they may disappear from the market in the next decade. Digitalization is a significant change that requires professional management in order to be effective. A clear vision should be the departing point in the process. Instead of introducing individual, chaotic solutions, it is worth spending time and resources to develop an integrated digital business model. In practice, such a solution will be more beneficial for the company.

The digital activity of small enterprises will undoubtedly develop. In order for the process not to be overly slow, more support is needed from the authorities in terms of access to finance, infrastructure, tools, professional advice and training.

References

1. *Aktywność*, [hasło w:] Wielki słownik języka polskiego. Retrieved from <https://wsjp.pl/haslo/podglad/1623/aktywnosc/2769377/dzialania>, 19.08.2022.
2. Bergson-Shilcock, A. (2020). *The New Landscape of Digital Literacy: How workers' uneven digital skills affect economic mobility and business competitiveness, and what policymakers can do about it*. Waszyngton: National Skills Coalition.
3. Brennen, J.S., Kreiss, D. (2016). Digitalization. *The International Encyclopedia of Communication Theory and Philosophy*. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1002/9781118766804.wbiect111>, 20.07.2022.
4. Buchner, A., Zaniewska, K. (2016). *Katalog Kompetencji Cyfrowych Małych Firm. Raport z badań*. Warszawa: Fundacja Centrum Cyfrowego.
5. Digitally Driven (2021). *DigitallyDriven/Europe European Small and Medium-Sized Enterprises (SMEs). Transformation, Innovation, and Resilience During the COVID-19 Pandemic*. Retrieved from <https://digitallydriven.connectedcouncil.org/europe/>, 19.08.2022.
6. Fundacja DigitalPoland (2022). *Inwestycje w technologie w dobie pandemii 2022. Nowe wyzwania MŚP: cyfryzować czy oszczędzać?*. Warszawa: Fundacja DigitalPoland.
7. Fundacja Warsaw Enterprise Institute (2017). *Niebezpieczny status Quo. Dlaczego małe firmy nie rosną?*. Warszawa: Fundacja Warsaw Enterprise Institute. Retrieved from <https://wei.org.pl/wp-content/uploads/2021/06/file-bfe13a8658c5f8330dc58a3188e77c50.pdf>, 19.08.2022.
8. Gong, C., Ribiere, V. (2021). Developing a unified definition of digital transformation. *Technovation, Vol. 102*, pp. 1-17.
9. Gudanowska, A., Kononiuk A. (eds.). (2020). *Uwarunkowania ucyfrowienia procesów produkcji i wzrostu kompetencji cyfrowych społeczeństwa*. Białystok: Oficyna Wydawnicza Politechniki Białostockiej.
10. GUS (2021). *Spółczesne trendy w zarządzaniu małymi przedsiębiorstwami*. Lublin: Politechnika Lubelska.
11. Mieszajkina, E. (2020). *Współczesne trendy w zarządzaniu małymi przedsiębiorstwami*. Lublin: Politechnika Lubelska.
12. Oberländer, M., Beinicke, A., Bipp, T. (2020). Digital competencies: A review of the literature and applications in the workplace. *Computers & Education, Vol. 146*, pp. 1-13.
13. Oh, K., Kho, H., Choi, Y. (2022). Determinants for Successful Digital Transformation. *Sustainability, Vol. 14, No. 3*, pp. 1-14.

14. Polska Agencja Rozwoju Przedsiębiorczości. (2022). *Raport o stanie sektora małych i średnich przedsiębiorstw w Polsce*. Warszawa: Polska Agencja Rozwoju Przedsiębiorczości.
15. Reis, J., Amorim, M., Melão, N., Matos, P. (2018). Digital Transformation: A Literature Review and Guidelines for Future Research. *Trends and Advances in Information Systems and Technologies*, pp. 411-421.

RESPONSIBLE CONSUMPTION IN EUROPE: CAUSES AND HABITS

Jurgita PAUŽUOLIENĖ^{1*}, Ligita ŠIMANSKIENĖ², Aušra PACEVIČIŪTĖ³

¹ Klaipeda University of Applied Sciences in Klaipeda (Lithuania); j.pauzuoliene@kvk.lt,
ORCID: 0000-0002-1034-2296

² Klaipeda University in Klaipeda (Lithuania); ligita.simanskiene@ku.lt, ORCID: 0000-0002-0548-0459

³ Klaipeda University in Klaipeda (Lithuania); ausra.paceviciute@ku.lt, ORCID: 0000-0002-8234-3511

* Correspondence author

Purpose: The main reason to do the research of consumption of society in Europe is the ever-increasing consumption, not sorting enough, which leads to problems on a global scale. Responsible consumption can be described as the behaviors and attitudes of the consumers to consume or less consume products and services that have the potential to directly or indirectly harm to society, economy, the world, and all living and nonliving things. The aim of the paper is to investigate the habits and causes of responsible consumption in Europe.

Design/methodology/approach: Analysis of research literature sources, systematization, synthesis, generalization, quantitative research and data processing methods was used. The collected empirical data were processed using the SPSS (Statistical Package for the Social Sciences) program. In the data processing, descriptive statistics was used, such as percentiles, mean, mode and standard deviation. Research was done using an online questionnaire. The questionnaire was compiled by the authors, based on the scientific literature. In the research, respondents participated from Lithuania (373 respondents) and other European countries (444 respondents from Latvia, Poland, Italy, United Kingdom, Germany, Bulgaria, France).

Findings: Results showed that the main reason why people choose to consume responsibly are taking care of their own and their family's well-being and a sense of responsibility for what is happening in the world. The results of the study revealed that, in principle, the respondents who took part in the survey consume quite responsibly, but do not volunteer much and participate in community activities. These activities would help to share both food and other goods without throwing them away.

Research limitations/implications: Only those respondents who use an internet connection could participate in the study. It was also a random selection of the respondents, so in the future it would be useful to do research that would cover all age groups and other demographical characteristics.

Practical implications: Although there are no direct recommendations for consumers on how to use responsibly, the results show what kind of responsible consumption methods they use, what inspires them to be responsible. This should help readers change their consumption habits to be more responsible.

Social implications: The results of this study will undoubtedly contribute to more responsible consumption and encourage people to act more responsibly. Research results shows that there is a relatively large part of people who care about the ecological situation of the whole world,

volunteer, their answers give encouragement, even in small steps, but to be responsible consumers.

Originality/value: The paper reveals the buying habits of consumers, which will help the readers of the paper (managers of organizations and, of course, consumers) to understand the meaning of responsible consumption in the world and encourage them to be more responsible consumers. This paper explains how sustainable consumption is compatible with the goals of sustainable development. The paper is also interesting that it compares the answers of respondents from quite different European countries. The results have both theoretical and practical implications for the search for measures for responsible consumption.

Keywords: causes, habits, responsible consumption, sustainable development goals, Europe.

Category of the paper: research paper.

1. Introduction

The negative effects of intensive production and growing consumption in the 21st century have led entrepreneurs and stakeholders to talk more about responsible consumption. The negative consequences of consumption for the environment and society encourage people to use their products more responsibly and carefully. Responsible consumption is a broad concept that has not only an environmental dimension but also an economic, social and health dimensions, that takes into account the foundations of sustainable development. Consumption, although often considered an individual choice, is deeply ingrained in behaviors, cultures, and institutions, and is driven and supported by corporate and government practices. Consumption is also at the heart of many of our most critical ecological, health, and social problems (O'Rourke, Lollo, 2015). This have encouraged various stakeholders, such as government regulatory agencies, relevant international organizations, and education and science institutions to incorporate sustainable consumption at their corporate and strategic planning levels (Wang et al., 2019). According to Glavič (2021) sustainable consumption is the use of products and services that have a minimal impact on the environment and enable future generations to meet their needs. It can be regarded on different levels including global, state, region, city, community, or enterprise, public institution, household or individual levels. Sustainable consumption is mostly regarding materials (especially critical raw materials), energy, water, resource efficiency, and (zero) waste. Promoting sustainable consumption is a crucial aspect of sustainable development, which depends on achieving long-term economic growth that could ensure environmental and social needs for both present and future generations (Sesini, Castiglioni, Lozza, 2020). According to Prothero et al. (2011) it is critical to understand consumption within its macro context and to move beyond understanding behaviors to influencing them through pro - active public policy. This is especially important given that many of the barriers to sustainable consumption behavior are rooted in public policy or a lack thereof. For example, changes in the availability and quality of public transportation,

the availability and affordability of sustainable products and housing, the development of appropriate product labeling schemes, and so on all depend on public policy actions. Without the enactment of effective policies, consumers are severely limited in the degree to which they can act on their pro sustainability attitudes.

A responsible consumer can be defined as a person basing his acquisition, usage, and disposition of products on a desire to minimize or eliminate any harmful effects and maximize the long-run beneficial impact on society. Webster (1975 from Prendergast, Tsang, 2018) defined a socially conscious consumer as, a consumer who takes into account the public consequences of his or her private consumption or who attempts to use his or her purchasing power to bring about social change. According Webb et al. (2008) socially responsible consumer is a person basing his or her acquisition, usage and disposition of products on a desire to minimize or eliminate any harmful effects and maximize the long-run beneficial impact on society. It can be state that responsible consumption is a way of consuming that is beneficial considering 3 different cornerstones, by no specific order. First, it benefits the economy, especially the local economy, as it allows goods and services to be traded, benefiting the agents involved in these trades. Secondly, it has a positive impact on society, as the products or services purchased are linked to a workforce that has fair wages and working conditions and they're also positively good for the buyers (in matters such as health). Finally, a responsible consumer also acknowledges the impacts associated with products' different stages (from its production, transportation, and disposal) and tries to buy the ones with a lower impact. Based on some researches consumers are becoming more socially conscious and are including ethical considerations in their purchase decisions (Prendergast, Tsang, 2019), as well as consumers are increasingly interested in various forms of responsible consumption (Schrader, 2007). Consumers have more product choices and, therefore, have more opportunities to reveal their social preferences when making purchase decisions (Auger et al., 2010). The responsible consumer understands that his choices bring about not only individual short-term consequences (satisfaction derived from consumption), but also long term individual and social results. More sustainable lifestyles cannot be achieved without marking changes in consumer attitudes and behavior (Francois-Lecompte, Roberts, 2006).

The topic of responsible consumption is analyzed quite broadly and with a specific focus on the 12th sustainable development goal which includes sustainable consumption and production. According to Rybarova (2020) problematic of sustainable consumption and production is a broad conception that is integrating application of advanced methods and techniques of business management, in all areas, including eco-design and innovation, sustainable marketing, risk management and strategic management with a focus on sustainable development for the environment.

In the paper we raise problematic question: What are consumers' responsible consumption habits and causes?

2. The essence of responsible consumption and production, theoretical framework

Sustainable development is at the very heart of the European Union (EU). Every EU initiative is aimed at improving citizens' lives, on a healthier planet, for a sustainable future. Sustainable consumption and production (SCP) have been recognized as an integral part of the Sustainable Development Agenda until 2030 and is one of the 17 goals of sustainable development that has a significant impact on other goals. It is identified separately as objective number 12. Responsible consumption and production can be defined as using of materials in the manner that minimizes negative impacts on the environment, society and economy "doing more and better with less" increasing net welfare gains from economic activities by reducing resource use, degradation and pollution along the whole lifecycle, while increasing quality of life by involving various stakeholders (Lukman et al., 2016; United Nations, 2022a). Sustainable production is "the creation of goods and services using processes and systems that are non-polluting, conserving of energy and natural resources, economically viable, safe and healthful for workers, communities, and consumers". SCP is a well-established interdisciplinary research field with a wide variety of practical life-cycle approaches, including life-cycle analysis (LCA) (Katila et al., 2020). Typical activities include circular economy, cleaner production, pollution prevention, integrated pollution prevention and control (IPPC), best available techniques (BAT), responsible care, process optimization, energy integration, recycling, reuse, repair, regeneration, remanufacturing, renewable resources, factor X, eco-efficiency, industrial ecology, supply chain, life cycle assessment, doing more with less, environmental accounting, social responsibility, global reporting initiative, etc. (Glavič, 2021).

Goal 12 "Responsible consumption and production" is divided into 11 targets and focuses on ethic, equity, ecological and economic principles of consumption (United Nations, 2022b). Targets specify the goals and indicators represent the metrics by which the world aims to track whether these Targets are achieved. The implementation of SDG 12 on sustainable consumption and production is still challenging in Europe (Eurostat, 2020b), while being instrumental to the realization of the Agenda 2030 as a whole. The ways in which most people consume today – large volumes at a high rate, along a linear trajectory and with significant wastage (take-make-dispose) – are not sustainable.

Over the most recent five years of available data, the EU made progress towards almost all the 17 sustainable development goals (SDG). Progress in some goals has been faster than in others, and within goals, movement away from the sustainable development objectives also occurred in specific areas (Rybarova, 2020). Insufficient progress towards the EU target under Goal 12 was recorded under the indicators: Primary energy consumption, Generation of waste excluding major mineral wastes and movement away from the EU target was recorded under the indicator Final energy consumption. It can be seen that the progress to promote sustainable

production and consumption is uneven. However, shifting to sustainable consumption and production patterns is a prerequisite to addressing global crises, including climate change, biodiversity loss and pollution, and is central to achieving sustainable development. There is a positive trend in the development of national instruments and strategies aimed at supporting this shift. By 2020, 83 countries and the European Union reported a total of 700 policies and implementation activities under the 10-Year Framework of Action of December 2020, 40 countries had reported on sustainable public procurement policies or action plans (or equivalent legal dispositions), which encourage the procurement of environmentally sound, energy-efficient products, and promote more socially responsible purchasing practices and sustainable supply chains (United Nations, 2021). Based on the Europe sustainable development report (2021) Europe faces its greatest SDG challenges in the areas of sustainable diets and agriculture, climate and biodiversity (SDG2, 12-15), in strengthening the convergence of living standards across its countries and regions and needs to accelerate progress on many goals. The Europe union is still in progress and there are still Significant challenges remain by achieving the 12th goal of sustainable development.

3. Methodology of the research

The research method. The quantitative research method was used in the research. The questionnaire was prepared on the pollimill.com website, and the link was sent to respondents.

The research population. Residents of Lithuania. The survey was conducted among Lithuanian consumers. Residents of other European countries were selected as a control group (Latvia, Poland, Italy, United Kingdom, Germany, Bulgaria, France). In this survey participated 373 respondents from Lithuania and 444 from other European countries. A simple random sample was used in the research. The survey time February-March of 2021.

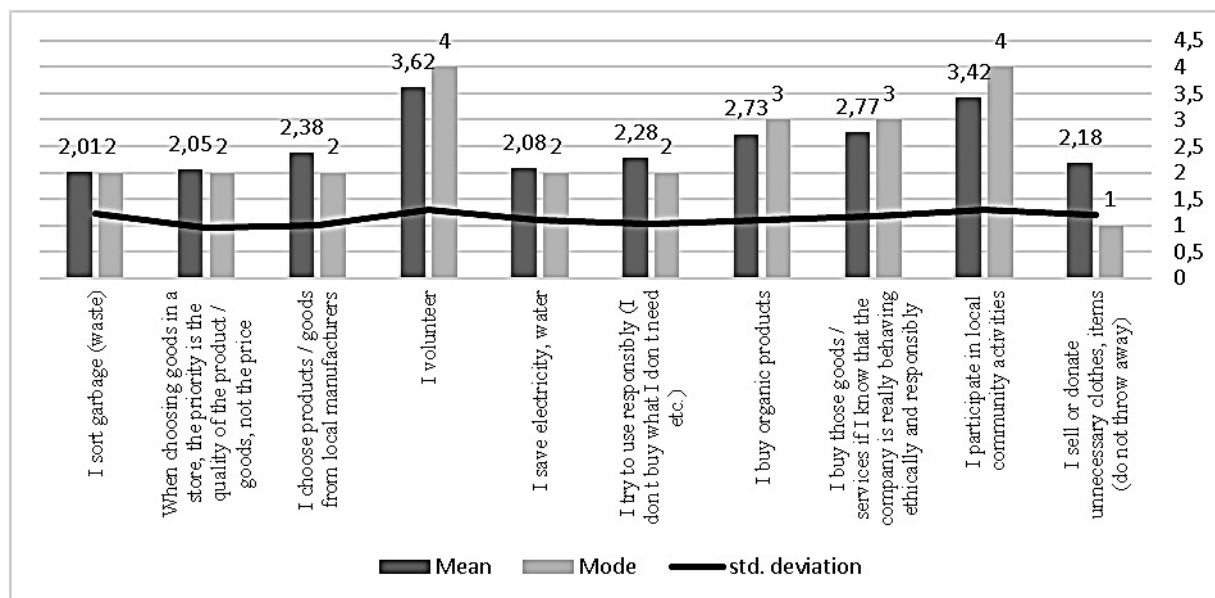
Research ethics. The research was guided by ethical principles:

- The principle of goodwill is ensured by the statements of the questionnaire, which are presented in a respectful style, without creating preconditions for respondents to lose privacy.
- Applying the principle of respect to the individual, the purpose of the study was explained to the respondents.
- Volunteering is the free will of study participants to participate or not to participate in a study.
- Research participants are guaranteed anonymity and data confidentiality.
- Honestly reported data, results, methods and procedures, and publication status.
- Avoided bias in data analysis, data interpretation, and decisions.

Data processing methods. The collected empirical data were processed using the SPSS 20.00 (Statistical Package for the Social Sciences). The data processing descriptive statistics were used, such as percentiles, mean, mode, and standard deviation. The data was also processed by the Independent samples t-test where significant differences are when $p \leq 0,05$.

4. Discussion on the research results

Research data analysis reveals that respondents are trying to be socially responsible consumers. Respondents' responsible consumption less manifested in volunteering (mean 3,63, mode 4) and participating in local community activities (mean 3,43; mode 4). Respondents often sort garbage (mean 2,01; mode 2); save electricity, water (mean 2,08; mode 2); sell or donate unnecessary clothes, items (mean 2,18; mode 1) and so on. Respondents rarely buy organic food (mean 2,73; mode 3) and buy those goods/services if know that the company is really behaving ethically and responsibly (mean 2,77; mode 3). From the obtained data we can see that individual consumption is connected to consumption patterns, life cycle thinking, and lifestyles (habits). The amount of waste generated can be reduced by changing consumption patterns through responsible purchasing planning, sorting waste, using it for a longer period of time or handing it over to others, recycling it and not turning it into landfill waste.



Note: Scale range : 1 – I always do that, 2 – I often do that, 3 – I rarely do that, 4 – I sometimes do that, 5 – I never do that.

Figure 1. Responsible consumption habits.

Source: created by authors based in the research data.

Research findings showed that there are significant differences between Lithuania and other European countries. Mean differences is provided in Table 1. The obtained results reveal that the residents of European countries, compared to the residents of Lithuania, more often voluntary ($p = 0.000 < 0.05$) and buy those goods/services if know that the company is really behaving ethically and responsibly ($p = 0.040 < 0.05$). Respondents from Lithuania more often sold or donated unnecessary clothes, items ($p = 0.000 < 0.05$) and more often participate in local communities ($p = 0.001 < 0.05$) compared with respondents from Europe countries. Such results suggest that, in general, respondents have relatively strong habits of responsible consumption. Of course would like more respondents to participate in volunteering and participate in local community activities.

Table 1.

Responsible consumption habits (mean difference between countries)

Country		I sort garbage (waste)	When choosing goods in a store, the priority is the quality of the product/goods, not the price	I choose products/goods from local manufacturers	I volunteer	I save electricity, water	I try to use responsibly (I pay attention to whether the products are packed in recyclable containers, etc.)	I buy organic products	I buy those goods/services if I know that the company is really behaving ethically and responsibly	I participate in local community activities	I sell or donate unnecessary clothes, items (do not throw away)
Lithuania	Mean	2,02	2,03	2,36	3,87	2,11	2,31	2,82	2,87	3,14	2,09
	Std. Deviation	1,167	,920	,951	1,271	1,106	1,007	1,120	1,154	1,398	1,071
	Sum	755	759	882	1442	788	860	1053	1071	1171	780
Other Europe country	Mean	2,00	2,06	2,39	3,40	2,07	2,27	2,65	2,69	3,28	2,21
	Std. Deviation	1,242	,980	1,054	1,259	1,090	1,041	1,075	1,180	1,191	1,260
	Sum	888	914	1058	1506	917	1005	1173	1191	1453	980
Significant differences between countries <i>p values</i>		p=0,537	p=0,092	p=0,112	p=0,000	p=0,889	p=0,162	p=0,247	p=0,040	p=0,001	p=0,000

Note: Scale range: 1 – I always do that, 2 – I often do that, 3 – I rarely do that, 4 – I sometimes do that, 5 – I never do that. Significant differences are when $p \leq 0,05$.

Source: created by authors based in the research data.

Respondents were asked to indicate other responsible consumption habits. Many responses were provided. It was most often mentioned that garbage is sorted, food is not wasted and consume responsibly. Some of answers are listed in the Table 2.

Table 2.
Other responsible consumption habits

Some provided answers
I shop once a week. I shop at the market from farmers.
I am taking my shopping bag with me.
I fix electronic devices and clothes instead of buying new ones. I avoid buying low quality products and choose those which will last longer and can be fixed (shoes, clothes, furniture etc.).
I prefer seasonal products and during summer time I like to make fruit jams at home to use over ripe fruits and avoid waste.
I do not buy gift bags, but use the ones that have been given to me and my family. I always have a fabric shopping bag with me. I try fixing broken boots and clothes. We collect waste paper.
I am trying to use my car with traditional engine as less as is possible but this still is a challenge for me.
I try to buy a well-planned amount of food in order to avoid food waste.
I try to use my bike as much as possible, I switch off the lights when I am not in a room.
Using public transport or bike instead of own car.
I buy fair trade products.
I avoid using plastics.
I try to buy only what is necessary.

Source: created by authors based in the research data.

The United Nations provides several ways what consumers can do about responsible consumption. The first reducing waste and second, be thoughtful about what to buy and try to choose a sustainable option whenever possible. Don't throw away food, and reduce consumption of plastic—one of the main pollutants of the ocean. Carrying a reusable bag, refusing to use plastic straws, and recycling plastic bottles. Making informed purchases also helps. For example, the textile industry today is the second-largest polluter of clean water after agriculture, and many fashion companies exploit textile workers in the developing world. Try to buy from sustainable and local sources can make a difference as well as exercising pressure on businesses to adopt sustainable practices.

The respondents were asked: what are the main reasons that motivate or encourage to use responsible? (see fig. 2).

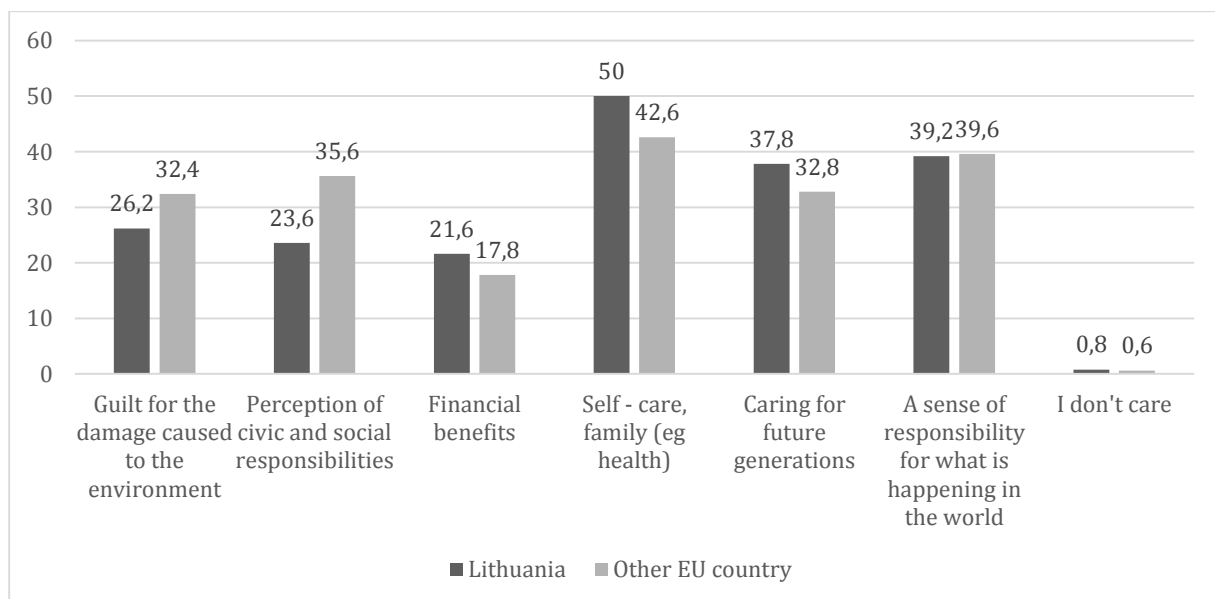


Figure 2. Causes that motivate to consume responsible (percent).

Source: created by authors based in the research data.

The research data reveal that the main reasons which motivate to use responsible for most of respondents are: self-care, family, a sense of responsibility for what is happening in the world, caring for future generations, perception for civil and social responsibilities. It can be said that respondents care about responsible consumption. They are not indifferent to these problems and try to solve them through responsible consumption.

Conclusions

The negative consequences of consumption for the environment and society encourage people to consume responsibly and to choose carefully which goods to purchase. Responsible consumption is behaviour that includes the responsible use of natural resources, the efficient use of organic products, waste sorting, recycling, and so on. Practicing responsible consumption also means knowing better the products being bought and their environmental, social, or economic impact. The essential point of responsible consumption is to be aware of the impacts of consumption on various criteria and to act to make this consumption more positive. One of the greatest global challenges is to integrate environmental sustainability with economic growth and welfare by decoupling environmental degradation from economic growth and doing more with less.

Our study revealed that respondents' consumption habits are quite responsible, but global practice shows that most people still lack the knowledge and skills to contribute to responsible consumption and the well-being of society. People have little involvement in community activities or volunteering. Little attention is paid to the company's interest in socially responsible and ethical activities. Also, only some consumers pay attention to packaging to see if it can be recycled or not. It reveals that consumers make little change in their daily shopping habits, although they are well aware of the consequences of irresponsible consumption. The main causes that motivate people to consume responsibly are self-care, family, a sense of responsibility for what is happening in the world and caring for future generations.

References

1. Auger, P., Devinney, T.M., Louviere, J.L., Burke, P.F. (2010). The importance of social product attributes in consumer purchasing decisions: a multi-country comparative study. *International Business Review*, Vol. 19, No. 2, pp. 140-159.
2. Europe sustainable development report (2021). Retrieved from <https://www.sdgindex.org/reports/europe-sustainable-development-report-2021/> 10.04.2022.
3. Eurostat (2020b). *Ensure sustainable consumption and production patterns*. Retrieved from <https://ec.europa.eu/eurostat/statistics-explained/index.php/> 10.04.2022.
4. Francois-Lecompte, A., Roberts, J.A. (2006). Developing a measure of socially responsible consumption in France. *Marketing Management Journal*, Vol. 16, No. 2, pp. 50-66.
5. Glavič, P. (2021). Evolution and Current Challenges of Sustainable Consumption and Production. *Sustainability*, Vol. 13, No. 16, pp. 1-24, <https://doi.org/10.3390/su13169379>.
6. Jackson, T. (2007). *Sustainable consumption. Handbook of Sustainable Development*. G. Atkinson (ed.) et al. Cheltenham, UK – Northampton, MA, USA.
7. Katila, P., Colfer, C.P., Jong, W., Gallaway, G., Pacheco, P., Winkel, G. (2020). *Sustainable Development Goals: Their Impact on Forest and People*. Retrieved from <https://www.cambridge.org/core/product/5FA75743F80CCE33751BD2095E5754DC>.
8. Lukman, R.K., Glavič, P., Carpenter, A., Virti, P. (2016) Sustainable consumption and production – Research, experience, and development – The Europe we want. *Journal of Cleaner Production*, Vol. 138 (Part 2), pp. 139-147.
9. O'Rourke, D., Lollo, N. (2015). Transforming Consumption: From Decoupling, to Behavior Change, to System Changes for Sustainable Consumption. *Annual Review of Environment and Resources*, Vol. 40, No. 1, pp. 233-259.
10. Predergast, G.P., Tsang, A.S.L. (2019). Explaining socially responsible consumption. *Journal of Consumer Marketing*, Vol. 361, pp. 146-154.
11. Prothero, A., Dobscha, S., Freund, J., Kilbourne, W.E., Luchs, M.G., Ozanne, L.K., Thøgersen, J. (2011). Sustainable Consumption: Opportunities for Consumer Research and Public Policy. *Journal of Public Policy & Marketing*, Vol. 30, No. 1, pp. 31-38.
12. Rybarova, D. (2020). *Assessing progress towards responsible consumption and production*. SHS Web of Conferences 83: Current Problems of the Corporate Sector 2020. doi.org/10.1051/shsconf/20208301059.
13. Schrader, U. (2007). The moral responsibility of consumers as citizens. *International Journal of Innovation and Sustainable Development*, Vol. 2, No. 1, pp. 79-96.
14. Sesini, G., Castiglioni, C., Lozza, E. (2020). New Trends and Patterns in Sustainable Consumption: A Systematic Review and Research Agenda. *Sustainability*, Vol. 12, No. 15, pp. 1-23. [doi:10.3390/su12155935](https://doi.org/10.3390/su12155935).

15. United Nation (2021). Retrieved from <https://unstats.un.org/sdgs/report/2021/goal-12/>, 20.06.2022.
16. United Nations (2022a). *Responsible consumption and production*. Retrieved from <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>, 10.04.2022.
17. United Nations (2022b). *The 17 goals*. Retrieved from <https://sdgs.un.org/goals>, 10.04.2022.
18. Wang, Ch., Ghadimi, P., Lim, M.K., Theng, M.L. (2019). A literature review of sustainable consumption and production: A comparative analysis in developed and developing economies. *Journal of Cleaner Production*, Vol. 206, pp. 741-754.
19. Webb, D.J., Mohr, L.A., Harris, K.E. (2008). A reexamination of socially responsible consumption and its measurement. *Journal of Business Research*, Vol. 61, No. 2, pp. 91-98.

THE COLOR SHADES OF LEADERS IN THE COUNTRIES OF ECONOMIC TRANSFORMATION: THE CASE OF POLAND

Andrzej PAWLUCZUK

Bialystok University of Technology; a.pawluczuk@pb.edu.pl, ORCID: 0000-0002-1642-9894

Purpose: The aim of the paper is to identify the process of shaping leaders in a transformed Eastern European Countries (EEC) like Poland based on the case study in the IT sector.

Design/methodology/approach: A research analysis of the world literature on the subject indicates that these issues have yet to be studied from a long-term perspective. In light of the economic system, the author describes the difference and core attributes for emerging leaders. The author uses the case study of the two IT leading companies and their leaders from roots up to final mergers and acquisitions of each other.

Findings: The case study shows that in a long-term perspective the key role is played by the founders based on grounded education, experience, embodied entrepreneurship attitudes, ethics, openness for innovations, independence of unclear relations, and mission are crucial to developing with success the company.

Research limitations/implications: The research covers only case studies so that it could be extrapolated to prominent players in specific sectors for companies with the activity of more than ten or even 20 years on the market.

Practical implications: The research could be used for training or teaching courses related to MBA, postgraduates, or management program study. Based on the review, the other companies can measure the risk with new potential countries in their early stage of new free markets. The leadership model could be duplicated so that market analysts and decision-makers could conduct an in-depth study about the leaders in certain countries. The in-depth collaborations should have a long-term perspective with a clear and correct leader and/or founder. The students should consider working in companies with solid leadership ethics to build their prospectus careers.

Social implications: The public organization and authorities should cooperate and take a donation from ethical companies and leaders. Hiding support from ethical leaders/founders could be taken without obligations. Donations do not mean even PR.

Originality/value: This review emphasizes that becoming a leader means possessing skills that should be shaped during education and even socialization. Leaders could cover their unethical behavior or incompetence to become a manager, but it would provide a huge, postponed on time disaster for the company. The paper is addressed to all potential and present leaders, including students, during their study.

Keywords: company survival factors, education, leadership, mergers&acquisitions.

Category of the paper: Case study, General review.

1. Introduction

Setting the goal of presenting a portrait of a professional leader in the author's association invoked a painter's color palette. Using various paints, brushes, and canvas, his vision of the picture creates a work of art. Will it be considered outstanding in the artist's life, or will it turn out during daily life after his death? Outstanding could be a few, depending on what art we are discussing. A painter needs, first of all, talent than a good workplace, and tools are the last thing that is necessary but easy to possess. Each country, regardless of the social and economic system, has its leaders, starting with private or state enterprises, public organizations: hospitals, schools, universities, non-profit organizations: foundations and associations, but also party or religious organizations (Örtenblad, 2018). The number and type of leaders themselves create a color palette. Changing the economic system causes additional coloration of this color scheme described palette. The painter will therefore be the manager, and the image will take the effect of the organization's activity here, depending on its purpose, which the product, service, financial results, customer satisfaction, etc., will realize. A comparison of each artist with a particular classification would be correct. However, according to business by analogy, comparing managers in a given group will be more appropriate when there are some standard features. The author would not take into account a commonly cited general theories such as Great Men Theory, Trait Theory, Behavioral Theory, Contingency Theory and Leadership as a process (Samul, 2020).

Since the political transformation in Poland have been published about 300 monographs, devoted to the leader or manager, with the words in the title: leader, manager, manager (NUKAT, 2022). After a few years, along with the increasing openness of Poland and cooperation not only in economics but also in education or science, publications from the trend of postmodern management appeared, which indirectly referred to managers and leaders of organizations through organizational culture (Kostera, 1996). There is no in-depth analysis of Polish leaders in the period of 20 or even 30 years, creating enterprises from scratch. However the paper fills a niche because it presents a case study of two IT companies that started their operations at the beginning of the free market economy in Poland. It is essential to set research goals, which are as follows:

1. How did the socio-economic changes affect the development of leadership characteristics in Poland?
2. What were the conditions of operation of the leaders in Poland against the background of mature markets in the world?
3. What characteristics of a leader allowed the company to successfully develop in the long term?

The author used literature studies and the case study method as a method. Literature studies included mainly authors from Poland, who also had experience in conducting research and working at foreign universities in Western Europe, the USA and other developed countries. The case study is a fairly common, structured research method that has numerous advantages and disadvantages (Yin, 2015).

The author draws the landscape of the socio-economics system in Poland with input to education policy. The labour market was very weak without new methods of production and operating at the markets as well as without innovative products in each sector with few exceptions, e.g. Vigo System. Based on literature review, there was a list of attitudes of leaders. The final research part shows the case study of two leaders and their company for over three decades, where one of them was acquired by a smaller company in terms of number of workers and revenue, but with higher organizational culture and effective leadership of the founder.

2. Socio-economics system in the post-Soviet countries and its influence on the managerialism in first decades of transformation

In this section, the author presents the main features of the functioning of the post-socialist economy in the context of the influence on the currently operating way of managing organizations by leaders. One of the most commonly quoted economic indicators is GDP (Google search 494 mln records), we read and hear in the media that it has increased or dropped by as much as percent, in a given country, with specific comments. On the other hand, a very few people know this methodology, even in the economists' world, the explanation of the individual components is not without errors (Stiglitz, Sen, Fitoussi, 2013). As a rule, countries with high GDP are rich, so private and public organizations operate efficiently and effectively, because they are properly managed. Being properly managed is almost synonymous with a good education system, obviously not just managers or leaders. In these few sentences we set up the general rules, without in depth cultural, environmental and political analysis. Continuing the issue of GDP, it is worth noting that many studies current purchasing power parities are included, but in the previous regime in Poland and the Eastern Bloc countries, it did not include services and public sector activities such as education, administration, and health. Each comparison immediately pointed to lower GDP per head in the Eastern Bloc countries compared to Western Europe, the United States, Japan, Canada and Australia. Does that mean, however, that every job will have the same meaning in the country's GDP? Often productivity is independent of technology and results from the ability and diligence of a worker as well as his physical condition. Examples of such professions are: artist, driver, cleaner, porter, cashier, factory worker, horticulture worker, etc. Employees for the same work experience receive extremely different salaries, which indirectly affects the differences in GDP. GDP is such

an indirect brand of the country, influencing also the perception of the company and then the managers.

However, returning to the painter's artist, and thus entering the art, one can immediately ask whether this management is art? How much does a painter's talent have with his education as well as for the manager's education with his management style in given economic circumstances and a particular company?

In every economic system there are good artists (painters), as do the managers/leaders. The past affects the actions taken in the future, the behavior and habits of people more difficult to change over time with their age. The shaping academic staff in PRL still taught in the way of new managers after 1989, in a way that is not completely coherent, persuasive, often with the acquired new knowledge based on textbooks without market practice and without strong contact with academics from developed countries. Few cases of these employees who knew very well the foreign languages of Western Europe and read articles and conducted joint research with scientists from Western Europe or other developed countries (eg A. Koźmiński, W. Kieżun, P. Ploszajski, K. Oblój, E. Kwiatkowski). A large number of academics used to speak western languages passively because Russian languages was dominant. In addition, there was a lack of appropriate teaching methods and teaching aids. Case study in management student education was not on the agenda, too few joint projects and little discussions were held on the effects of dissolved projects so students received feedback. Corporate realities and the entire crew are the second most important factor managers have encountered. By 1989, very strong trade unions existed in Poland, not only in the public administration but also in state enterprises or public organizations such as schools, hospitals, universities, etc. with the legalization of Solidarity trade union movement, there were often different trade unions, more or less associated with loyal party committees (Staniszki, 1991). The widespread lack of properly trained personnel, systems and numerous technical deficiencies have not provided the basis for a professional development of a large-scale human resource training system (Koźmiński, 2008c). Professors in the 90s were able to promote up to 100 graduates, work at several different universities. The system of assessing the quality of the didactic by students practically did not work.

However, returning to the socio-economic situation of Poland before 1989, the number of large enterprises and businesses has been increasing steadily since 1990, with the simultaneous decline of large business entities. The total number of companies in Poland at the end of 2021 reached 2,26 mln, where big and medium-sized companies have a share of 0,8% (PARP, 2022). Only a few companies have traded with foreign companies from the West Bloc. So, in a model based on central planning, a critical mass of leaders could be developed, which would be well advised in new socio-economic conditions. In this period, there was a distortion of the economy through centrally planning, evolving, regulating, etc. The current organizational structures are becoming more flat, distributed work models, or organizations acting as networks.

An essential forge of leaders was the conspiracy, hence the term leader, the conspiracy manager. Many people of that period left the managers of large private entities, such as Jan Krzysztof Bielecki - President of PEKAO, Mateusz Morawiecki - President of BZWBK, and Prime Minister of the Polish government now.

Has the leader received managerial leadership through independent and proactive actions, or he has been asked by a team and can be brought in "wheelbarrow" through party or union activism, as is sometimes the case in state-owned companies that are undergoing ownership changes in Poland? Changing the system, changes in state-owned companies continues to the present times.

The quiet and open knowledge of the manager is an indispensable element, and therefore reduces the risk of the entity's functioning on the market. Because of the research, where even 70% of the energy leaders spend on conversations and relationships with employees, it places great demands on society and empathy for the leader. A professional leader in a family business, in a company that he created himself and in a promotion situation.

3. Theoretical foundations for the professionalism of a leader

Prof. Andrzej Koźmiński, the President of Kozminski Academy, who has been researching leadership in the field of management science for many years, points out that at the beginning of the twentieth century the Library of Congress (the largest book in the world) was not one of the leaders in leadership. Today there are hundreds of them, and every year there are many more studies, including scholarly ones, although there are all kinds of guides at the top of the list of publications. *If anyone wants to learn leadership from them, he will treat them too instrumentally. And leadership plays an important role in the metaphysical element*, says prof. A. Koźminski. According to him, the leader is someone who combines the characteristics of the manager, the artist and the priest (Johatch et al., 2006). Discussion about leadership is broad not only among academics, Vaclav Havel said: "The power of an authentic leader lies not in external circumstances, but in the human heart", so it means to make a free our heart, then the world (Harkins, Swift, 2010). The great leadership theorist Warren Bennis, see more coherent perspective: "The process of becoming a leader is very similar to the process of becoming an integrated human being" (Harkins, Swift, 2010).

The explanation of the terminology of a professional leader is well presented in L. Evans (Evans, 2008). Based on this systematic concept and characteristics, criticism, it is easy to agree with the author. A professional leader/manager is an ambitious concept for any business system. The leader's assessment perspective should take place over a long period of time, then such a leader can act as a mentor at a certain time. The pathologies of the post-Soviet economy have been written before, but the analysis of the spectacular fall of companies from the turn of the

century and the many pitfalls, regardless of the reasons (Kodak, Enron, Theranos, Volkswagen, WireCard) or cities (eg Detroit) in the USA indicates that the presence of leaders defects are present everywhere. It is also due to human nature and normal statistical distributions. The literature of the subject was not specified how many subordinates the manager should have: 20; 200 or maybe for 2000, when he would become a leader.

Table 1.

Company names and Polish leaders in selected sectors in Poland

Healthcare	Banks	IT	Communication services	Furniture	Consumer defensive	Consumer cyclical
Polpharma: Jerzy Starak	Getin Bank: Leszek Czarnecki	Asseco Poland: Adam Góral	Polsat: Zygmunt Solorz	Black Red White: Tadeusz Chmiel	Dino: Tomasz Biernacki	LPP: Marek Piechocki, Jacek Kujawa
Adamed: Maciej Adamkiewicz	Alior: Wojciech Sobieraj	Comarch: Janusz Filipiak	TVN: Jan Wejchert, Marusz Walter	Forte: Maciej Formanowicz	Eurocash: Luis Amaral	CCC: Dariusz Milek
Diagnostyka: Jakub Swadzba	Meritum Bank*: Sławomir Lachowski	Prokom Software*: Ryszard Krauze	Vectra: Tomasz Żurański	Nowy Styl: Adam i Jerzy Krzyszczak	Topaz: Zbigniew Paczowski	Wittchen: Jędrzej Wittchen

*Company, which were acquisitioned after operating more than decades.

Source: own elaboration based on sector and market reports.

The enterprises presented in Table 1 come from different sectors, but they have many common features. First of all, according to the assumptions of the article, they have been operating on the market for over 20 or even 30 years, they developed mainly organically, using their own and external funds (loans, subsidies or the issue of bonds and shares), and thus they are not state public enterprises. Some companies are now managed by the second family generation, others have hired managers and the founders sit on the supervisory board. Each of the listed companies, regardless of the industry in which it operates, is characterized by a high level of innovation, often made acquisitions in the country or abroad, opened branches and created its own organizational culture.

Individual characteristic apart of the socio- economic system of the company, are more crucial to gain the final success. Senior researcher of leadership A. Koźmiński emphasizes such features as (Koźmiński, 2008b):

- self-reliance and acceptance of individual responsibility for one's success or failure,
- proactive and innovative approach taking into account the embodied risk,
- ability to communicate, to cooperate and to negotiate,
- strong achievement motivation and self-discipline.

Nowadays it can be observed more detailed cases regarding the managers, for example about emotional intelligence to manage relationships with hidden informal leaders (Kuzior, Balahurovska, 2022). Other research about the neuroscience of the brain supports that effective leadership is based on science, not art (Fabritius, Hagemann, 2018). The author of this short article does not make a definitive indication of the essence of leadership, especially since recent studies of potential leaders also indicate emotional and spiritual intelligence (Samul et al., 2020).

4. Leaders in the IT industry - case study

A case study of long-term leader development is illustrated in the example of the IT industry. The analysis of the professionalization of the activities has been carried out in the long term, also based on broad access to source materials. The forms described were founded in the 90s of the twentieth century. The stories of ALFA and BETA leaders in the IT industry were utterly different. It is an interesting case study where BETA employed a couple of people over a decade to take over ALFA, which has competed with global players on the domestic market and was more than 50 times larger before several years of operation than BETA. Ethos, ethical work, and moral backbone are the keys to a professional leader. This example shows the victory of a skilled leader over an unprofessional leader. Over the years, other issues have emerged, showing some pathologies for a transformational economy. The best research tool was to scan their silent knowledge, i.e., know-how, emotions, and intuition. But such possibilities are still not available today, and their evaluation and analysis would be largely subjective and could still be evaluated in time.

ICT is a dynamically developing industry not only in Poland but also in the world. It is also a branch where a relatively large number of new entrants have been created. These ICT companies that operate in foreign markets need more professionalism at every stage and field of operation. As is well known, the ICT market is very competitive, with high wages and relatively high employee mobility and fluctuations. Management of ICT workers not only in Poland is therefore not accessible. The ICT market in many countries also depends on public spending, so some cyclical processes show how flexible a business is. It has recently been pointed out that ICT spending by the public sector has declined, causing liquidity problems in many companies. In addition, the increase in wages and prolongation of projects indicated that the projects turned out unprofitable.

Table 2.
Professionalization of managerial activities

Category	Leader ALFA Company	Leader BETA Company
Formal education	Master of Machine Building Technology	Masters of Computer Science, Ph.D. in Economics
Position in public sector	No evidence	University lecturer
First main commercial experience	Subordinate employee	own producing and trading activity at the market, short working time in the US
Approach to risk	High, do not taking into account all aspects of risk	Moderate and reasonable, calculated based on resources: team, knowledge, time etc.
Form of making first crucial contracts	Participation in public tenders	Initiative to small local cooperative and public entities
Form of obtaining first contracts/orders abroad	No products and orders on foreign markets	Acquiring contracts in the US market
Ethical/moral status	Not entirely clear activity on the German market, suspicions of theft	No information about unethical activity
Social activity/charity	Sponsorship of large competitions and sports clubs in the light of Jupiter	Support for social organizations and cultural institutions, and even private individuals without much publicity
Business development	High-speed and dynamic growth of the company in the first years of operation	Gradual, evolutionary, organic and through acquisitions of other entities
Company location and relationships with the environment	Large, dynamic cities with large labor markets and skilled workers	Medium-sized peripheral city in an area with lower economic growth, strong cooperation with local public and private universities
Origin of the company's capital	National entities and funds registered in countries with owner secrecy	Own resources and national entities
Management	The self-control of all activities in the company	Delegates tasks
Customers in the industry	Orientation of activities in several industries	Orientation of activities on one particular industry
Way of contracting	The basis of activity is good access and informal contacts	The base of activity in the first years is a good product and a low price tailored to the customer
Personality	Personality strongly dominant	Modest personality. He claims to be just an adviser to his employees

Source: own elaboration based on numerous press articles, magazines (Forbes, Puls Biznesu, Parkiet), prospectuses, annual reports of the company Alfa and Beta and book (Wójcik, 2015).

These studies also fit into the research conducted by Grant Thornton and HSBC (Mrozek, Wróblewski, 2016). The portrait of the Polish business leader points out: "The statistical Polish business leader has created the company from scratch in the industry of his choice, and the hard work and business intuition have allowed him not only to stay on the market but also to develop his business."

"The current generation of entrepreneurs is an excellent generation of business pioneers. They did not get anything; they got it all; they had the idea and the enthusiasm at the beginning of their business".

"The Polish leader is younger and began his adventure with entrepreneurship later than his foreign counterpart. Nevertheless, he is the author of his success, while many of the richest in the world have built their success on the merits of others, such as inheriting ancestral possessions."

The second generation of managers from the 70ties or 80ties of the family business has managed only a few big companies, and many gained education abroad and started to develop or continue the family company on the world market, as indicated in Table 1.

5. Summary

In the face of economic realities, weaker quality formal education, and party and/or union entanglements, managers of transition countries have had to face a broader spectrum of managerial challenges. Professionalization of being a manager and a leader is indispensable, but it is worth stressing that paths are different, not only related to formal education. Having a good family pattern, working in a sports club, social or religious organization, you can already have social skills learned informally from an early age. On the other hand, personal or congenital talents can undoubtedly achieve the title of a master artist, especially when backed up by formal education or relevant courses and internships.

It is indispensable to professionally manage a manager's work in the examples provided by the IT industry, as it is likely that companies will only be able to operate with a professional management approach in the long run. Those managers who break the rules of professional management or the components that make up its composition, such as ethics, lead businesses to the brink of bankruptcy. However, this issue has yet to be widely debated in public and scientific forums. Professionalism is so evident in science, such as mathematics, physics, or chemistry, that it does not discuss it. Incorrect calculation of parameters for the skyscraper, inappropriate materials, and performance will cause its crash, so there are standards and other guidelines. The risk approach to contracts and strategic decision is valuable, what we could observe in long term perspective. However the innovation always is connected with risk.

On the other hand, in the case of social sciences, the ability to identify and evaluate the activities of a professional manager is more complicated and often ambiguous because, in an ecosystem, there is no way to control and influence it. Decision-making is also based on information in this specific situation. From a decision to implement them, a particular unit of time passes, and each organization has a certain level of inertia. The Polish IT sector is still growing, but a large number of companies, due to lack of professionalism in the leader's actions or, more broadly speaking, about management from the point of view of research, prompts the question as to how the manager could fault such errors. Research in silent knowledge and social processes based on sociology, psychology, and neurology (as a field within medical science)

should foster further professionalization of the manager's activities. Indeed, a professional manager can become a master (artist) in his field. If comparing a professional manager to an artist is appropriate, then not every artist becomes a champion, just like a manager. Coupling research on the manager's professionalism should benefit the company, its employees, its customers, and other stakeholders in the ecosystem, such as the financial sector. The rapid deterioration of a company's financial condition, along with the loss of liquidity, brings a lot of negative emotions to the organization, causing excessive stress on employees and thereby worsening their quality of life.

References

1. Evans, L. (2008). Professionalism, professionalism and the development of education professionals. *British Journal of Educational Studies*, Vol. 56, Iss. 1, pp. 20-28.
2. Fabritius, F., Hageman, H. (2018). *Umysł lidera*. Warszawa: ICAN Institute.
3. Harkins, P., Swift, P. (2010). *W poszukiwaniu modelu przywództwa*. Warszawa-Kraków: Wolters Kluwer Polska Sp z o.o.
4. Johatch, M., Kostera, M., Koźmiński, A.K. (2006). The Three Faces of Leadership: Manager, Artist, Priest. *Organizational Dynamics*, Vol. 35, Iss. 1, pp. 49-68.
5. Khurana, R., Nohria, N., Penrice, D. (2004). *Management as a Profession*, Working Papers, Center for Public Leadership, Retrieved from: https://dspace.mit.edu/bitstream/handle/1721.1/55923/CPL_WP_04_01_KhuranaNohriaPenrice.pdf, 10.10.2022.
6. Kostera, M. (1995). Differing managerial responses to change in Poland. *Organization Studies*, 16/4, pp. 673-697.
7. Kostera, M. (1996). *Postmodernizm w zarządzaniu*. Warszawa: PWE.
8. Kostera, M., Wicha, M. (1995). Symbolism of communist manager roles: A study of scenarios. *Scandinavian Journal of Management*, No. 11/2, pp. 139-158.
9. Kostera, M., Wicha, M. (1996). The 'divided self' of the Polish state owned companies: Culture and environment. *Organization Studies*, 17/1, pp. 83-105.
10. Koźmiński, A.K. (2008a). *Koniec świata menedżerów?* Warszawa: Wydawnictwa Akademickie i Profesjonalne.
11. Koźmiński, A.K. (2008b). *Management in transition*. Warszawa: Difin.
12. Koźmiński, A.K. (2008c). *How it all happened: essays in political economy of transition*. Warszawa: Difin.
13. Kuzior, A., Balahurovska, I. (2022). Interaction between the manager and the hidden informal leader. *Scientific Papers of Silesian University of Technology, Organization &*

- Management, No. 165*, pp. 173-181. Retrieved from: <https://managementpapers.polsl.pl/wp-content/uploads/2022/12/165-Kuzior-Balahurovska.pdf>, 30.12.2022.
14. Mrożek, M.H., Wróblewski, T. (2016). *Portret lidera polskiego biznesu*. Retrieved from: <https://grantthornton.pl/wp-content/uploads/2016/04/Portret-lidera-polskiego-biznesu-raport-Grant-Thornton-i-HSBC.pdf>, 3.11.2022.
 15. Örtenblad, A. (2018). *Professionalizing Leadership: Debating Education, Certification and Practice*. Palgrave Macmillan.
 16. Pfeffer, J. (2011). Management a Profession? Where's The Proof? *HBR, September*, pp. 1-2.
 17. *Raport o stanie sektora małych I średnich przedsiębiorstw w Polsce (2022)*. Warszawa. Retrieved from: https://www.parp.gov.pl/storage/publications/pdf/Raport-o-stanie-sektora-malych-i-rednich-przedsibiorstw_13_10_2022.pdf, 25.11.2022.
 18. Romme, G. (2017). Management as a science-based profession: a grand societal challenge. *Management Research Review, Vol. 40, No. 1*, pp. 5-9. Retrieved from: <https://doi.org/10.1108/MRR-10-2016-0225>, 10.10.2022.
 19. Samul, J. (2020). The Research Topics of Leadership: Bibliometric Analysis from 1923 to 2019. *International Journal of Educational Leadership and Management, Vol. 8(2)*. Retrieved from: doi: 10.17583/ijelm.2020.5036, 10.10.2022.
 20. Samul, J., Zaharie, M., Pawluczuk, A., Petre, A. (2020). *Leading and developing virtual teams. Practical lessons learned from university students*. Białystok: Politechnika Białostocka. Retrieved from: <https://pb.edu.pl/oficyna-wydawnicza/wp-content/uploads/sites/4/2020/12/Leading-and-developing-virtual-teams.pdf>, 4.10.2022.
 21. Staniszkis, J. (2001). *Postkomunizm: Próba opisu*. Gdańsk: Słowo/Obraz Terytoria.
 22. Stiglitz, J.E., Sen, A., Fitoussi, J. (2013). *Błąd pomiaru. Dlaczego PKB nie wystarcza*. Warszawa: Polskie Towarzystwo Ekonomiczne.
 23. Walker, D.M. (2002). *Restoring Trust in American Business and the Accounting Profession* (This document was written by CPA, Comptroller General of the United States, based on a speech he gave to the American Institute of Certified Public Accountants' leadership conference in November 2002), November 26.
 24. Wójcik, K. (2015). *Depresja Miliardera – historia Ryszarda Krauze*. Warszawa: Czerwone i Czarne.
 25. Yin, K.R. (2015). *Studium przypadku w badaniach naukowych. Projektowanie i metody*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.

INNOVATIONS IN THE AREA OF HEALTH IN SELECTED COUNTRIES OF THE EUROPEAN UNION ON THE EXAMPLE OF POLAND AND GERMANY

Elżbieta PAWŁOWSKA^{1*}, Marta PENKALA²

¹ Silesian University of Technology, Faculty of Organization and Management; Institute of Management; elzbieta.pawlowska@polsl.pl, ORCID: 0000-0001-6863-5430

² Silesian University of Technology, Faculty of Organization and Management; Institute of Management; marta.penkala@polsl.pl, ORCID: 0000-0001-7876-7525

* Correspondence author

Purpose: The aim of the article is to identify and compare various types of product innovations and business processes in the area of health in selected countries of the European Union. The rationale for undertaking research on this subject resulted from the lack of scientific studies on innovation in the health sector.

Design/methodology/approach: The analysis was carried out on the basis of two countries, namely Poland and Germany. For this purpose, an analysis of domestic as well as foreign literature was used aimed at proving the originality of the problem undertaken. In addition, the method of comparative analysis aimed at searching for similarities and discrepancies occurring in the phenomena under consideration in the article was used. An analysis of selected indexes and rankings on the implementation of innovations in the field of health globally was also carried out.

Findings: The article provides insights into the implemented innovations in the field of health. The results obtained show that innovations in the area of health care are more developed in Germany than in Poland, and also most of them are product innovations.

Originality/value: Implementation of innovations in the field of health care is important due to the permanent changes that are taking place on the technological, social and economic levels - not only in a specific country, but all over the world. Most of the findings presented in the article can be used to improve the operation of medical facilities in many areas, as well as to increase the quality of service to patients and improve the comfort of their lives.

Keywords: innovation, research and development activities, health care.

Category of the paper: A literature review.

1. Introduction

The environment in which organizations currently operate is undoubtedly undergoing many dynamic changes. Thus, it is important that appropriate measures are taken to encourage both scientists and entrepreneurs to conduct all kinds of research and seek innovative solutions involving the creation of new products, ways of doing things, improving productivity and improving the technologies used.

It is worth noting that innovations are used in every sector of the economy, which undoubtedly has a positive impact on the development of countries. They are of particular importance in the area of healthcare (Grenier, Oiry, 2021; Condry, Quan, 2021). Statistics published by the European Patent Office (EPO) show that innovation in healthcare is the leading field of inventions in terms of quantity, while pharmacy and biotechnology are considered the fastest growing disciplines (EPO, 2020). This situation is due to the fact that today's medical sector is constantly faced with various problems, especially in the context of an ageing population (Vaportzis, Clausen, Gow, 2017; Eze, Mateus, TCO Hashiguchi, 2020; Alzahrani, Hunt, Whiddett, 2021; Irmén, Litina, 2022; Extermann et al., 2022). The increasing number of chronically ill patients, the upward trend in the incidence of cancer, the rising costs of diagnostic and therapeutic procedures and the underfunding of health care services have a significant impact on the health of the sector. Therefore, the implementation of innovation is one of the solutions that can be used to reduce or avoid some of the problems mentioned.

Many authors emphasise that innovation activities in this field encompass different aspects of it, such as medical products and procedures used, medicines, or e-medicine. In addition, innovation may refer to the organisation and management of health services, advances in technology, medical products in a broad sense, and the pharmaceutical sector (Tyszka, Lubos, 2009; Dymyt, M., Dymyt, T., 2016; Barlow, 2016). It can be concluded that innovations in this sphere should not only refer to internal improvements of medical facilities, but, above all, they must concern and have an impact on the patient.

The theoretical and cognitive analysis showed that although the literature extensively addresses the issue of innovation, there is a certain shortage of the scientific studies on innovation in the area of health, especially innovation implemented in other countries. The identified cognitive gap was reflected in a research gap relating to the identification and comparison of innovations in the area of health in selected European Union countries. In addition, the focus of the research on the medical sector resulted from the researchers' conviction about the importance of this area, which should be characterised by a high degree of innovation. The analysis of the literature did not reveal such studies in the context of comparing the innovations implemented in different countries. In order to fill the identified gaps, the aim of the study was to identify and compare different types of product innovation and business processes in the area of health in selected European Union countries.

For the health sector, innovation is particularly important for several reasons. Firstly, they result from the specificity and role of fulfilling a social mission for society through the provision of health services. Secondly, due to the constant changes taking place at technological, social and economic levels, it is important to develop new forms of service provision, products and system solutions, as this builds trust and a sense of security in society.

The main research problem is focused on finding an answer to the question: is there a difference between the amount of implemented innovations and their type in the area of health in Poland and Germany?

The research presented in this article responds to a cognitive and research gap identified in the literature. As part of the research undertaken, product and business process innovations were identified. The results of the research confirmed, i.a. that innovations in the field of health care are more developed in Germany than in Poland, and that most of them are product innovations.

2. The essence of innovation

The literature so far has not developed a single universal definition of innovation, there are various approaches to it proposed, but they are often not consistent with each other. This is partly due to the fact that the development of the concept of innovation has been significantly influenced by various sciences. The table 1 presents selected definitions of the term.

Table 1.
Choosing definitions of innovation

Author	Definition of innovation
C. Leadbeater	"A long, interactive and social concept, involving different people from different backgrounds with different competencies" (Leadbeater, 2003, p. 30)
J.P.J. de Jong, D.N. Den Hartog	"Creating new ideas, products and processes that have a simultaneous impact on productivity" (De Jong, Hartog, 2007, pp. 41-64)
J. Schumpeter	"(...) Innovation is divided into five types: 1. introduction of a new product or a new grade of an already known product. 2. The use of new methods for producing or selling a product. 3. The opening of a new market. 4. Acquiring new sources of supply for raw materials or intermediate products. 5. A new industry structure, leading to the creation or destruction of a monopoly position" (Śledzik, 2013, pp. 303-312)
J. Baruk	"It is a deliberate human-designed change in product, manufacturing methods, organization of work and production, and management methods, applied for the first time in a community to achieve specific socio-economic benefits, meeting specific technical, economic and social criteria" (Baruk, 2006, p. 102)
A. Pomykalski	"(...) innovation is an activity that gives resources new opportunities to create added value for shareholders, consumers and other interest groups" (Pomykalski, 2001, p. 9)
D. Smith	"Innovation is a new idea, practice or object" (Smith, 2006, p. 6)
J. Wyrwa	"A learning process that has a social and territorial reference and a cultural and institutional context" (Wyrwa, 2014, pp. 15-16)

Cont. table 1.

R. Knosala, A.M. Deptuła	The authors define innovation as "any idea transformed into a concrete action/thing, which is characterized by a deliberately designed change of a novelty nature, both sensu stricto and largo, which is intended to bring certain benefits". (Knosala, Deptuła, 2018, p. 18)
D. Cropley, A. Cropley	"Innovation is the process of generating novelty and then implementing it in organizations". (Cropley, D., Cropley, A., 2014, pp. 21–59)
Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation	"An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)". (OECD/Eurostat, 2018, p. 20)

Source: own study based on literature.

Based on the above definitions, it can be concluded that innovation is a concept treated by researchers very broadly. It is commonly regarded as the introduction of a new product, technology or solution or a significant improvement of an existing one. It should be noted that today the popularity of innovation is constantly growing, as new or improved solutions are used in every area of human life.

Due to the difficulties associated with defining innovation clearly, many types of innovation are distinguished in the literature. The most up-to-date typology is presented in the Oslo Manual and lists among others business process and product innovations.

Table 2.*Types of innovation*

Type of innovation	Definition
Business process innovation	"(...) a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use by the firm".
Product innovation	"(...) a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market. Product innovations must provide significant improvements to one or more characteristics or performance specifications".

Source: Own study based on OECD/Eurostat (2018), Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg.

The current version of the Oslo Manual does not distinguish between the basic types of innovation - marketing and organisational - because, along with process innovation, they are mostly included in business process innovation. A single innovation may consist of a combination of types of product innovation and business process innovation. Therefore, the typology of innovations according to their subject matter is not a classification whose categories are mutually exclusive (OECD/Eurostat, 2018). In the area of health, it could be distinguished, among others, innovations related to the treatment process, often referred to as pharmaceutical-medical innovations, technological-information innovations, organisational innovations, as well as marketing innovations (Pawłowska, 2015). Another division is medical innovations - related to the evolution of medical knowledge, which is a result of the achievements of biomedical engineering, information and communication techniques and

changes in the pharmaceutical market. A distinction is also made between innovations related to the provision of healthcare services - these are innovations relating mainly to the organisation and functioning of the healthcare system, as well as other entities that constitute the environment for this system (Dymyt, M., Dymyt, T., 2018). Innovations in healthcare can be classified as social innovations. Their main purpose is to try to solve social problems, related to poverty, education, health and other aspects of human development, which cannot be solved by the use of appropriate technology alone (Dubé et al., 2014; Kimble, Rashad Massoud, 2017; Niekerk, Manderson, Balabanova, 2021). A typology of health innovations is presented in the Figure 1.

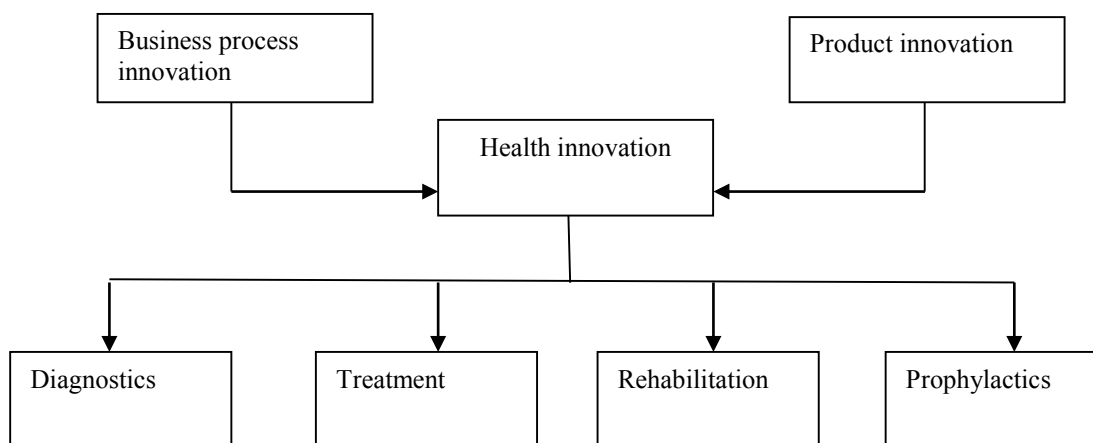


Figure 1. Typology of health innovations.

Source: own study.

It can be concluded that innovations in the area of health are innovative solutions that contribute to positive outcomes, including the provision of quality services, but also the effective functioning of the organisation itself and translate into diagnostics, treatment, rehabilitation and prophylactics, increasing patient satisfaction and quality of life.

3. Innovation in health care - a global perspective

In the literature, there is a lack of scientific studies addressing the topic of innovation in health comparing the situation in more than one country. In particular, the topic of the health system (Döring, Friedemann, 2010; Hofmarcher, 2013; Ioberman, 2013; Globerman, 2013), costs of this system (Saksena et al., 2018), as well as innovations in individual countries (Gerke, Stern, Minssen, 2020; Lipowicz, Nojszewska, Sikorski, 2020; Kokocińska, 2020; Stern et al., 2022; Lantzsich et al., 2022) are discussed. Most articles in the literature refer to the health system as a whole, while there are no studies comparing the situation of innovation in Poland and Germany.

Reviewing the literature on the subject, one must conclude that globally, health innovation has the potential to relate to saving lives, improving health outcomes (both for individuals and societies), making the best use of limited financial resources allocated by countries to health care, and setting, achieving and supporting both national and international health goals.

It should be emphasised that the emergence of innovation in the field of health, is important within the framework of actions taken by the EU institutions. The Horizon Europe Programme, which is scheduled to run from 2021 to 2027, aims to fund research and innovation, being build on three main pillars.

Table 3.
Structure of the Horizon Europe Programme

	Pillar I	Pillar II	Pillar III
Name	Excellent science	Global challenges & European industrial competitiveness	Innovative Europe
Aim	Reinforcing and extending the excellence of the Union's science base	Development of key technologies and solutions that are the basis of EU policies and sustainable development goals	Stimulating market-creating breakthroughs and ecosystems conducive to innovation
Institutions	<ul style="list-style-type: none"> • European Research Council; • Marie Skłodowska-Curie; • Research Infrastructures. 	<ul style="list-style-type: none"> • Clusters: <ul style="list-style-type: none"> ○ Health; ○ Culture, Creativity & Inclusive Society; ○ Civil Security for Society; ○ Digital, Industry & Space; ○ Climate, Energy & Mobility; ○ Food, Bioeconomy, Natural Resources, Agriculture & Environment. • Joint Research Centre. 	<ul style="list-style-type: none"> • European Innovation Council; • European Innovation Ecosystems; • European Institute of Innovation & Technology (EIT).

Source: Own study based on https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/horizon-europe_pl, 22.10.2022.

The above-discussed pillars have a significant impact on the development of innovation in the area of health. From the perspective of the analysed issue, activities undertaken within the framework of the cluster of pillar II referring to health, whose main aim is to deepen knowledge in order to develop and implement innovative solutions in the subject of broadly understood health and disease management, seem to be extremely important. Within this cluster, the following areas of action are distinguished (KPK, 2022):

- a. Health at different stages of life,
- b. Environmental and social factors,
- c. Non-communicable diseases and rare diseases,
- d. Communicable diseases,
- e. Tools, technologies and digital solutions in health and care,
- f. Health systems.

The activities of the European Institute of Innovation and Technology (EIT, 2022) should not be overlooked either, as the main task of this institution is to promote innovation activities undertaken by EU countries by facilitating cooperation between the three most important sectors - business, research and education.

A study conducted by The U.S. Agency for International Development (USAID, 2020) indicate that 70 to 90 percent of global health innovation relates to improving products, services and practices that already exist, while only about 10 percent of innovation activities relate to inventing something entirely new that can meet the health needs of communities. An interesting perspective on health innovation is presented by The Foundation for Research on Equal Opportunity, which created the FREOPP World Index of Healthcare Innovation (FREOPP, 2021). The index ranks countries not only by traditional indicators such as affordability of health care facilities and health outcomes, but also by characteristics such as the degree to which patients have a choice of doctor and insurer, patents in health care, scientific impact and Nobel Prizes in chemistry and physiology or medicine, access to new treatments and digitization of health. The index also measures the fiscal sustainability of countries' health care systems, meaning the degree to which a country is able to maintain public health care spending without punitive taxes or a debt crisis. All components use a scoring method on a scale of 0-100 to assess each country's performance relative to others. Therefore, it should be inferred that the index uses a data-driven approach to identify the leading health systems in 31 countries based on four equivalent categories, which are quality, choice, science and technology, and fiscal sustainability. The ranking of the FREOPP World Health Innovation Index 2021 is presented on the Figure 2. in a tabular form.

Overall Rank	Country	Overall Tier ▲	Overall Score	Quality	Choice	Science & Technology	Fiscal Sustainability
1	Switzerland	Excellent	65.15	65.39	68.25	53.92	73.06
2	Netherlands	Excellent	62.99	62.65	73.31	42.56	73.43
3	Germany	Excellent	59.79	52.73	70.25	37.69	78.48
4	Ireland	Excellent	56.67	58.16	61.48	32.52	74.50
5	Israel	Excellent	55.72	63.21	59.67	38.38	61.62
6	United States	Excellent	54.78	56.33	54.53	73.93	34.35
7	Australia	Good	50.76	60.07	65.44	25.27	52.25
8	Hong Kong	Good	50.72	40.56	61.58	24.96	75.77
9	Belgium	Good	50.51	48.84	56.23	35.43	61.53
10	United Kingdom	Good	50.21	52.15	57.04	47.18	44.46
11	Denmark	Good	49.87	49.20	52.20	45.37	52.70
12	Singapore	Good	49.71	46.83	66.44	32.63	52.95
13	Taiwan	Good	49.26	50.22	60.10	17.75	68.96
14	South Korea	Good	48.36	51.81	63.35	18.14	60.16
15	New Zealand	Good	48.28	58.47	54.61	25.47	54.56
16	Czech Republic	Good	47.58	38.84	56.84	15.58	79.06
17	Portugal	Good	46.92	63.15	58.83	15.78	49.93
18	Sweden	Moderate	45.35	48.72	53.87	40.99	37.82
19	Austria	Moderate	45.33	50.86	55.45	29.84	45.16
20	United Arab Emirates	Moderate	45.19	46.72	45.86	22.41	65.79
21	Finland	Moderate	44.64	50.45	42.34	36.99	48.78
22	Spain	Moderate	44.53	47.13	56.85	23.52	50.63
23	Canada	Moderate	44.31	53.26	54.05	27.63	42.29
24	Norway	Moderate	44.17	57.10	48.59	33.76	37.22
25	France	Moderate	42.60	53.25	54.04	32.79	30.34
26	Greece	Moderate	41.55	38.72	58.67	19.66	49.14
27	Hungary	Moderate	40.31	32.34	48.82	17.72	62.34
28	Italy	Poor	37.90	44.22	44.21	19.37	43.80
29	Slovakia	Poor	37.70	28.75	48.66	14.32	59.06
30	Japan	Poor	37.52	57.20	56.09	36.76	0.04
31	Poland	Poor	35.52	25.23	44.01	8.40	64.45

Figure 2. Ranking of the World Health Innovation Index 2021 FREOPP.

Source: FREOPP World Index of Healthcare Innovation, <https://freopp.org/key-findings-from-the-freopp-world-index-of-healthcare-innovation-cda78938c047>, accessed 07.01.2022.

Figure 2 allows us to observe that six countries received an overall score of "Excellent": Switzerland, the Netherlands, Germany, Ireland, Israel and the United States. In contrast, Italy, Slovakia, Japan and Poland are the countries that received an overall score of "poor" in the FREOPP World Health Innovation Index 2021. In doing so, however, it should be noted that it is possible to create a classification of the countries presented based on the individual categories that make up the overall rating obtained by each country.

Another indicator for observing how advanced countries are in terms of innovation is the Global Innovation Index (GII), published annually since 2007 (WIPO, 2021). The Global Innovation Index measures the performance of a particular country by considering its innovation inputs and innovation outputs. Innovation inputs can represent a country's spending on R&D and higher education, while innovation performance is, for example, intellectual property. In 2021, 132 global economies were analyzed, and as in previous editions of the report, Switzerland ranked first. Second place belongs to Sweden, and third place belongs to the US. The top ten innovative countries also include the UK, South Korea, the Netherlands, Finland, Singapore, Denmark and Germany (WIPO, 2021).

The above data indicate that there is a need for improvement measures in health care globally, which is a direct result of the need to adapt the methods and technologies used and the desire to improve the efficiency of health care systems to the dynamically changing environment and patients' expectations.

2.1. Poland

According to the publication 'Health System Profile 2021' (OECD/European Observatory on Health Systems and Policies, 2021) which was developed thanks to cooperation between the Organisation for Economic Co-operation and Development (OECD), the European Observatory on Health Systems and Policies and the European Commission, for many years now, low financial outlays allocated to health care have resulted in a shortage of doctors and nurses, which strongly influences the problem of access to services, which is felt by patients in the form not only of long waiting times for specialists and medical procedures, but also incurring high own fees. In addition, the management of the health care system in Poland is dispersed, so that effective coordination of the measures taken is difficult. It should be emphasised that in 2019, the average total expenditure allocated to healthcare in the European Union was 9.9% GDP, while in Poland this figure was significantly lower – 6.5% GDP. Moreover, healthcare expenditure per capita was over €1,500 in Poland in 2019 (adjusted for differences in purchasing power), representing one of the lowest amounts within the European Union countries, while the EU average is over €3,500. In 2019, almost 39% of adults in Poland report suffering from at least one chronic disease, while for citizens over 65 this percentage rises to 70% - also for this reason, the implementation of health innovation should be a key issue in Poland.

In Poland, participation in Pillar II (Global Challenges and European Industrial Competitiveness) in the health area of Horizon Europe was reported by 25 entities, which received €17.62 million in funding from its budget to implement 33 projects.

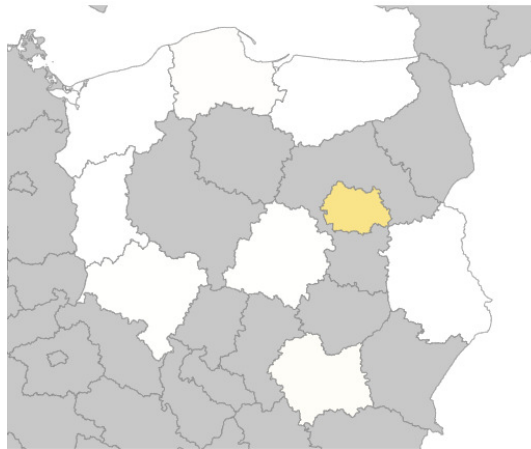


Figure 3. Net funding [€] by NUT2 region in Poland.

Source: Krajowy Punkt Kontaktowy ds. Horyzontu Europa, Narodowe Centrum Badań i Rozwoju.

The analysis of Figure 3. allows to conclude that the Warsaw Capital Region is the beneficiary of the highest funding. In this region, the National Centre for Research and Development is the entity that has been granted the highest financial support, amounting to over €5 million. It should be emphasised that this organisation focuses its activities on providing support to organisations to create and implement innovative solutions (NCBR, 2020). The entity that also received funding under this programme, amounting to more than €2 million, is the Maria Skłodowska-Curie National Institute of Oncology - National Research Institute - which is extremely important in view of the growing trend of oncological diseases in Poland.

In the Global Innovation Index 2021, Poland ranked 40th, down two positions from before the COVID-19 pandemic. Despite this, it should be noted that innovation in Poland is developing, however not in such a dynamic and resilient way as in the world economies that top the ranking.

Bearing in mind the demographic situation in Poland - a decline in the number of births and fertility rates, as well as the aging of the population - innovative activities carried out in health in the broadest sense seem extremely important. This article presents only examples of implemented health innovations, however, it should be emphasized that more and more projects in this area are being developed in Poland every year.

One interesting example of a health innovation implemented in Poland is the Zeus bionic prosthesis for upper limb amputees. This product is controlled by the user using electrical signals sent by muscles (EMG). Admittedly, bionic prostheses are not a new product, but what makes the aforementioned model stand out among them is certainly the following (Aether Biomedical, 2022):

- a. one of the highest grip forces available on the market (greater than 150 N),
- b. speed and strength reflecting muscle strength to ensure a firm grip,
- c. innovative fingers that are resistant to damage without sacrificing grip strength.

The prosthesis makes it easier for users to perform activities of daily living - from holding sushi chopsticks to holding dumbbells. In addition, it is possible for buyers to customize the appearance of the device, which is undoubtedly another advantage.

The diseases of civilization in the 21st century, which are associated with the rapid development of civilization, lifestyle and physical activity, include diabetes (Ministerstwo Zdrowia, 2022). With the increasing number of patients, an extremely important example of health innovation is the GlucoStation portable and non-invasive glucose meters (Glucoactive, 2022), which use optical methods when measuring. The GlucoStation device provides a telemedicine solution, allowing limited contact between the patient and the doctor, which in the era of the COVID-19 pandemic seems to be an extremely important advantage.

Another example of a health innovation that responds, as it were, to the current pandemic situation is Neuroforma, which is an innovative online neurorehabilitation system prepared by rehabilitation specialists (Neuroforma, 2022). The premise of this project is a hybrid system that allows the patient to perform rehabilitation exercises both at the rehabilitation center and at home, as well as providing telerehabilitation. When exercising at home, the patient can take advantage of the support offered by a rehabilitation therapist, or exercise on his or her own by selecting exercises from an activity base, according to the area requiring rehabilitation. The developers point to Neuroforma's simplicity of use, as well as mobility and convenience. In addition, motivation to exercise at home is provided by collecting points and receiving rewards for regularity.

Professionals can use the TeleNeuroforma platform for hybrid rehabilitation. It not only contains sets of ready-made exercises, but also allows you to create your own using a wizard. In addition, it is also possible for a rehabilitation facility to purchase a stationary exercise device - Neuroforma PRO, which, combined with TeleNeuroforma, will make it easier for patients to perform stationary exercises at the facility and continue treatment at home.

Currently, many countries are emphasizing the emergence of smart hospitals, the main idea of which is to base health care management on modern information technologies and artificial intelligence. In Poland, an example of such a place is the Institute "Polish Mother's Memorial Health Center" in Lodz, which started the implementation of the "smart hospital" project in 2018. The hospital's management stresses that the idea of a smart hospital will not only improve the work performed by the employed staff, but patients will also notice positive effects in the form of, for example, shorter queues or waiting times for an appointment at a specialized clinic or procedures. In addition, the implementation of this concept should make it possible to generate 20% savings. Thanks to the IT solutions introduced at every level of the hospital, from clinics and outpatient clinics to administrative units and the unit's management, there is a noticeable improvement in the quality of work and the amount of time that is actually devoted

to each patient, as paper record-keeping has been reduced to a minimum (Centrum Zdrowia Matki Polki, 2020).

Based on the above, it can be concluded that in Poland, more and more attention is being paid to the implementation of innovations in various areas of broadly understood health, thus enabling not only the development of health care, but also increasing the quality of life of patients.

2.2. Germany

The publication 'Health System Profile 2021' (OECD/European Observatory on Health Systems and Policies, 2021) states that spending on the health sector in Germany, measured as a share of GDP, is the highest in Europe and that the health system offers a broad package of benefits, a high level of service and universal access to relatively high quality and effective care. The governance structure of the German healthcare system is complex, as decision-making is divided between the federal and national levels, together with strong local government bodies. The legal norms are defined by the federal government, while the regulatory details are the responsibility of the Gemeinsamer Bundesausschuss (Gemeinsamer Bundesausschuss, 2022), which is the decision-making body of the joint self-government of doctors, dentists, hospitals and health insurance funds in Germany. The federal states, on the other hand, supervise the self-governing units at regional level, are responsible for planning and investment in hospitals and also for medical education. In 2019, Germany spent 11.7% GDP on healthcare, which is the highest within the EU countries, as is its healthcare expenditure per capita of €4505. In addition, the country under analysis is also characterised by a high number of doctors and nurses, with their rates per population and growth rate significantly higher than the EU average.

In Germany, 179 entities applied to participate in Pillar II (Global Challenges and European Industrial Competitiveness) in the health area of Horizon Europe and received €207.79 million in funding from its budget for 137 projects.

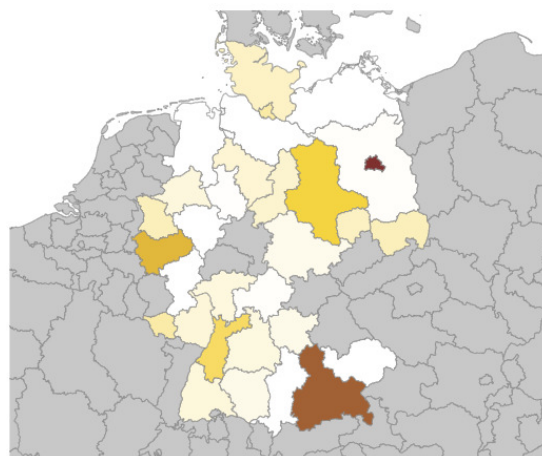


Figure 4. Net funding [€] by NUT2 region in Germany.

Source: Krajowy Punkt Kontaktowy ds. Horyzontu Europa, Narodowe Centrum Badań i Rozwoju.

An analysis of Figure 4. leads to the conclusion that the NUT2 Berlin and Oberbayern regions received the highest funding. In the first region, the project participant with the highest funding of over €16 million is the Charité - Universitätsmedizin Berlin, which involves around 5,000 researchers in the development of pioneering medical innovations (Charité - Universitätsmedizin Berlin, 2022). In Oberbayern, on the other hand, the recipient of the highest funding of over €10 million is the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., which is a world-leading organisation in applied research, pioneering many innovative solutions (Fraunhofer-Gesellschaft..., 2022).

In the Global Innovation Index 2021, Germany ranked 10th, down one position from the previous year. Receiving high scores in all categories, enables the country to translate its efforts and investments into the implementation of innovations in many fields. With a large number of graduates in science, or engineering, Germany presents an excellent human capital and research system. In addition, they rank second in the world in terms of spending on research and development activities (WIPO, 2021).

An interesting example of a health innovation implemented in Germany is the EmergencyEye system, which allows emergency call centers and service centers responsible for communicating with victims to use more than just a phone call (EmergencyEye, 2022). The system was developed for use in emergency calls, but is now also in use in the energy, gas and water industries, chemical groups, logistics and service companies. The unquestionable advantage of the EmergencyEye system is that it improves the efficiency of emergency call centers and those tasked with communicating with the injured, as staff will be able to handle calls faster, more accurately and efficiently, and provide better support and care for the injured. The innovative technology is configured in minutes, and can be easily integrated into existing IT infrastructure.

Another interesting innovation that has been implemented in the German health field is Amparo's lower limb (below the knee) temporary prosthesis (Amparo, 2022). Its vision is to empower 90% of the world's 30 million amputees by providing them with access to affordable, high-quality prosthetics. Amparo's revolutionary prosthetic socket solution is now the fastest, easiest and most affordable on the prosthetic market. The prosthesis is designed so that fitting can occur anywhere and with optimal efficiency, so rehabilitation can begin almost immediately. In addition, by adapting to volume changes throughout the recovery process, it provides maximum comfort.

Amparo's product line also includes the Mobile Clinic, or "mobile prosthetic clinic," which includes, in addition to the custom-made prosthesis, the devices necessary for its placement. With the Mobile Clinic, there is freedom of choice in where amputees receive treatment.

Supporting people with disabilities in mobility and a sense of independence is provided by innovations created by the Munevo company (Munevo, 2022). Among the interesting product innovations offered by this company are:

- a. Munevo Drive - this is a head controller for electric wheelchairs, which serves as a platform for all other products. With this device, it is possible to control the wheelchair hands-free, as it is done using head movements. This product is available as a kit consisting of Smartglasses, an adapter and pre-installed software;
- b. Munevo Arm - with Munevo Drive, robotic arms from KINOVA and Assistive Innovations can be controlled, providing support for work, education, activities of daily living and hobbies;
- c. Munevo Phone - this is an application that allows you to control your phone (e.g., while listening to music, or for making calls) using your head movements.
- d. Munevo Monitor - is an application that allows you to display the image from your glasses on your mobile device;
- e. Munevo Home - with this product it is possible to control a smart home system.

It is predicted that digitization, in its broadest sense, will transform the daily operation of health care units. It is noted that German hospitals are at the forefront of the digital transformation taking place in many countries around the world. New technologies provide greater efficiency, while also reducing costs for the healthcare system. The Universitätsklinikum Hamburg-Eppendorf (UKE) was the first clinic in Europe to introduce a so-called electronic patient "file" in 2011, whose data is stored centrally by the hospital, allowing constant access to patient data by doctors, therapists, or nurses. In addition, thanks to the implementation of this solution, in the clinic's pharmacy the system packs more than 12,000 doses of medication for patients every day, and in the ward nurses check patients' wristbands before administering medications, further enhancing security. Another example of a smart hospital in Germany is the Universitätsklinikum in Essen, which in 2019 piloted algorithms that perform routine work in radiology, such as checking CT scans or evaluating examinations for signs of cancer. It should be noted that the algorithm implemented in Essen is a form of artificial intelligence that is constantly fed with data, so that it is constantly learning, as reflected, for example, by the rates of detecting cervical cancer metastases at an early stage with an accuracy of 95-97% (GTAI, 2019).

Newsweek magazine, in cooperation with Statista, has compiled a list of 250 hospitals around the world with the most advanced technology, artificial intelligence and broad telehealth solutions in 2021 (World's Best Smart Hospitals, 2021). The 10th place in the aforementioned ranking is held by Charité - Universitätsmedizin Berlin, which was also recognized in 2022 as the best hospital in Europe (World's Best Hospitals, 2022).

Analyzing the above examples of innovations in the field of health introduced in Germany, it can be concluded that innovative activities related to remote medicine are extremely important. In addition, solutions are also being implemented for the empowerment and sense of independence of people with disabilities, based on the use of modern technologies. It should also be emphasized that German hospitals are constantly striving to provide the best possible quality of patient care, which is reflected in the high positions held by these units in many rankings.

3. Conclusions

The analysis that has been carried out presents the identification and comparison of different types of product innovation and business process innovation in the field of health in Poland and Germany, but also the expenditure allocated to healthcare or participation of these countries in the Horizon Europe Programme.

Table 4.
Comparison of criteria in Poland and Germany

Criterion	Poland	Germany
Population in 2019	37.97 million	83.09 million
Healthcare expenditures in 2019	6.5% GDP	11.7% GDP
Healthcare expenditures per capita	€1500	€4505
Rank in the Global Innovation Index 2021	40	10
Rank in the FREOPP World Index of Healthcare Innovation 2021	31	3
Type of innovation	Product innovation • Zeus - Bionic Hand, • GlucoStation, • Neuroforma, and others.	Product innovation • EmergencyEye, • Products of Amparo company, • Products of Munevo company, and others.
	Business process innovation • Smart hospital Instytut „Centrum Zdrowia Matki Polki” w Łodzi, and others.	Business process innovation • Smart hospital Universitätsklinikum Hamburg-Eppendorf, Universitätsklinikum Essen, Charité - Universitätsmedizin Berlin, and others.
Horizon Europe Programme – pillar II – area: health		
Funding received	€17,62 million	€207,79 million
Number of participants	25	179
Number of projects	33	137

Source: own study.

Based on the table 4, it can be concluded that:

- Healthcare expenditures in 2019, as well as healthcare expenditures per capita, were at a significantly higher level in Germany than in Poland, despite of almost three times higher population there;
- In both, the Global Innovation Index 2021 and the FREOPP World Index of Healthcare Innovation 2021, Germany ranked higher than Poland;
- Poland and Germany have both types of innovation included in the Oslo Manual 2018, i.e. product innovation and business process innovation. However, most of these are the first types of innovation, while within business process innovation, the concept of 'smart hospitals' is used more often in Germany than in Poland;
- The funding received under Horizon Europe Programme is almost 12 times higher in Germany than in Poland. Furthermore, the number of participants in Germany is more than 7 times higher and the number of projects more than 4 times higher than in Poland.

The analysis shows that innovation in health care is more developed in Germany than in Poland. This is also connected with the economic situation occurring in both countries and, consequently, to the expenditure they spend on healthcare each year.

4. Summary

The challenges that were posed to healthcare units in many countries during the COVID-19 pandemic made it clear how important the use of advanced technologies is in medicine. In addition, the pandemic accelerated a trend that could have been observed in the medical market for years - hospitals and other health care units are becoming more and more "smart". It is emphasized that "telehealth" in the broadest sense is an integral part of the current times. It should be noted that during the pandemic, the ability to provide services remotely, including patient monitoring and mutual communication proved invaluable. The introduction and improvement of solutions related to telemedicine is very important - not only because of the pandemic situation, but also because of convenience, the availability of the service "here and now" and the quality of the therapy provided. What's more, for many patients, the advantage of telemedicine is that it saves time and reduces the costs associated with traveling to the facility. It should also be borne in mind that this is a very beneficial solution for patients whose health condition does not allow them to move freely. In addition, the idea of "smart hospitals" seems to be extremely relevant in the context of telehealth, as it uses available IT solutions and artificial intelligence in its operation, which positively affects patients and employees of health care units.

Based on the examples of health innovation in Poland and Germany presented above, one must conclude that health innovation is more developed in Germany. Such a situation is probably related to greater state spending on research and development, as well as on the health care system. Unfortunately, the current situation in the medical market and the progressing economic crisis is undoubtedly not conducive to the growth of the implementation of innovative solutions in Poland. The solution to this problem could be not only the cooperation of the public sector with business based on the formula of public-private partnership, but first of all, increasing expenditures on R&D and the health sector.

Currently, it can be observed that many countries are affected by problems relating to the aging population, the increasing number of chronically ill people, or those suffering from cancer and other ailments. Therefore, it would be interesting to present innovations in other countries outside the European Union, such as Switzerland or the United States. Such an analysis would provide insight into the ways in which innovations are implemented and used both to improve the quality of life of citizens and the functioning of the health sector in other countries that are not connected with the European Union.

References

1. Aether Biomedical, <https://aetherbiomedical.com/>, 8.01.2022.
2. Alzahrani, T., Hunt, M., Whiddett, D. (2021). Barriers and facilitators to using smart home technologies to support older adults: perspectives of three stakeholder groups. *Int. J. Health. Inf. Syst. Inform.*, 16, 22.
3. Amparo, <https://www.amparo.world/home-en>, 11.01.2022.
4. Baruk, J. (2006). *Zarządzanie wiedzą i innowacjami*. Toruń: Wydawnictwo Adam Marszałek.
5. Centrum Zdrowia Matki Polki przekształca się w „smart hospital”, <https://pulsmedycyny.pl/centrum-zdrowia-matki-polki-przekształca-sie-w-smart-hospital-1001844>, 25.03.2022.
6. Charité-Universitätsmedizin Berlin, <https://www.charite.de/forschung>, 22.10.2022.
7. Condry, M.W., Quan, X.I. (2021). Digital Health Innovation, Informatics Opportunity, and Challenges. *IEEE Engineering Management Review*, 49(2).
8. Döring, A., Friedemann, P. The German Healthcare System. *The EPMA Journal*, 1(4), 535-547.
9. Dubé, L. et al. (2014). Convergent innovation for sustainable economic growth and affordable universal health care: innovating the way we innovate. *Annals of the New York Academy of Sciences*, 1331(1). New York: Harvard Business School Publishing.
10. EmergencyEye, <https://emergencyeye.de/>, 11.01.2022.
11. Europejski Instytut Innowacji i Technologii (EIT), https://european-union.europa.eu/institutions-law-budget/institutions-and-bodies/institutions-and-bodies-profiles/eit_pl, 22.10.2022.
12. Europejskie zgłoszenia patentowe 2020, <https://patentportal.pl/europejskie-zgloszenia-patentowe-w-2020-r/>, 18.10.2022.
13. Extermann, M., Hernandez-Favela, C.G., Soto Perez de Celis, E., Kanesvaran, R. Global Aging and Cancer: Advancing Care Through Innovation. *Geriatric Oncology*, vol. 42.
14. Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., <https://www.fraunhofer.de/de/ueber-fraunhofer.html>, 22.10.2022.
15. FREOPP World Index of Healthcare Innovation, <https://freopp.org/about-the-freopp-world-index-of-healthcare-innovation-c84200df79b7>, 7.01.2022.
16. Gerke, S., Stern, A.D., Minssen, T. (2020). Germany’s digital health reforms in the COVID-19 era: lessons and opportunities for other countries. *NPJ Digit. Med.*, 3, 94.
17. Global Innovation Index 2021 – Germany, https://www.wipo.int/global_innovation_index/en/2021/, 8.01.2022.
18. Globerman, S. (ed.) (2013). *Reducing Wait Times for Health Care: What Canada Can Learn from Theory and International Experience*. Fraser Institute.

19. Glucoactive, <https://gluco-active.com/pl/>, 8.01.2022.
20. Grenier, C., Oiry, E. (eds.) (2021). *Altering Frontiers: Organizational Innovations in Healthcare*. London: Wiley-ISTE.
21. Irmen, A., Litina, A. (2022). Population aging and inventive activity. *Macroeconomic Dynamics*, 26.
22. Jong, J.P.J., Hartog, D. (2007). How Leaders Influence Employees' Innovation Behaviour. *European Journal of Innovation Management* 10(1).
23. Kimble, L., Rashad Massoud, M. (2017). What do we mean by innovation in healthcare? *European Medical Journal*, <https://emj.emg-health.com/wp-content/uploads/sites/2/2018/01/What-do-we-mean-by-Innovation-in-Healthcare>.
24. Knosala, R., Deptuła, A.M. (2018). *Ocena ryzyka wdrażania innowacji*. Warszawa: PWE.
25. Kokocińska, K. (2020). *Innowacyjne technologie w ochronie zdrowia. Aspekty prawne*. Warszawa: Wolters Kluwer.
26. KPK, Klaster Zdrowie, <https://www.kpk.gov.pl/horyzont-europa/klastry/zdrowie>, 22.10.2022.
27. Lantsch, H., Eckhardt, H., Campione, A., Busse, R., Henschke, C. (2022). Digital health applications and the fast-track pathway to public health coverage in Germany: challenges and opportunities based on first results. *BMC Health Services Research*, vol. 22, Article 1182.
28. Leadbeater, C. *Overdue: How to create a modern public library service*, <https://www.demos.co.uk/files/overdue>, 24.10.2022.
29. Lipowicz, I., Nojszewska, E., Sikorski, S. (eds.) (2020). *Innowacje w ochronie zdrowia. Aspekty prawne, ekonomiczne i organizacyjne*. Warszawa: Wolters Kluwer.
30. *Markets Germany* (2019). Berlin: Germany Trade and Invest (GTAI).
31. Ministerstwo Zdrowia – Cukrzyca, <http://www.archiwum.mz.gov.pl/zdrowie-i-profilaktyka/choroby-cywilizacyjne/cukrzyca/>, 8.01.2022.
32. Munevo, https://munevo.com/home_en, 11.01.2022.
33. Neuroforma, <https://www.neuroforma.pl/>, 8.01.2022.
34. Niekerk, L., Manderson, L., Balabanova, D. (2021). The application of social innovation in healthcare: a scoping review. *Infectious Diseases of Poverty*, 26.
35. Nkiruka, D. Eze, Céu Mateus, Tiago Cravo Oliveira Hashiguchi (2020). *Telemedicine in the OECD: an umbrella review of clinical and cost-effectiveness, patient experience and implementation*. PLoS One.
36. OECD/European Observatory on Health Systems and Policies (2021). *Germany: Country Health Profile 2021, State of Health in the EU*. Paris-Brussels: OECD Publishing, European Observatory on Health Systems and Policies.
37. OECD/Eurostat (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities*. OECD Publishing, Luxembourg-Paris: Eurostat.

38. Pomykalski, A. (2001). *Zarządzanie innowacjami* Warszawa-Łódź: PWN.
39. Saksena, P., Smith, T., Tediosi, F., Yerramilli, P., Fernández, O., Thomson, S. (2018). Financial protection in Europe: a systematic review of the literature and mapping of data availability. *Health Policy*, [https://www.healthpolicyjrn.com/article/S0168-8510\(18\)30049-6/fulltext](https://www.healthpolicyjrn.com/article/S0168-8510(18)30049-6/fulltext).
40. Śledzik, K. (2013). Teoria innowacyjności Josepha A. Schumpetera a trolle patentowe. *Zarządzanie i Finanse*, 11(4), cz. 4. Sopot.
41. Smith, D. (2006). *Exploring Innovation*. Berkshire: McGraw-Hill Education.
42. Stern, A.D., Brönneke, J., Debatin, J.F., Hagen, J., Matthies, H., Patel, S. et al. (2022). Advancing digital health applications: priorities for innovation in real-world evidence generation. *Lancet Digital Health*, 4(3).
43. Sternberg, R., Krauss, G. (ed.) (2014). *Handbook of Research on Entrepreneurship and Creativity*. Cheltenham Edward Elgar Publishing: Limited.
44. Strategia NCBR (2020). Warszawa, <https://www.gov.pl/web/ncbr/raport-roczny-ncbr-2020>, 8.01.2022.
45. The U.S. Agency for International Development (USAID) (2020). *Global Health Innovation Index. A tool for identifying the most promising Global Health Innovations*.
46. Tyszka, A., Lubos, B. (2009). Innowacje w sektorze farmaceutycznym w Polsce. *Zeszyty Naukowe, Kolegium Gospodarki Światowej*, nr 24. Warszawa: Szkoła Główna Handlowa.
47. Vaportzis, E., Clausen, M.G., Gow, A.J. (2017). Older adults perceptions of technology and barriers to interacting with tablet computers: a focus group study. *Front Psychol.*, 8,1687.
48. WIPO (2021). *Global Innovation Index 2021: Tracking Innovation through the COVID-19 Crisis*. Geneva: World Intellectual Property Organization.
49. World's Best Hospitals 2022, <https://www.newsweek.com/worlds-best-hospitals-2022>, 25.03.2022.
50. World's Best Smart Hospitals 2021, <https://www.newsweek.com/worlds-best-smart-hospitals-2021>, 25.03.2022.
51. Wyrwa, J. (2014). *Innowacje społeczne w teorii i praktyce*. Warszawa: PWE.

EMERGENCY MANAGEMENT IN COMMUNICATION INCIDENTS

Luiza PIERSIALA

Department of Logistics, Faculty of Management, Częstochowa University of Technology;
luiza.piersiala@pcz.pl, ORCID: 0000-0002-3995-1167

Purpose: The aim of the article is to assess the actions of emergency services (Fire Department, Police and Medical Emergency Service) at the scene of an incident and to indicate the importance of the exchange of information between the emergency services mentioned.

Design/methodology/approach: The article presents the characteristics of the concept of risk, traffic disaster threat and crisis management. It also presents the results of research on the assessment of the logistics of emergency services by people involved in traffic accidents. The first part presents the theoretical background related to the concept of crisis management and related issues. The next part presents the characteristics of Polish emergency services and describes their procedure at the scene of an incident. A diagnostic survey method was used in the empirical analysis. The basic source of data for statistical research for the development of the article was a survey questionnaire available online.

Findings: The results of the conducted analyses indicate that the public correctly assesses the operations of emergency services at the scene of a traffic accident.

Originality/value: The process the operations of emergency services should be accompanied by appropriate in-formation activities because a consistent approach to disasters, based on an understanding of their common features and the response expertise they require, is becoming the accepted practice throughout the world.

Keywords: exchange of information; risk; crisis management; traffic disaster; resource management.

Category of the paper: research paper.

1. Introduction

Globally, the number of accidents (especially road traffic accidents) is increasing and so are more injuries caused by sudden incidents and accidents. In order to priorities patients to ensure that they are properly attended to and that the resources and facilities of medical facilities are used optimally during accidents, it seems crucial to know the competences and responsibilities of emergency services at the scene of an accident. Human life and health are paramount values, therefore ensuring road safety is a basic global, EU, national and local priority. Emergency

management services, such as firefighting, rescue teams and ambulances are all heavily reliant on road networks (Rohr et al., 2020). In Poland, emergency services, organizations and entities differing in character and scale of preparation are prepared to carry out rescue operations. In this diversity of services one can indicate different affiliation, organizational structure, numbers, type of equipment and financing methods, nevertheless their priority actions are convergent. These services are: National Fire Department, Police and Emergency Medical Services. They are one of the essential public entities ensuring a certain type of safety and protection of health and life, based also on the provisions of the Constitution (Journal of Laws No. 78, 1997) and other legal acts, such as the Act on crisis management (Journal of Laws of 2019). Efficient emergency response to traffic incidents is crucial for the purpose of saving lives and properties. However, it is important to point out that there are barriers to effective communication. They include lack of information or knowledge, lack of attention to detail, selective listening, status biases and different perceptions of risk (Cole, 2020) A review of the current literature highlights the growing role of disaster management teams as an integral part of responding to traffic accidents (Briggs, 2005).

The European Commission's published data shows that in 2021, the rate of fatalities per million inhabitants fell to 59 from 66 in 2020 and 77 in 2019. The number of fatalities in Poland is decreasing, but their share is high compared to other European Union countries. As a country, however, Poland is above the EU average of 44 fatalities. Especially when we compare Poland with other countries in the region: in Romania last year, the number of fatalities per million people rose to 93 from 85 the year before (but in 2019 it was 96), and in Bulgaria to 81 from 67 the year before. In Latvia, 78 people per million were killed on the roads, and in Croatia, 72. Compared to Western European countries, however, we are a long way off: in Germany, 31 people per million people were killed, in Denmark - 23, similarly in Switzerland, in Sweden - 18, and in Norway - only 16. The European Commission's data shows that 19,8 thousand people died in accidents in the EU in 2021. That's 5 percent and 1,000 more victims compared to pandemic 2020. This issue is also relevant because of the increasing number of road accidents and the resulting increase in fatalities. Therefore, it is important for emergency services to ensure safe and rapid action at the scene of a traffic accident to minimize the time to receive and exchange information, reduce the number of casualties and the time to provide assistance (European Commission, 2022).

I will first describe and present arguments from the existing literature related to communication management, disaster avoidance and organizational communication climate. Based on this discussion, I will develop a framework. In the methodology section, I will identify the method and analysis used to conduct this study. I will then present results. The next section includes a discussion based on the results. Finally, I will present conclusions, limitations of the study and recommendations for the future.

2. The review of literature

The concept of risk has been discussed in many publications, hence I will only mention a few aspects that appear in relation to its definition in the literature. De-fining risk is quite a difficult task, and it is almost impossible to provide an unambiguous, precise definition. Since the mid-1970s, the concept of risk has come to encompass more and more areas of social life and is defined on the basis of various sciences and theories, including economics, behavioral sciences, legal studies, psychology, statistics, insurance, probability theory and public safety sciences (Hood, 1992; Power, 2007). Some authors perceive an excessive effort in the typology and classification of safety, hazards, risks and a syndrome of 'reinventing the wheel', as the literature on risk theory and its applications in insurance, banking, investment, but also management and command is rich and valuable (Sienkiewicz et al., 2020). A crisis is inseparably connected to contemporary companies (organizations). The history of risk research and the philosophy of risk, among others, has been discussed in detail by Kaczmarek (2006; 2010). The most widely known book in this area is *Against The Gods: The Remarkable Story of Risk* by Peter Bernstein from 1996. In it, the author analyses how risk has been perceived from ancient to modern times. In this context, he pays much attention to the invention of the calculus of probability and its application in conjunction with decision theory to the analysis of risk issues. The word risk comes from the Italian *risicare*, which means 'to dare'. Therefore it follows that risk is a choice rather than an inevitable destiny. According to the ISO definition, risk is defined as the effect of uncertainty on the activity undertaken (ISO 9000). Risk can be defined as the result of the probability of a negative occurrence and its outcome (Manstead et al., 1996). Risk is most often interpreted as the probability of loss (Institute of Risk Management). It is therefore treated as a synonym for a state of risk. Kabus et al. (2020), on the other hand, indicates that risk is the uncertainty associated with future events or the outcome of decisions. Risk and its division into different categories indicates that it is a subject closely related to the concepts of safety and disaster.

The subject of defining the word disaster is to begin by defining a word with the opposite meaning, which is safety. This word is derived from the Latin language from the words: "sine cura", understood as stability. Broad, lexical formulations treat security as: a state of non-threat, calmness, certainty. The term of safety can be found in each and every scientific discipline and depending on the level and objectives of the research it is interpreted accordingly. Safety is one of the basic human needs and a situation characterized by the lack of risk of losing something that a person values in particular, for example: health, work, respect, feelings, material goods. Security is the main need and supreme value of a human being and social groups, as it is also the basic need of states and international systems, as well as their declared goal. Historically, security has been known to mankind since the dawn of time. Some even claim that the need for safety was an indispensable need for the establishment of the state

(Pieprzny, 2007). Providing security to citizens is one of the fundamental duties of any state organization and one of the essential functions of the state, so richly described in political, legal and administrative literature (Malešič, 2021). Various institutions and services in the country are responsible for national security. Ensuring security is a condition of great significance for sake of the development of the society and the state as a whole (Olak, K., Olak, A., 2016). Security is associated with order, calmness and the ability to react in an organized and rapid manner to violations of the law that occur. For the society, on the other hand, security is the key notion in the everyday functioning of the society, ensuring the possibility of development and peace of mind associated with everyday life in both the public and private spheres. Unnatural threats, i.e. these caused by various forms of human activity, take the form of disasters - sudden and unexpected events with negative consequences. In reference to the subject of this article, ensuring the safety of the population during a variety of traffic incidents on Polish territory lies with the emergency services, which are mainly composed of emergency medical services, fire departments, the army, and the police (Trzos, 2004).

The first of definitions of a disaster to be mentioned is derived from the National Defense Academy's Dictionary of National Security Terms, which defines this event as: a sudden event with tragic consequences, causing material damage and serious injury or death to people. Another definition states that it is an event requiring the use of forces and resources beyond the capabilities and capacities of local services adapted to combat and to prevent the effects of such situations, where assistance is required beyond local medical services. However, this definition also includes the additional aspect that not all victims can be helped at the same time, which contributes to medical segregation (Zawadzki, 2007). Following an analysis of the division of disasters, one may notice a significant multitude of the variety of these events. The lack of specific divisions and particular events assigned to them may result in many controversies during the occurrence of a disaster and its proper classification as well as effective overcoming of the situation at hand. However, it is worth noting that despite the variety of divisions of disasters, each of them share some points. The main focus should be on those types of disasters whose risk of occurrence is greatest. As one of the most frequently occurring technical threats (external material threat caused by human activity), are communication disasters, more specifically disasters related to road transport. Traffic accidents are a serious problem in the modern world, as they are one of the main causes of all injuries, accounting for one third of deaths world-wide. Every year about one million people, adults and children, are killed on the roads and several million are injured. The death rate from road traffic injuries is 2,2% of all deaths worldwide (Paradowska, 2016). As a type of disaster, it is a major social and public concern, generating a heavy burden, not only because of the loss of health or life, but also through the significant strain on emergency services, the health system and the environment. A traffic accident is a sudden and unforeseeable event that occurs on or off a public road and causes damage to property (damage to vehicles) and/or to the health or lives of those involved. Traffic disasters primarily include an event in land, sea or air traffic involving at least one

vehicle and resulting in loss of property, health or life of the people involved. Due to the development of the road infrastructure, and the consequent increase in the number of vehicles on the road, it is disasters and land traffic incidents that are the events with the highest number of fatalities. An extremely important factor during a traffic incident is not only the proper equipment, securing the scene of the incident, qualified rescuers, but also the exchange of information between the emergency services and hence their cooperation. Traffic incidents are unique. The emergency services must work closely and efficiently together for the improvement of all operations at the scene. Injuries and damages resulting from traffic accidents involve significant costs and losses, which Brongel called 'the most serious and the most expensive war of the modern world' (Brongel, 2007).

The issue of crisis management logistics is a subject closely related with the increase in road accidents in Poland and worldwide. Road accidents belong to the category of the non-military crisis threat as technical disasters. In the light of the literature review, several crisis management themes emerge. Crisis situations are a set of certain unfavorable circumstances occurring in a given area, resulting in certain unfavorable changes for people or the environment. They affect not only the environment, but also the physiological, emotional and social well-being of the live functioning within. The logistics of crisis situations is to eliminate, to some extent, these unfavorable circumstances through appropriate management and planning of operations at the site of the incident. It is focused on saving the life and health of the injured, providing them with all the necessary resources and medical aid. In such situations, the time of arrival on the scene and the fastest possible execution of the necessary actions is particularly important, as time affects the chances of survival of the injured. A state of crisis causes an imbalance, and the task of logistics is to restore it (Kochanek, 2013). A valid element of an efficient crisis management system is the logistics of crisis situations. It provides theoretical solutions to support planning, preparation, response and recovery processes in the event of a crisis situation. The subject of crisis logistics is especially the affected population. Moreover, it deals with all logistical aspects taking place either to secure property or to rebuild critical infrastructure. The main objective of emergency logistics operations is to reach all victims as promptly as possible, to save the health and lives of the injured and to meet the basic needs of the affected population.

An efficient emergency response requires an emergency response plan. It consists of four stages: prevention, preparation, response, recovery. These stages are interconnected and form a closed cycle. The emergency logistics is to plan for situations that have not yet occurred in order to be as prepared as possible and to be able to act as quickly as possible the moment an event occurs (Ziarko, Walas-Trębacz, 2005). Difficult and complex decision-making is characteristic of disaster site management. Thus, disaster management is in a sense a specific form of risk management. Risk management itself aims, among other things, to improve human safety and prevent losses, but above all to avoid unnecessary risks (Vasvári, 2015; Berek, Kovacs, 2018). On the other hand, the main objective of disaster management is to save lives

and protect the health of citizens - which further emphasises the need for sound decision-making. Traffic disasters pose a unique challenge for teams providing medical assistance to the affected population (Oldenburger et al., 2017).

However, it is important to remember that communication is an essential tool for crisis management. The purpose of communication in crisis management is to raise awareness of threats and to induce protective practices before and during hazardous occurrences (Coombs, Holladay, 2018). The veracity of messages sent and received becomes essential in crisis situations, and people's well-being and decisions depend on the quality of the information they receive. Regular and accurate communication is essential for the proper functioning of crisis management (Coombs, 2021, Thai et al., 2019). Information flows are an integral part of any logistics supply chain (Kadłubek, 2020). The decision-making process in its essence is a complex activity, requiring not only knowledge from the decision-maker, but also their experience in similar situations, or those learnt from relevant training (Kabus, Dziadkiewicz, 2022). An important logistical element in a communication incident, especially a mass incident, is the flow of information (Salomone, 2017), without which it would not be possible to provide efficient and rapid assistance to the injured. The decision theory is a common area of interest for numerous fields of science, covering the analysis and support of the decision-making process, which is an attempt to determine the best solution with a given resource of knowledge and information about possible consequences (Bhalla et al., 2015). Information is important from the very beginning, even before the operations start. Thanks to the notification, the services know how many victims are on the scene, where the incident occurred and what caused it. Most services operate on their own radio channels, but during a mass incident it is important to organize communications in such a manner so the information flows through all the services involved. There is a B112 channel that allows communication with other services. Through this channel, the coordinator communicates with the officers of the teams concerned. The members of these teams can communicate with each other through their own channels. This avoids confusion in the information received by the commanding office at the scene of the incident and makes all operations more efficient. A persistent problem in the management of response to disasters is the lack of coordination between the various agencies involved. There is an intense stress on the characteristics of networked relationships, set apart by flexibility, transparency, participation, and accountability. These factors impact not only the effectiveness and efficiency, but also the legitimacy of the overall emergency management governance process (Journal of Laws 2020.360).

However, no emergency operation, despite the use of the latest equipment and qualified personnel, will be efficient and effective without ensuring the safety of rescuers, as well as coordination and reliable information flow between services. Correct and reliable information flow is essential in the logistics of emergency services providing assistance in traffic incidents. Without a proper flow of information, emergency services are not able to help the victims sufficiently, and thus to do their job properly. Nowadays, the organization of effective

information transfer, as well as the proper management of information transfer, is an essential condition for the efficient conduct of all large emergency operations. The lack of proper information and effective communication between the various participants in an operation leads to chaos. Chaotic emergency operations are usually caused by a misunderstanding of the real needs and thus, despite the effort put into them, are not very effective. The proper coordination of emergency operations carried out at the scene of a mass incident is of vital importance for its success (Cronin, Weingart, 2007). The type of information transmitted is strictly dependent on the current phase of the activities. However, the first information causing the start of the response phase is crucial, as they are often obtained from accidental witnesses of the incident and are sometimes inaccurate, which may be the reason for an inadequate response to the incident. Therefore, it can prove to be difficult to gather complete and precise information about an incident shortly after its occurrence. Usually the first accurate and reliable information coming from the scene of an incident is the one received from the emergency services that arrived on the scene. They provide the necessary precise information for further action, i.e. the exact location of the incident with optimal access routes, current and potential risks, number of victims and type of injuries, type of assistance needed. This information is a priority and must be shared immediately to all the services required during the operation. It should be known before segregation and provision of qualified assistance. Differences in knowledge and expertise can lead to representational gaps, differences in how problems are conceptualized, affecting what information is viewed as being relevant to share and pay attention to, and how it is interpreted (Waring, 2018). These information-sharing difficulties have been observed across several countries, including the USA (Bharosa, 2010) and Netherlands (Jarosławska-Kolman et al., 2016). In summary, information is very important and is a pillar in an effective organization.

3. Description of the functionality of emergency services in Poland

The beginnings of medical emergency services in Poland date back to the end of the 19th century, precisely to 1891, when the first emergency ambulance service was established in Cracow. It was located in the Fire Brigade building, and students of the Jagiellonian University's Faculty of Medicine were on duty in the ambulatory. All the people involved were volunteers, hence the name: the Cracow Volunteer Rescue Company. It ceased its activities in 1950. The impulse for its establishment came from two tragedies in 1890 – a fire in the warehouse of the Kretschmer company in the Market Square, in which, among others, the owner of the company was killed, and a fire in Wiśniewski's pharmacy in Stradom District, in which two people were fatally burnt. In the following years, especially at the beginning of the 20th century, ambulance stations were being established in many larger Polish cities.

The Polish Red Cross Society was also founded in 1919. The members helped war victims and set up many outposts and ambulance stations, which were later taken over by the government. With time, legal regulations for ambulance services began to be introduced, and this mainly happened at the beginning of the 21st century (Journal of Laws of 2019, item 993). According to the Act of 8 September 2006 (Podgórski, Nadolny, 2016), the composition of the medical system in Poland includes: ZRM (Medical Rescue Teams), which use the land route - ambulances, LPR (Polish Air Rescue), which use the air route - it disposes of helicopters and sanitary planes, SOR (the E.R.), and cooperating units, i.e. WOPR (Water Volunteer Search and Rescue), TOPR (Tatra Mountains Volunteer Search and Rescue), GOPR (Mountain Volunteer Search and Rescue).

In modern medical rescue, the aid at the scene of the incident and, subsequently, during transport is of great importance. The proper organization of tasks allows saving life on the site of an incident, proper evacuation and treatment of an injured person in a specialized center in accordance with health indications. The manner of operation by medical rescue services in a mass casualty incident is defined by the procedures developed by the Ministry of Health. First, the team receives information about the incident from the medical dispatcher. On the scene one of the persons takes the role of the Medical Operation Commander. Other services arriving on the scene must report their presence to this person, and then the tasks are assigned. This is followed by a general assessment of the incident and securing the scene. The so-called segregation of the injured is carried out, the so-called triage. Radio communication is essential in order to communicate with each other at all times. Assistance, constant supervision of all involved, psychological support if possible and, if necessary, transport to hospital is provided to the affected persons. Finally, an action card documentation, based on the 'mass casualty incident assessment card', is to be drawn up (Journal of Laws of 1991, No. 88, item 400).

Another emergency service participating in traffic disasters is the State Fire Brigade. In the current legal status the basis for the operations of the State Fire Brigade is the Act on the State Fire Brigade of 24 August 1991 (Liwo, 2020). The Act on State Fire Brigade corresponds with the Act on fire protection. The State Fire Brigade in its current status is a public entity performing the functions of a public authority. The legal forms of measures taken by the State Fire Brigade force up the obligation of a specific conduct of entities subordinated to the competence of this fire brigade and its actions. In the literature, it also included uniformed services in light of the administrative law (Journal of Laws of 1951, No. 58). The history of firefighting in Poland dates back to 1836, when the first Professional Fire Brigade was established in Warsaw. However, the first records on fire protection appeared much earlier, in the 14th century. They stated on warrants and prohibitions of the performance during the occurrence of the danger of fire. Under the Act on Protection against Fire and Other Disasters of 13 March 1934, the regulations and duties of the Fire Brigade were determined (Journal of Laws No. 41, item 365). The present-day division of the State Fire Brigade is quite similar to

the one established by the act of 4 February 1950 on fire protection and its organization (Journal of Laws 2020.360). There are headquarters of the State Fire Brigade, their provincial headquarters and district/city headquarters. Numerous Voluntary Fire Brigade units are worth mentioning. Of great importance in taking care of general safety is the National Rescue and Firefighting System. It is an integral part of the state's internal security organization, aiming for saving life, health, property or the environment, forecasting, recognizing and fighting fires, natural disasters or other local threats. The system associates fire protection units, other services, inspections, guards, institutions and entities which voluntarily, by means of a civil-legal agreement, agreed to co-operate in rescue operations. The main objective of the National Rescue and Firefighting System is to provide protection of life, health, property or environment, within the framework of actions undertaken by the State Fire Brigade and other rescue entities (with particular emphasis on Voluntary Fire Brigades), through: firefighting, elimination of local threats (rescue operations), chemical and ecological rescue, technical rescue, medical emergency service within the scope of providing qualified first aid. During a mass incident, the State Fire Brigade reminds the Emergency Medical Service. After receiving the notification and arriving at the scene of the incident, one person is appointed to lead the operation. The officer of the fire brigade classifies the occurrence of the incident, whether it is a multiple event, a mass event, or a disaster or natural disaster. This is followed by medical segregation. The State Fire Brigade cooperates with the other services. Together with the emergency medical service, they rescue people and evacuate the injured, as well as secure the incident area. Depending on the type of incident, they also deal with elimination of dangers and prevention of further dangers in the area. Polish legislation states that a rescue operation with the participation of the National Rescue and Firefighting System entities is usually commanded by an officer of the State Fire Brigade. In case there are not enough ambulances to transport the injured, transport by the State Fire Brigade is possible. The rescue operation officer can also send public means of transport, such as city buses.

Another service involved in a mass incident is the Police. It is an executive entity which was established on 24 July 1919 by an act of the Parliament of the Second Republic of Poland. During World War II, the activities of the Polish police were significantly limited. In 1944 the State Police was dissolved and the Citizens' Militia was created. Its main task was to maintain public order. The organization of the Militia was specified in 1955. Its main organ was the Headquarters. Since 6 April 1990, in accordance with the act on the Police, the Citizens' Militia was dismantled and the Police was established. In the current legal state, the basis for the Police activity is the Act of 6 April 1990 on the Police (Journal of Laws 2017.1319).

Police operations at the scene of a traffic incident can be divided into two stages, namely the stage of preliminary activities (when the Police receive information about the incident, verify it and direct police patrols to the scene of the incident) and the stage of proper rescue response, consisting of the following three stages. First, alarming and warning, then the order stage, ensuring freedom of access for other services, securing the place, preventing panic,

informing bystanders about the event, directing the traffic. The Police are also involved in providing first aid to the injured.

It is necessary to present the characteristics of the incidents, in which the respondents surveyed may have been involved. In the case of mass events, the medical aid, due to the large number of injured and sick people and due to the limited medical potential, is narrowed down to the so-called "vital considerations", and all the injured are subject to medical segregation. It is an essential element of rescue operations in mass incidents. The aim of this procedure is to find among the victims of the incident those who are in a life-threatening condition and in this way to enable them to receive the medical aid in priority. The aim of segregation is also to organize medical rescue activities. Thanks to this, the medical personnel can provide medical assistance to an increased number of the injured and wounded, especially to people in the state of direct threat to life. In the literature, a mass accident is an event that suddenly results in a large number of injured people exceeding the capabilities of the emergency services arriving on the scene. In such events, the emergency services are not able to provide the medical aid to all victims at the first moment, despite medical procedures specially developed for such events. A large number of victims and the scope of their injuries create obstacles for the emergency services, which, guided by the principle - to save as many people as possible, are often forced to make medical compromises. In practice it means that victims whose chances of survival are slim are not treated. The moment the disproportion between the needs of the injured and the possibilities of providing help by emergency services, which occurs in mass accidents, is eliminated, the injured can be treated at the scene of the accident in a routine way, using the available equipment and human resources. A single accident is an emergency event with risks to a single victim. This person will receive full medical attention in accordance with current emergency procedures (Vassallo, 2017).

Addressing the procedures of emergency services at the scene of the incident, it is stated that they first secure the scene, if necessary facilitate access to the injured, evacuate people to a safe place, and then proceed to the initial segregation of the injured, i.e. triage. Evacuation is the movement of the injured from a dangerous area by the decision of the State Fire Brigade officer.

Any movement of people by decision of a doctor or paramedic is an extraction or transportation. Triage is one of the key principles for the effective management of major emergencies (Koenig et al., 2010). Triage is a French word derived from 'trier', meaning to select, to separate, to categorize or to classify, and refers to the categorization, classification and prioritization of patients and injured people based on the urgency of their need for treatment (Bazyar et al., 2019). It is a medical procedure to priorities treatment and to classify injured people in accordance to the severity of their injuries. Medical segregation is a continuous, ongoing process, repeated from time to time. The aim of the triage is to help as many victims as possible in a relatively short period of time. Medical segregation may be undertaken by paramedics, system nurses, doctors, as well as firefighters or any other person with a completed

course of qualified first aid, appointed by the officer of the operation. Medical segregation should be delegated by the most experienced paramedic in the team. People are assigned to a particular category by making a preliminary assessment of basic vital signs such as ability to walk, breathing, pulse, state of consciousness. If the initial segregation is carried out by State Fire Brigade rescuers, they are not qualified to declare death, so in a situation where movement and breathing are not detected, they assign a yellow category, thereby giving these victims secondary priority for transport. There are several different segregation systems. The most popular system in Poland is the START system. It is also the system most commonly used in the United States. This system is also used in Canada and selected regions of Australia and in the Israeli-occupied territories. It was developed by the Newport Beach Fire Department and Hoag Hospital in California in 1980 (Koenig et al., 2010). In this system, all injured adults over the age of 8 are assessed based on the system's algorithm in 60 seconds or less (preferably 30 seconds). In this system, criteria including walking ability, respiratory rate, capillary filling, radial pulse and command performance are used. According to this system, victims should be divided into four groups (priorities). The red colour is used to indicate those injured people who should be helped first and immediately. These are patients who can recover with appropriate medical care. Yellow is used for victims who need medical attention but whose life will not be endangered by a short delay in receiving it, so they are treated second. Their proper treatment must start within the first 24 hours following the incident. Green is for patients who will survive regardless of the help received. Black, on the other hand, means the victim who has no breathing and no pulse after the airway has been opened, and there is a high probability of death. This group also includes people with burns over the entire body surface, or with extensive crushing. While rescuers, doctors and firefighters are giving first aid to victims in the red and yellow groups, people in the green group are gathered in one place in a sit-ting position so that one person can control them and constantly observe their behavior (Smith, 2012).

Moreover, the types of medical segregation, namely primary and secondary segregation are also to be discussed. Primary segregation is the segregation of the injured performed immediately after the arrival on the scene of the emergency entity. At that time, victims are initially assigned to the appropriate colours. Secondary segregation is the segregation of the injured which is carried out after the implementation of medical emergency procedures in relation to the highest priority victims. It begins after the red group has been treated, but before their transportation. Then the medical records come into use. Secondary segregation usually differs from primary segregation. After secondary segregation the victims are transported to the appropriate medical facilities in the order determined by the qualified in the first aid in consultation with the doctors present (Podgórski, Nadolny, 2016).

4. Research methodology

The source data for the statistical research were obtained by the questionnaire method. The survey questionnaire was distributed electronically through a web service. The link to the questionnaire was sent to people involved in traffic incidents, but not belonging to the emergency services. In order to obtain the most extensive and thorough information, a typical case of random selection was used.

The study proper was based on questionnaires. It was conducted between January and February 2022 on a group of 150 people. Respondents completed an online survey via a website. In the empirical sphere participated the people who were involved in traffic incidents but are not members of the emergency services. In order to obtain the widest and most complete information, a typical random selection case was used. Spatial coverage was determined randomly. The questionnaire contained questions concerning the evaluation of the actions of the rescue team in terms of preparation for the rescue action. The questionnaire was completed by 258 people, but 102 people did not participate in the road incidents or were members of the emergency services, and 6 questionnaires were filled in incorrectly (not all questions were answered). 58% of correctly completed questionnaires were obtained. A total of 156 questionnaires were obtained, of which 150 correctly completed were included in the further analysis.

The structure of the sample was selected based on the percentage of population registered by the Central Statistical Office. The population aged 18 to 66 was taken into account. Due to the fact that the sample cannot be considered fully representative, the obtained results should not be generalized to the entire population. Nevertheless, they contribute to a better understanding of the functioning of emergency services at the scene.

Undertaking a study to analyze the preparedness of emergency services to participate in rescue operations, research questions were formulated: whether there is a correlation between perceptions of uniformed services and gender, place of residence or education, and whether there is a relationship between ratings of the usefulness of particular emergency services and demographic variables. In addition, the respondents were asked about their opinion of individual emergency services and to indicate which of them has the most important role at the scene of a traffic incident. In addition, it was determined whether there are irregularities at the scene, and if so, what they are.

BM SPSS Statistics for Windows, Version 24.0 was used for the statistical analysis.

5. Results

150 people participated in the survey: 64% male and 36% female. The largest groups of respondents were people aged 18 to 26 years and 27 to 40 years. On the other hand, a less numerous group were people between 41 and 65 years old. The least numerous group was people over 66 years old. The structure of the sample by age and gender of the respondents is presented in Table 1.

Table 1.

The structure of the sample of the respondent by age and gender

Variable: gender	Frequency	Percentage (%)
Female	54	36
Male	96	64
Variable: ages	Frequency	Percentage (%)
18 - 26	72	48
27 - 40	45	30
41 - 65	30	20
Over 66	3	2

Source: own study.

The opinions of respondents vary depending on: gender, level of education and place of residence, therefore they were analyzed from this point of view. Among the respondents, 73% come from a small town (up to 250 thousand residents), 21% from a medium town (between 251 and 500 thousand residents), 6% from a village. The highest number of female respondents in the study were women with secondary education (60% of female respondents) and with higher education (31%), while male respondents were mostly respondents with secondary education (52%) and with higher education (31%).

First, the respondents were introduced to the definitions of traffic incidents: single, multiple, mass and traffic disaster. Then, they answered which communication incident they had participated in. The individual incidents were characterized in de-tail in the questionnaire. The distribution of answers to the above inquiry showed that 58% had been involved in a mass traffic incident. This was followed by those who had been involved in a single incident (24%) and those who had been involved in a multiple traffic incident (9%). One person was involved in a traffic disaster, while despite its characteristics 6% of people, could not specify what type of incident they were involved in.

The next question was designed to explore which of the emergency services holds the most significant role during these traffic incidents. Respondents could mark only one answer. Most people indicated the Medical Emergency Service (54%). Next was the Fire Brigade (32%). The Police came last (14%). None of the respondents marked the "no opinion" answer. Relationships between ratings of the relevance of emergency services and demographic variables such as age, place of residence and education were also examined. No significant relationships could be found between any of the variables examined. There are also no differences between men and women in this regard (Table 2).

Table 2.*Correlations between emergency service relevance ratings and demographic variables*

Attitude towards the uniformed service			
Women	Age	Correlation coefficient	-0,122
		Relevance (double-sided)	0,298
	Education	Correlation coefficient	0,055
		Relevance (double-sided)	0,642
	Size of the place of residence	Correlation coefficient	-0,072
		Relevance (double-sided)	0,538
Men	Age	Correlation coefficient	0,161
		Relevance (double-sided)	0,167
	Education	Correlation coefficient	0,115
		Relevance (double-sided)	0,324
	Size of the place of residence	Correlation coefficient	-0,069
		Relevance (double-sided)	0,555

Source: own study.

Furthermore, the work of emergency services involved in the incidents was examined using a Likert scale, where 1 - is a very bad rating, and 5 - a very good, with the middle value of 3 - I have no opinion. According to the questionnaire, the vast majority of men (86%) answered "very good" or "good" when asked to evaluate the operation of the medical emergency service, and as many as 72% of women also answered the same way to the above question. Only 14% of men had a negative opinion of the medical emergency service's performance at the scene of the incident. In the female group, 28% of the respondents answered that they had a bad or very bad opinion of this uniformed service. Relationships between attitudes to the assessment of medical emergency service performance with demographic variables such as age, place of residence and education were also examined. No significant relationships could be found between any of the variables examined. There are also no differences between men and women in this regard (Table 3).

Table 3.*Spearman's rank (rho) correlations between medical emergency service performance ratings and demographic variables*

Attitude towards the uniformed service				
Women	Age	Correlation coefficient	0,053	
		Relevance (double-sided)	0,635	
	Education	Correlation coefficient	-0,005	
		Relevance (double-sided)	0,968	
	Size of the place of residence	Correlation coefficient	-0,044	
		Relevance (double-sided)	0,705	
	Subjective assessment of the financial situation	Correlation coefficient	0,031	
		Relevance (double-sided)	0,794	
	Men	Age	Correlation coefficient	-0,003
			Relevance (double-sided)	0,980
Education		Correlation coefficient	-0,014	
		Relevance (double-sided)	0,903	
Size of the place of residence		Correlation coefficient	-0,540	
		Relevance (double-sided)	0,647	
Subjective assessment of the financial situation		Correlation coefficient	0,117	
		Relevance (double-sided)	0,316	

Source: own study.

In summary, it may be concluded that people who positively evaluated the performance of the medical emergency service at the scene of an incident are not assigned to the appropriate age group, do not have a specific education, and do not come from a small or large city.

Table 4 presents an analysis of the averages for the different uniformed services. The descriptive statistics show that there are differences between the individual uniformed services. Respondents recognized that the medical emergency service is the first in the ranking of acting at the scene of an incident, followed by the fire service. On the other hand, by far the worst rated emergency service was the police.

Table 4.

The averages for the different uniformed services

Type of the uniformed service	Average importance score	Standard deviation
Fire Service	3,120	0,704
Medical Emergency Service	2,147	0,790
Police	3,427	0,846

Source: own study.

The distribution of answers confirms the results obtained earlier concerning the role of emergency services at the scene of an incident and shows that the main role in mass incidents is played by the Fire Department and the Medical Emergency Service. These entities have the authority to provide assistance to the injured, to assess the condition of the injured through medical segregation and are equipped appropriately to save people's lives. They can also provide transportation for the injured. The Po-lice, on the other hand, while also important is perceived from a slightly different angle. They are mainly involved in securing the scene of the incident, directing traffic, and marking out areas for arriving services.

Another of the questions asked if there were any irregularities while providing assistance and securing the scene. The results show that the majority of people (64%) answered that there were no irregularities, while 36% of people noticed them. Those who gave an affirmative answer to the above question were asked to justify their answer, either by selecting the answers considered by the interviewer or by describing the problems noticed themselves. Among the features that significantly affect the assessment of the performance of uniformed services in terms of irregularities that occur at the scene of an incident, the following should be indicated:

- insufficient security provided at the scene of the incident (12 people),
- late arrival at the scene of the incident (30 persons),
- inefficient level of cooperation of services at the scene of an incident (14 persons),
- noticeable chaos (12 persons),
- little information provided to those affected by the incident (6 people).

It was noticeable that most of the people surveyed (71%) believe that the emergency services were able to control the chaos at the scene of the disaster, while the opposite was true for 29% of the respondents. According to 60% of the people surveyed, the emergency services

are adequately equipped technically and in terms of training to ensure the safety of those involved in the incident. 70% of the respondents gave a positive answer to the question.

A large part of respondents (76%) confirmed that the rescue system at the scene of an incident is well organized, 6% of people had no opinion on this issue, while the rest of the respondents (18%) marked a negative answer. The survey also asked about public expectations of emergency services. The results are shown in Figure 1.

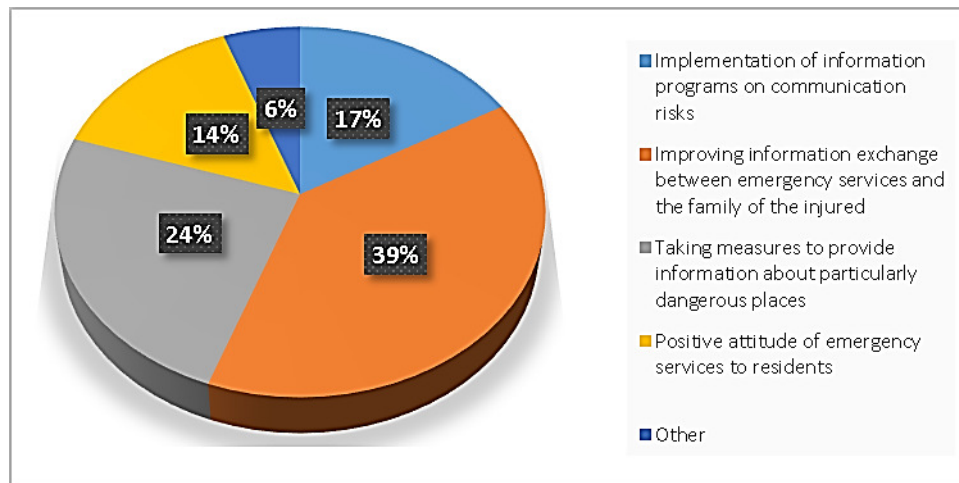


Figure 1. Public expectations of emergency services.

Source: own study.

The analysis of the above questionnaire shows that emergency services meet the expectations required by society. The operations of rescue units are carried out in a professional manner and the knowledge of rescuers is sufficient to provide assistance. The rescue system itself operates in a satisfactory manner. The paramedics were rated highest, followed by the firefighters. It can be concluded that they are considered as people to have the best training and have the greatest impact on ensuring the safety of victims and witnesses. Respondents also pointed out that it takes too much time for the emergency services to arrive at the scene of an incident, there is chaos, and there is poor communication between the injured and the rescuers. It can be surmised that the chaos stems from the fact that rescue teams struggle to make decisions due to poor communication, inconsistent situation awareness, and conflict of interests (Chen et.al., 2013). In order to eliminate these mistakes, it is necessary to increase the number of training to improve the skills of emergency services, as well as to improve the dynamics of arriving at the scene of an incident.

6. Discussion

The purpose of this study was to assess the actions of emergency services (Fire Department, Police and Medical Emergency Service) at the scene of an incident and to indicate the importance of the exchange of information between the emergency services mentioned.

The study considered the largest number of people involved in a mass traffic incident, followed by those involved in a single incident and those involved in multiple traffic incidents.

It was found that there were no significant relationships between ratings of the usefulness of emergency services and demographic variables such as age, place of residence and education. No significant relationships were found between any of the variables studied. In addition, the work of emergency services involved in incidents was positively evaluated by both men and women. An examination of attitudes toward evaluating the performance of emergency medical services with demographic variables such as age, place of residence and education found no significant relationships. There were also no differences between men and women in this regard.

Evaluating all emergency services, the best rating was given to the ambulance service and the weakest to the police. Important factors affecting the situation at the scene included.

Important factors affecting the situation at the scene in terms of bad behavior included: arriving too late at the scene of an ineffective level of cooperation between services at the scene, insufficient security provided at the scene, chaos, too little information given to those affected by the incident.

The complexity of the communication process is very often underestimated, where errors in communication can lead to serious negligence and delays at the scene.

7. Conclusions

The content presented in the article and the results of the author's research can inspire further work for researchers dealing with issues of crisis management, public management, risk management. The analysis presented in the article provides a basis for further research on various information activities in different types of emergency situations. Further research is needed. The article discusses only selected articles, providing a basis for further research. The literature review can be expanded to include an analysis of related scientific works produced in other social science disciplines. The results of this study will not only contribute to the discourse in the context of crisis management in communication incidents, but will also benefit practitioners and policy makers.

There are limitations to the research undertaken. The main one is the number of respondents taking part in the survey. In order for the study to be generalizable to the entire population, a much larger research sample would need to be surveyed.

As part of future research, I think it would be worthwhile to expand the study to include the professional competence of emergency responders, as well as to include work experience as a factor that can affect traffic management and faster response at the scene of a traffic disaster. Having worked too long in an organization or industry can have both positive and negative effects. Z positive perspective, employees tend to be more experienced and familiar with risks and related information. However, employees can become too comfortable in their work environment and take risks. In addition, because they no longer understand details of the workplace, non-compliant behavior may occur. Therefore, future studies should examine the impact of work experience on all factors related to communication management.

References

1. Act of 8 September 2006 on the State Medical Rescue (Journal of Laws of 2019, item 993).
2. Act of April 26, 2007 on crisis management (Journal of Laws of 2019, item 139, as amended).
3. Act of April 6, 1990 on the Police (Journal of Laws 2020.360).
4. Act of April 6, 1990 on the Police (Journal of Laws 2020.360).
5. Act of August 24, 1991 on the State Fire Service (Journal of Laws of 1991, No. 88, item 400, as amended).
6. Act of February 4, 1950 on fire protection and its organization (Journal of Laws of 1951, No. 58, item 404, as amended).
7. Act of March 13, 1934 on protection against fires and other disasters (Journal of Laws, No. 41, item 365).
8. Bazyar, J., Farrokhi, M., Khankeh, H. (2019). Triage Systems in Mass Casualty Incidents and Disasters: A Review Study with A Worldwide Approach, *Macedonian Journal of Medical Sciences*, 7 (3) DOI: 10.3889 / oamjms.2019.119.
9. Berek, T., Kovacs, J. (2018). Risk Assessment of the Human Factor in the Field of Building and Infrastructure Defense, *Acta Polytechnica Hungarica*, Vol. 15, No. 8.
10. Bernstein, P.L. (1996). *Against the Goods: the remarkable story of risk*, John Wiley & Sons: New York.
11. Bhalla, M.C., Frey, J., Rider, C., Nord, M., Hegerhorst, M. (2015). Simple Triage Algorithm and Rapid Treatment and Sort, Assess, Lifesaving, Interventions, Treatment, and Transportation mass casualty triage methods for sensitivity, specificity, and predictive values. *Am. J. Emerg. Med.*, 33(11), <https://doi.org/10.1016/j.ajem.2015.08.02>.
12. Bharosa, N., Lee, J., Janssen, M. (2010). Challenges and obstacles in sharing and coordinating information during multi-agency disaster response: Propositions from field exercises. *Inf. Syst. Front.*, 12, 49-65. <https://doi.org/10.1007/s10796-009-9174-z>.

13. Briggs, S.M. (2005). Disaster management teams. *Curr. Opin. Crit. Care.*, Dec. 11(6), doi: 10.1097/01.ccx.00001186916.92757.ab.
14. Brongel, L. (2007). *The golden hour, the time of life, the time of death*. Krakow: Krakow Medical Publishing House.
15. Chen, R., Sharman, R., Rao, H.R., Upadhyaya, S.J. (2013). Data Model Development for Fire Related Extreme Events: An Activity Theory Approach. *MIS Quarterly*, vol. 37, no. 1, pp. 125-47.
16. Cole, K. (2020). *Crystal Clear Communication: Skills for Understanding and Being Understood*. Brisbane: Pearson Education Australia.
17. Coombs, W.T. (2021). *Ongoing Crisis Communication: Planning, Managing, and Responding*. Sage.
18. Coombs, W.T., Holladay, S.J. (2012). *The handbook of crisis communication*. Wiley-Blackwell.
19. Cronin, M.A., Weingart, L.R. (2007). Representational gaps, information processing, and conflict in functionally diverse teams. *The Academy of Management Review*, 32(3), 761-773. doi.org/10.2307/20159333.
20. European Commission (2022). *Road safety: European Commission rewards effective initiatives and publishes 2021 figures on road fatalities*.
21. Hood, C. (1992). Risk Management. In: *Risk: Analysis, Perception and Management*. The Royal Society.
22. *Institute of Risk Management*. Available online: <https://www.theirm.org/>, 03.30.2021.
23. ISO 9000: 2015, point 3.7.9, 2015.
24. Jarosławska-Kolman, K., Ślęzak, D., Żuratyński, P., Krzyżanowski, K., Kalis, A. (2016). System of the State Medical Rescue in Poland, *Scientific Papers of SGSP*, Nb 60/4.
25. Kabus, J., Miciula, I., Piersiala, L. (2020). Risk in Supply Chain Management. *European Research Studies Journal*, vol. 4.
26. Kabus, J., Dziadkiewicz, M. (2022). Residents' Attitudes and Social Innovation Management in the Example of a Municipal Property Manager. *Energies*, 15, 5812. <https://doi.org/10.3390/en15165812>.
27. Kaczmarek, T. (2006). *Risk and risk management. Interdisciplinary approach*. Warsaw: Difin.
28. Kaczmarek, T. (2010). *Risk management: an interdisciplinary approach*. Warsaw: Difin.
29. Kadłubek, M. (2019). Information Areas in Logistics Supply Chain Management. In: R. Orăștean, C. Olgrean, S.C. Mărginean (eds.), *Organizations and Performance in a Complex World*. IECS. Springer Proceedings in Business and Economics. Cham: Springer. https://doi.org/10.1007/978-3-030-50676-6_7.
30. Kochanek, E. (2013). Outline of crisis-states logistics. Security. *Teoria i Praktyka*, nb. 1.
31. Koenig K.L., Schultz, C.H. (2010). *Koenig and Schultz's disaster medicine: comprehensive principles and practices*. Cambridge University Press.

32. Liwo, M.A. (2020). The State Fire Service as one of the main public entities in matters of ensuring a specific type of safety and order. *PPP, No. 11*.
33. Malešič, M. (2021). Institutional and emergent improvisation in response to disasters in Slovenia. *Int. J. Emergency Management, Vol. 17, No. 2*, pp.138-153.
34. Manstead, A.S.R., Hewstone, M., Czapiński, J. (1996). *Social psychology*. Warsaw: Blackwell's Encyclopedia, Jacek Santorski & CO.
35. Olak, K., Olak, A. (2016). Contemporary understanding of national security. *Acta Scientifica Academiae Ostroviensis. Sectio A. Humanities, Social and Technical Sciences*.
36. Oldenburger, D., Baumann, A., Banfield, L. (2017). Characteristics of Medical Teams in Disaster. *Prehosp. Disaster. Med., Apr. 32(2)*, doi: 10.1017/S1049023X16001461.
37. Paradowska, M. (2016). *Comparison of Road Safety Policy Objectives in Poland and in the European Union. Transport Development Challenges in the Twenty-First Century*. Springer International Publishing.
38. Pieprzny, S. (2007). *Protection of public safety and order in administrative law*. Publishing House of the University of Rzeszów.
39. Podgórski, M., Nadolny, K. (2016). Procedures to be followed in the event of a mass event and a multiple event. Standardization of actions at the scene of an accident, with particular emphasis on EMS teams. *To the rescue, 2/16*.
40. Power, M. (2007). *Organized Uncertainty: Designing the World of Risk Management*. Oxford: Oxford University Press.
41. Regulation of the Minister of Internal Affairs and Administration of 3 July 2017 on the detailed organization of the national rescue and firefighting system (Journal of Laws 2017.1319).
42. Rohr, A., Priesmeier, P., Tzavella, K., Fekete, A. (2020). System Criticality of Road Network Areas for Emergency Management Services—Spatial Assessment Using a Tessellation Approach. *Infrastructures, 5*, 99. doi: 10.3390/infrastructures5110099.
43. Salomone, J. (2017). Disasters – they're not someone else's problem anymore. Principles & pressures of triage. *Panamerican Journal of Trauma, 14(2)*.
44. Sienkiewicz, P., Marshal, M., Górny, P. (2012). *Risk in crisis management*. Toruń: Adam Marszałek Publishing House.
45. Smith, W. (2012). Triage in mass casualty situations. *Continuing Medical Education, 30(11)*.
46. Thai, M.T., Wu, W., Xiong, H. (2019). *Big data in complex and social networks*. CRC Press.
47. The Constitution of the Republic of Poland of 2 April 1997 (Journal of Laws No. 78, item 483 as amended).
48. Trzos, A. (2004). Triage: Medical segregation. *National Medical Review*.

49. Vassallo, J., Beavis, J., Smith, J.E., Wallis, L.A. (2017). Major incident triage: derivation and comparative analysis of the Modified Physiological Triage Tool (MPTT). *Injury*, 48(5), <https://doi.org/10.1016/j.injury.2017.01.038> PMID: 28131484.
50. Vasvári, T. (2015). Risk, Risk Perception, Risk Management - a Review of the Literature. *Public Finance Quarterly*.
51. Waring, J., Bishop, S., Clarke, J. (2018). Healthcare leadership with political astuteness (HeLPA): a qualitative study of how service leaders understand and mediate the informal 'power and politics' of major health system change. *BMC Health Serv. Res.*, 18, 918. <https://doi.org/10.1186/s12913-018-3728-z>.
52. Zawadzki, A. (2007). *Early medical treatment in catastrophes. Handbook for paramedics*. Warsaw.
53. Ziarko, J., Walas-Trębacz, J. (2010). *Basics of crisis management. Part 1*. Crisis management in public administration. Kraków: Oficyna Wydawnicza AFM.

ANALYSIS AND EVALUATION OF THE PERFORMANCE OF MICRO AND SMALL ENTERPRISES IN SELECTED COUNTRIES OF CENTRAL AND EASTERN EUROPE FROM 2017 TO 2020

Joanna PIOCH¹, Joanna SOSZYŃSKA-BUDNY^{2*}

¹ Sopot University of Applied Sciences; joanna.pioch@ssw-sopot.pl, ORCID: 0000-0002-7895-1696

² Sopot University of Applied Sciences; joanna.soszynska@ssw-sopot.pl, ORCID: 0000-0003-1525-9392

* Correspondence author

Purpose: The aim of this paper is analysis of selected parameters for the performance evaluation of the micro and small enterprise (MSE) sector in selected Central and Eastern European countries on the basis of data available in available statistical databases. The selected for analysis countries are the Czech Republic, Poland, Romania, Slovakia and Hungary.

Design/methodology/approach: In the paper we define basic issues of micro and small enterprise and describe their role in the state economy. Then, on the basis of statistical data from years 2017-2020, an analysis of selected parameters for the assessment of MSE is carried out. Among others, such characteristics in each country are analysed as: the number of micro and small enterprises in the period 2017-2020, the structure by size of the enterprise, the structure by the number of people employed, on the basis of the analysis conducted.

Findings: The performed analysis is used to evaluate different aspects of the development of the micro and small enterprises sector in the Central and Eastern European countries. The paper also tries to find an answer to the question of how the MSE sector developed in the post-Eastern Bloc countries between 2017 and 2020.

Practical implications: In the paper, we highlighted the lack of research on the MSE sector in particular. The conducted analysis will facilitate a better understanding of the problems faced by micro and small enterprises and may contribute to the increased interest in this subject, to a more in-depth analysis and an increase in the number of studies concerning only the MSE sector.

Originality/value: The study contributes to the discussion on the micro and small enterprise sector and its impact on the economy.

Keywords: micro enterprise, small enterprise, sector of the economy.

Category of the paper: research paper.

1. Introduction

The article addresses a research problem that is important for the economic development of the modern economy. There are many studies on the sector of small and medium-sized enterprises - SMEs, but it seems that they overlook the specific nature and importance of the smallest companies, i.e. micro and small enterprises (MSEs). According to the authors, the study is a contribution to the discussion on the state of the micro and small enterprise sector and their impact on the economy. The aim of the article is to analyze selected assessment parameters of the micro and small enterprise sector in selected countries of Central and Eastern Europe based on the data contained in the available statistical databases. The countries selected for the analysis are the Czech Republic, Poland, Romania, Slovakia, and Hungary. The article also attempts to find an answer to the question of how the micro and small enterprise sector developed in the former Eastern Bloc countries between 2017 and 2020.

2. Definition, competitiveness factors, and importance of small and micro enterprises

2.1. Definition of small and micro enterprises

In Poland, economic activity is defined in Article 3 of the Entrepreneurs Law (The Entrepreneurs Law Act of 6 March, 2018) as an organized commercial activity, conducted on its own behalf and on a continuous basis. Article 4 of the same act provides a definition of an entrepreneur, i.e. a natural person, a legal person, or an organizational unit that is not a legal person, but is granted legal capacity under a separate law, conducting economic activity. Article 55 of the Civil Code defines an enterprise as an organized set of tangible and intangible elements intended for conducting business activity, with an extensive list of these elements, including elements of a company's assets and liabilities and books related to the business activity as an important element constituting a business entity (The Civil Code of 23 April, 1964).

The differences between micro, small, and larger enterprises are related to financial and personal limitations, the scope of operations, predisposition and knowledge of owners, contact network, etc. (Gurkan, Bititci, 2015).

Enterprises are classified based on the type of business (manufacturing, services, trade), the form of ownership (public, private), legal form (sole proprietorships, partnerships, cooperatives, state-owned enterprises, etc.), scope of business activity (local, regional, international, global), and size (large, medium, small, and micro) (Grzenkiewicz et al., 2008; Marek, Białasiewicz, 2011; Lichtarski, 2005). The latter classification is the most relevant in the context of this article.

Despite the fact that thousands of studies and articles have been written about the SME (small and medium-sized enterprises) sector, it is only recently that there have been attempts to research a separate part of this sector, namely MSEs (micro and small enterprises). Economists dealing with the subject of small and medium-sized enterprises (SMEs) accept the thesis about the importance of this sector of the modern economy around the world virtually without any reservations. Although the analyses show that sometimes as much as 99% of the SME sector consists of micro and small enterprises (cf. Skowrońska, Tarnawa, 2021, 2022), most studies invariably also take into account medium-sized enterprises, which, as shown in the table below, differ significantly in terms of, for example, the number of employees, from that part which is defined as micro and small enterprises (MSEs).

Different countries around the world, due to their various development conditions, have adopted different criteria for classifying by the number of employees. Below is an example of the data in Table 1.

Table 1.

Definition of enterprise size by the number of employees in selected countries

Enterprise	Medium (less than)	Small (less than)	Micro (less than)
USA	500	100	N/A
China	2,000	300	N/A
EU	250	50	10
Australia	200	20	5
Turkey	250	50	10
UK	249	49	9

Source: (Gurkan, Bitici, 2015).

Initial considerations of the definition and criteria for classifying enterprises by size led to the consolidation of this definition in statistics and tax law.

According to the Polish Entrepreneurs Law act (The Entrepreneurs Law Act of 6 March, 2018), which uses categories developed by EU institutions (SME Definition - user guide, 2020), the size of an enterprise is assessed according to 3 quantitative and 1 qualitative criteria. Fulfilling two of the three quantitative criteria (the number of employees and balance sheet total or turnover amount), while simultaneously fulfilling the qualitative criterion regarding independence from other business entities, results in being classified into a given category of enterprises. The list of values for determining the scale of an enterprise's operations can be found in Table 2.

Table 2.

Criteria for classifying enterprises by size in Poland

Criterion	Micro enterprise	Small enterprise	Medium enterprise
Number of employees	Under 10 people	Under 50 people	From 50 to 249 people
Turnover	Up to €2 million	Up to €10 million	Up to €50 million
Balance sheet total	Up to €2 million	Up to €10 million	Up to €43 million
Dependency*	Independent	Independent	Independent

*Dependency criteria are defined in the Accounting Act (The Entrepreneurs Law Act of 6 March, 2018).

Source: Pach, 2008.

These criteria have been in force in the EU with minor changes since 2001 and were introduced, among other things, to verify the recipients of state aid (interventionism) to the SME sector. Pursuant to the EU Commission Regulation, aid to small and medium-sized enterprises is compatible with the common market and is not subject to the notification requirement of Article 88 of the Treaty (Commission Regulation (EC) No. 70/2001, 2001). At the same time, it is worth pointing out that the criteria indicated in the Entrepreneurs Law and the Accounting Act are different, and although this difference may not be significant, unifying the criteria would allow to increase the stability of the legal conditions for the operations of both micro enterprises and the SME sector.

2.2. Competitiveness factors of micro and small enterprises

Why should the state help entities from the SME sector? The last years, i.e. 2020-2022, have in particular confirmed the long-held belief that countries with higher levels of flexibility and self-sufficiency are more resilient to economic crisis. Unfortunately, it is also noticeable that the smaller the entity, the less resilient it is to disruptions in every sphere of operation. This applies to personal issues, such as the indisposition of staff and managers, through to economic issues, such as increases in interest rates or exchange rates. Even relatively minor actions that change the competitive conditions in the SME sector, such as the implementation of new regulations on minimum wages, the amount of taxation, or mandatory contributions, may have far-reaching effects, including closures. In the financial reporting of many countries, precisely because of the small size of operations, lower expectations are placed upon SMEs in terms of collecting and reporting financial or tax information (Kanapickiene, Spicas, 2019).

Among the reasons cited in the literature indicating the importance of the SME sector, one can find references to aspects that increase competitiveness, i.e. for example, strong ties to the environment, care for the local community, low capital intensity, and the ability to quickly change industries in the event of the loss of customer interest (Pach, 2008). High financial discipline resulting from low levels of financial resources, and a skilled workforce with a wide range of competencies enforced by the reduction of employment in micro entities are other significant characteristics of micro and small enterprises. Micro enterprises contribute to poverty reduction and reduce wage disparities between workers (Gurkan, Bititci, 2015).

Another important feature from the point of view of the national and regional economy is that almost exclusively micro and small enterprises create new jobs, while large and medium-sized enterprises either only maintain them or, even liquidate them in the event of a downturn. Also, the issues of management and organizational culture, different in micro and small enterprises (Gałązka, Czuba-Kulisińska, 2017), which are often built as family businesses, are indicated in the literature as a success factor for this type of business not burdened by bureaucratic barriers. It is the speed of decision-making associated with the absence of bureaucratic barriers and the decision-making autonomy that allow micro and small enterprises to increase their competitiveness (Kaliszczak, Nesterowicz, 2014).

2.3. Importance of micro and small enterprises in the economy of Poland and the EU

The size and importance of the SME sector and its significant part, i.e. micro and small enterprises, is most easily proven by pointing to the share of these entities in the employment structure in individual countries and in the EU as a whole, as shown in Table 3.

Table 3.

Structure of employment and number of enterprises by size in Poland and the 27 EU countries

Enterprise size	Number and structure [%] of enterprises (data for 2019)		Employment structure [%] (data for 2020)	
	Poland	EU-27	Poland	EU-27
Micro	1,918,147 (94.9%)	21,553,171 (93.0%)	35.0%	29.6%
Small	85,850 (4.2%)	1,361,258 (5.9%)	16.7%	19.7%
Medium	14,961 (0.7%)	211,000 (0.9%)	15.8%	15.8%
Large	3,290 (0.2%)	43,500 (0.2%)	32.3%	34.8%

Source: (Skowrońska, Tarnawa, 2022; SME Performance Review, 2021).

The analysis of the data in Table 3 shows that Poland does not deviate significantly from the EU-27 average in terms of the structure of enterprises. However, this deviation indicates a greater number of micro enterprises, while there are more small enterprises in the EU-27 countries than in Poland, which can be easily explained by the greater maturity of other economies and the relatively short period of building the economic structure in Poland associated with a larger number of economically weaker entities with fewer financial resources and/or lower revenues.

With regard to the structure of employment, greater discrepancies can be observed between Poland and the EU-27 countries. Only medium-sized enterprises have a comparable share in the number of employees. In large and small enterprises, according to the EU classification criteria, Poland employs, on average, a smaller percentage of all employees than the EU-27 average. Only in the case of micro enterprises Poland has a clear advantage of more than 5% in the employment structure. It can be explained in two ways. Positively, as higher than the EU-27 average entrepreneurship of Poles. But there is also a possibility that the explanation is related to the employers' excessive use of the institution of the so-called self-employment, i.e. the most common legal form of micro enterprises in Poland.

The importance of micro and small enterprises is indisputable. They account for about 99% of entities and provide jobs for more than 50% of employees in Poland and the EU. Without the micro and small enterprise sector, economic activity would be less competitive, less efficient, and less flexible. At the same time, however, due to economic and financial weakness, these companies do not have sufficient resources to create new, innovative technologies, although they are undoubtedly eager to implement them and, under the right conditions, are able to adapt to them quickly.

3. Analysis of selected assessment parameters of micro and small enterprises in selected countries of Central and Eastern Europe

The micro and small enterprise sector is an important element of the economy of the European Union. Micro and small enterprises account for over 99% of the total number of enterprises in the EU. The countries of Central and Eastern Europe are countries that developed economically only after the collapse of the Eastern Bloc, so these are countries that have been building their economic structure and their own political independence for a relatively short period of time. Therefore, analyzing the economic development of these countries is an important research aspect. Below is an analysis of how micro and small enterprises developed in selected countries of Central and Eastern Europe between 2017 and 2020.

3.1. Analysis of the number of micro and small enterprises from 2017 to 2020

The largest of the CEE countries (except Bulgaria, for which we did not have data) were selected for the analysis, namely: the Czech Republic, Poland, Slovakia, Romania, and Hungary. Each of these countries has its own political and economic characteristics. The Czech Republic, Poland, Slovakia, and Hungary joined the EU in 2004, while Romania joined in 2007. Moreover, the selected countries are characterized by their geographical proximity to Poland.

Table 4.

Number of micro and small enterprises in selected countries by year

Country	Number of enterprises			
	2017	2018	2019	2020
Czech Republic	272,136	270,779	277,343	267,917
Poland	2,058,051	2,131,404	2,193,073	2,243,758
Romania	523,953	545,843	566,145	-
Slovakia	112,556	117,676	124,676	127,344
Hungary	677,676	723,580	792,761	805,881

Source: Authors' own work based on: (Cirstea, 2021; Skowrońska, Tarnawa, 2021; Správa o stave maleho a stredneho podnikania v sr, 2020; Czech Statistical Office; Statistical Office of the Slovak Republic; Hungarian Central Statistical Office).

The data in Table 4 shows that the Czech Republic saw a slight decrease of 0.5% in the number of registered micro and small enterprises in 2018 compared to 2017, while 2019 saw an increase of 2.42% compared to 2018 and 1.9% compared to 2017. 2020 saw a decrease of 3.4% in the number of micro and small enterprises compared to the previous year.

In Poland, 2018 showed an increase of 3.6% in the number of micro and small enterprises compared to 2017, 2019 showed an increase of about 2.9% compared to 2018, and 2020 showed an increase of 2.3% compared to the previous year.

Romania saw an increase in the number of micro and small enterprises between 2017 and 2019. In 2018, there was a 4.2% increase in the number of micro and small enterprises compared

to 2017, while in 2019 there was a 3.7% increase compared to the previous year. Unfortunately, the data from 2020 has not yet been made available, so the article does not analyze the development of micro and small enterprises during this period.

In Slovakia, 2018 saw an increase in micro and small enterprises of about 4.5% compared to the previous year, and the following years saw a steady increase in the number of micro and small enterprises. 2019 showed an increase of 5.9% compared to 2018, and 2020 showed an increase of 2.1% compared to the previous year, 2019.

In Hungary, a clear increase in the number of micro and small enterprises was observed between 2017 and 2020 based on the available data. 2018 showed an increase of about 6.8% compared to 2017, 2019 showed an increase of 9.6% compared to the previous year, and 2020 showed an increase of 1.7% compared to 2019.

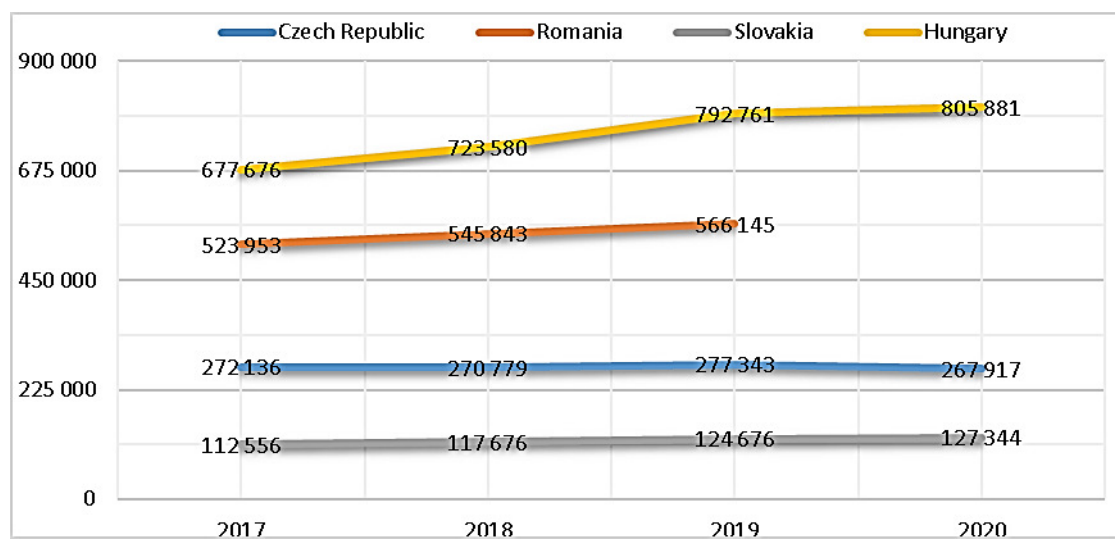


Figure 1. Number of micro and small enterprises in the Czech Republic, Romania, Slovakia, and Hungary from 2017 to 2020.

Source: Authors' own work based on: (Cirstea et al., 2021; Skowrońska, Tarnawa, 2021; Sprava o stave maleho a sredneho podnikania v sr; Statistika & My, 2020; Czech Statistical Office; Statistical Office of the Slovak Republic; Hungarian Central Statistical Office).

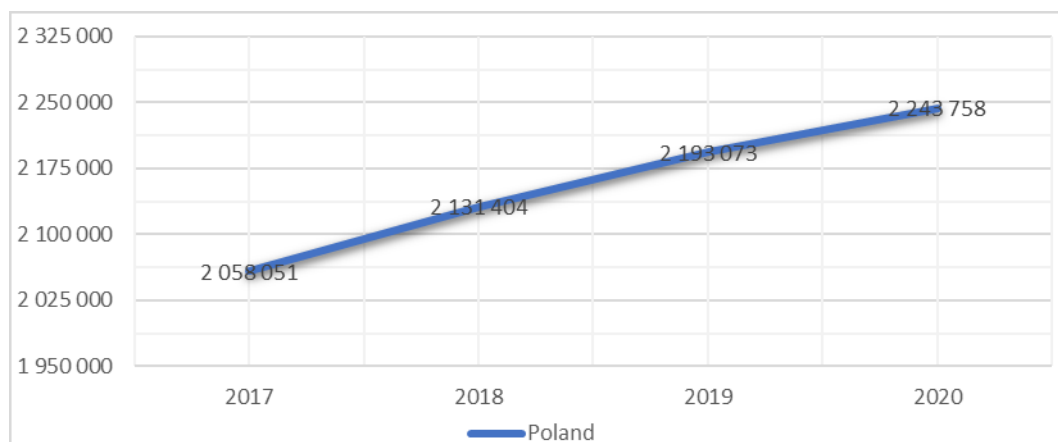


Figure 2. Number of micro and small enterprises in Poland from 2017 to 2020.

Source: Authors' own work based on: (Cirstea et al., 2021; Statistics Poland).

Due to the large difference in the order of magnitude, Figures 1 and 2 were separated. The data in Table 1 and Figures 1 and 2 shows that, in general, the number of micro and small enterprises in the years 2017-2020 in individual countries of Central and Eastern Europe was increasing. During those years, the development of this sector of the economy was observed. The exception is the Czech Republic, where there was a decline in the number of micro and small enterprises in 2018, followed by a sharp increase, and then another decline in 2020. One should consider what caused this state of affairs in the Czech Republic. In 2020, although there was still an increase in the number of micro and small enterprises in individual countries, there is a noticeable deceleration of this growth, with the exception of the Czech Republic, where there was a clear decrease in the number of micro and small enterprises. 2020 was the year when the coronavirus pandemic began, which may have been the reason for the deceleration of growth in the micro and small enterprise sector. Certainly, companies had to face many constraints in doing business and quickly adapt to the changes in the environment that this pandemic forced.

3.2. Analysis of the structure of enterprises by size

Based on the data from the available statistical databases of selected Central and Eastern European countries, Figure 3 shows the percentage share of micro and small enterprises in the economy of selected countries in 2020.

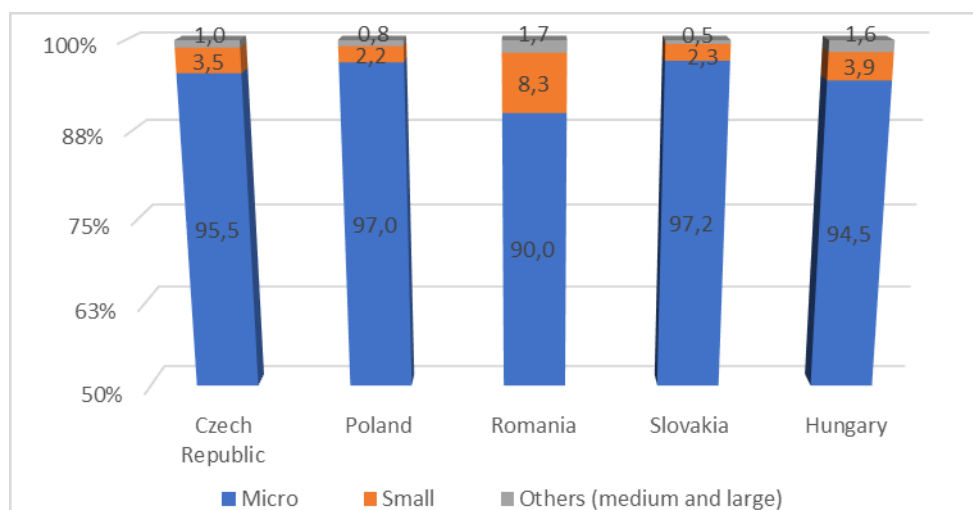


Figure 3. Percentage distribution of companies in individual countries.

Source: Authors' own work based on: (Cirstea et al., 2021; Skowrońska, Tarnawa, 2021; Statistika & My, 2020; Czech Statistical Office; Statistical Office of the Slovak Republic; Hungarian Central Statistical Office).

Based on the data in Figure 3, it was observed that micro and small enterprises constitute an important part of these countries' economies. In the case of Slovakia, Poland, and the Czech Republic, they account for 99.5%, 99.2%, and 99% of the total number of enterprises in these countries, respectively. In the case of Hungary, it is 98.4%, and in Romania 98.3%. It can be seen that in all the countries in question, medium-sized and large enterprises account for between 0.5% and 1.7% of the total number of enterprises.

Micro enterprises are the overwhelming majority of existing enterprises in the analyzed countries (Czech Republic, Poland, Romania, Slovakia, and Hungary). Taking Poland as an example, it can be said that this is perhaps due to the registration of sole proprietorships that provide services for the benefit of other companies. Thus, the micro and small enterprise sector is an important element of a country's national and local economies.

3.3. Analysis of the structure of micro and small enterprises by the number of employees

Table 5 presents data on the number of people employed in micro and small enterprises in 2020 in selected CEE countries. The individual columns include numerical data and show the percentage share in the total number of people employed in enterprises in a given country. The total number of employees includes those employed in micro, small, medium and large enterprises in a given country. Unfortunately, for the Czech Republic, there was no data on the number of employees broken down into micro and small enterprises because in their databases the breakdown by enterprise size is different from that generally accepted in the EU. The data presented for the Czech Republic includes the total number of employees in both micro and small enterprises according to the definition adopted by us.

Table 5.

Structure of micro and small enterprises by the number of employees in individual countries in 2020

Country	Type of enterprise				Total number of people employed in enterprises
	Micro		Small		
	Number of employees	% of employees	Number of employees	% of employees	
Czech Republic	1,329,300				4,090,200
Poland	4,120,000	40.8	1,050,000	10.4	10,100,000
Romania	1,234,005	26	1,065,390	22.5	4,741,852
Slovakia	874,100	46.3	245,430	13	1,889,900
Hungary	1,221,993	38.2	532,145	16.6	3,198,894

Source: Authors' own work based on: (Cirstea et al., 2021; Skowrońska, Tarnawa, 2021; Sprava o stave maleho a stredneho podnikania v sr; Statistika & My, Casopis Ceskeho Statistickeho Uradu; Hungarian Central Statistical Office).

Analyzing the data in Table 5, it was observed that in three countries (Slovakia, Hungary, and Poland) the number of people employed in micro and small enterprises accounts for more than fifty percent of all those employed in enterprises. For Slovakia it is 59.3%, for Hungary it is 54.8%, while for Poland it is 51.2%. In Romania, the number of people employed in micro and small enterprises is 48.5% of all employees, so it is also a significant share. Of all the countries under analysis, only the Czech Republic has a much smaller number of people employed in micro and small enterprises, as it is 32.5% of all people employed in enterprises. Despite the fact that the Czech Republic is a country where micro and small enterprises account for 99% of the country's enterprises, the majority of people are employed in medium and large enterprises. On the other hand, Poland and Slovakia have a very high share of micro enterprises.

Chapter 3.2 shows that the micro and small enterprise sector in the countries under analysis accounts for more than 97% of the total number of enterprises in those countries. Moreover, this sector employs, on average, more than 50% of the total number of people employed in enterprises. What is more, Chapter 3.1 showed that this sector is constantly growing. Based on the analysis, we can conclude that the micro and small enterprise sector is an important link in the economies of Central and Eastern European countries characterized by high resilience to economic changes. Micro and small enterprises can quickly adapt to suddenly changing conditions. They have a strong influence on the development of local entrepreneurship and force competition between entities, which also brings benefits to potential customers.

3.4. Analysis of the structure of micro and small enterprises by the number of enterprises in individual sectors

For the purpose of the analysis, the data was broken down into the three basic sectors of the economy: manufacturing, trade, and services. Table 6 shows the number of micro and small enterprises in each sector for the five selected countries in 2019. Eurostat data was used for the analysis.

Table 6.

Structure of micro and small enterprises by the number of enterprises in individual sectors in selected countries in 2019

Country	Manufacturing		Trade		Services	
	Number of enterprises		Number of enterprises		Number of enterprises	
	Micro	Small	Micro	Small	Micro	Small
Czech Republic	168,078	8,481	216,687	7,544	427,055	12,102
Poland	208,321	21,948	511,822	23,418	825,895	25,434
Romania	41,623	9,007	157,451	12,172	204,533	14,848
Slovakia	77,162	2,647	101,846	2,983	205,572	4,421
Hungary	46,530	5,598	127,894	7,549	329,814	10,910

Source: Authors' own work based on: (Eurostat).

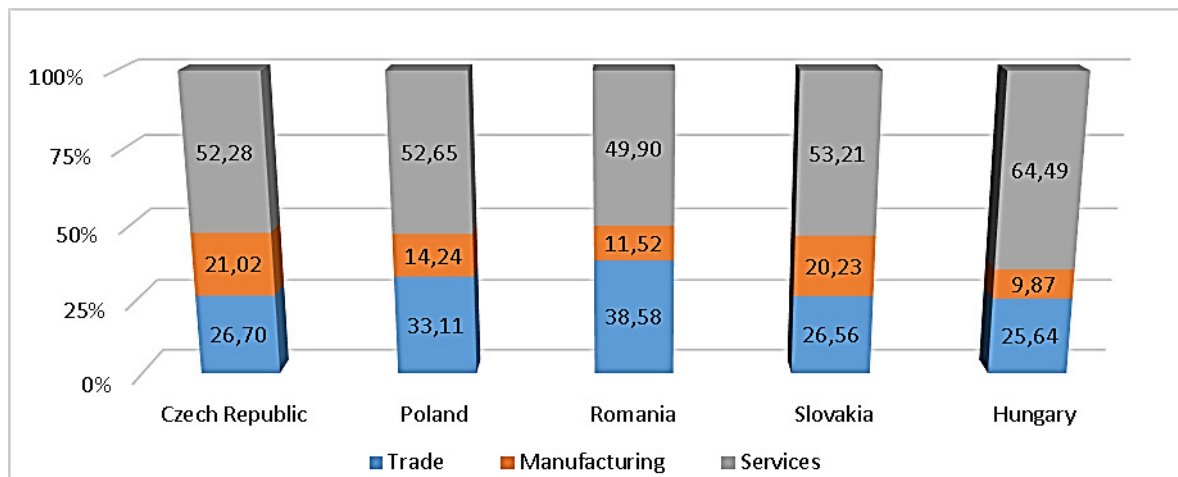


Figure 4. Percentage distribution of enterprises by economic sector.

Source: Authors' own work based on: (Eurostat).

From the data in Table 6 and based on Figure 4, we can see that the distribution of micro and small enterprises by economic sector varies in all five countries. Services account for the majority, between 52% and more than 64% of all micro and small enterprises in the countries under analysis. Trade ranks second in all five countries, accounting for between 25% and more than 38% of micro and small enterprises, while manufacturing comes third, accounting for between 9% and 21%. Across the economy as a whole in the countries studied, manufacturing is by far dominated by large enterprises (Eurostat).

Since Eurostat has not yet published data for 2020, the comparison of the number of micro and small enterprises in individual sectors of the economy in 2019 and 2020 was made for two countries, Poland and Slovakia, based on the data contained in their national statistical databases (Statistics Poland; Statistical Office of the Slovak Republic).

Table 7.

Number of enterprises by economic sector in Poland in 2019 and 2020

Year	Manufacturing		Trade		Services	
	Number of enterprises		Number of enterprises		Number of enterprises	
	Micro	Small	Micro	Small	Micro	Small
2019	190,469	11,789	479,251	13,365	763,735	12,800
2020	191,881	11,973	471,641	13,306	786,171	12,936

Source: Authors' own work based on: (Statistics Poland).

Comparing the data in Table 7, it can be seen that there was a minimal increase of 0.79% in the number of enterprises in the manufacturing sector in 2020 compared to 2019. The trade sector saw a decrease of 1.56% in the number of enterprises in 2020 compared to the previous year, while services saw an increase of 0.33% in the number of enterprises. Overall, the number of enterprises increased by 16,499 in 2020 compared to the previous year.

Table 8.*Number of enterprises by economic sector in Slovakia in 2019 and 2020*

Year	Manufacturing	Trade	Services
	Number of enterprises	Number of enterprises	Number of enterprises
	Micro and small	Micro and small	Micro and small
2019	13,672	27,162	59,406
2020	14,432	26,238	97,114

Source: Authors' own work based on: (Statistical Office of the Slovak Republic).

According to the data in Table 8, there was an increase of 5.56% in the number of enterprises in 2020 compared to 2019. The trade sector saw a decrease of about 3.4% in the number of enterprises, while services saw an increase of about 63.48% in 2020. The number of enterprises in the manufacturing, trade, and services sectors increased by 37,544 in 2020 compared to 2019.

Analyzing the above data from 2019 and 2020, it was noted that the number of micro and small enterprises increased. In both countries analyzed, there was a decrease in the number of enterprises in the trade sector, while there was an increase in the number of micro and small enterprises in the manufacturing and services sectors. Most likely, the decrease in the number of enterprises in the trade sector was caused by the fact that small shops had to close down due to the lockdowns caused by the coronavirus pandemic. The public (customers) had limited options for non-grocery shopping in the traditional way, which resulted in doing mainly online shopping. Not all small shop owners switched to the new way of selling.

4. Summary

The article defines the basic concepts of micro and small enterprises and describes their role in the state's economy. The current state of research on the micro and small enterprise sector was highlighted. Particular attention was paid to the lack of research in the field of exclusively micro and small enterprises. Then, based on statistical data from 2017-2020, an analysis of selected parameters for assessing the state and changes in the micro and small enterprise sector was carried out in selected countries of Central and Eastern Europe. The analysis included such characteristics as the number of micro and small enterprises between 2017 and 2020, including Poland and the EU-27 average. An analysis of the structure of micro and small enterprises by enterprise size and the number of employees was also carried out.

Micro and small companies in Central and Eastern Europe in the years of the study, i.e. 2017-2020, but also in the following years, were subjected, like entire economies, to difficult challenges caused by the pandemic and disrupted supply chains in the global economy. Despite this, they are functioning and are still looking for new ways to survive and grow in a rapidly changing world.

As is clear from the analysis carried out, micro and small enterprises (MSEs) are a very important element of the economies of Central and Eastern European countries. The development of the micro and small enterprise sector impacts the increase in production and GDP growth, provides new jobs, and thus reduces the level of unemployment in a given area. Micro and small enterprises are characterized by great flexibility in adaptation to changing market conditions because they are almost always based on private ownership. The survival of these enterprises in the market also forces active competition between entities. People employed in micro and small enterprises are often also their owners or co-owners, which means that they show strong motivation, determination, and efficiency in their actions in order to stay in the market and succeed. It should also be noted that the development of micro and small enterprises strongly influences the development of local entrepreneurship. Micro and small enterprises are flexible, grow rapidly, and adapt to the changing reality.

References

1. Cirstea, F., Balea, V., Cristescu, D., Vladescu, M., Oancea, A., Draghici, C., Taiu, D., Iordache, A. (2021). *Small and Medium Enterprises in the Romanian Economy*. Romania: National Institute of Statistics, ISSN 2066-5644.
2. Commission Regulation (EC) No 70/2001 of 12 January 2001 on the application of Articles 87 and 88 of the EC Treaty to State aid to small and medium-sized enterprises, <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001R0070:20070101:PL:PDF>.
3. Czech Statistical Office, <https://vdb.czso.cz/vdbvo2/>.
4. Eurostat, <https://ec.europa.eu/eurostat/data/database>.
5. Gałązka, K., Czuba-Kulisińska, B. (2017). Czynniki sukcesu przedsiębiorstw rodzinnych na przykładzie województwa śląskiego i lubelskiego. In: *Firmy rodzinne - rozwój teorii i praktyki zarządzania. Przedsiębiorczość i Zarządzanie, Vol. 18, Iss. 6, part 2*, pp. 119-132.
6. Grzenkowicz, N., Kowalczyk, J., Kusak, A., Podgórski, Z., Ambroziak, M. (2008). *Podstawy funkcjonowania przedsiębiorstw*. Warszawa: WN WZ UW.
7. Gurkan Inan, G., Bititci Umit, S. (2015). Understanding Organizational Capabilities and Dynamic Capabilities in the Context of Micro Enterprises: A Research Agenda. *Procedia - Social and Behavioral Sciences, Vol. 210*, pp. 310-319. <https://doi.org/10.1016/j.sbspro.2015.11.371>.
8. Hungarian Central Statistical Office, https://www.ksh.hu/stadat_files/gsz/en/gsz0018.html.
9. Kaliszczak, L., Nesterowicz, R. (2014). Uwarunkowania przedsiębiorczości w Polsce w dobie globalnego kryzysu. *Przedsiębiorstwo i Region, Vol. 6*, pp. 71-87.
10. Kanapickiene, R., Spicas, R. (2019). Credit Risk Assessment Model for Small and Micro-Enterprises: The Case of Lithuania. *Risks, Vol. 7, No. 2*, DOI: 10.3390/risks7020067.

11. Lichtarski, J. (2005). *Podstawy nauki o przedsiębiorstwie*. Wydawnictwo Akademii Ekonomicznej we Wrocławiu, Chapters 1 and 2.
12. Marek, S., Białasiewicz, M. (2011). *Podstawy nauki o organizacji. Przedsiębiorstwo jako organizacja gospodarcza*. Warszawa: PWE, Chapters 1 and 2.
13. Pach, J. (2008). Znaczenie małych i średnich przedsiębiorstw w Polsce po 2000 r. Rola przedsiębiorczości w gospodarce opartej na wiedzy. *Przedsiębiorczość - Edukacja, Vol. 4*, pp. 92-109.
14. Skowrońska, A., Tarnawa A. (2022). *Raport o stanie sektora małych i średnich przedsiębiorstw w Polsce*. Warszawa: PARP, <https://www.parp.gov.pl/component/publications/publication/raport-o-stanie-sektora-malych-i-srednich-przedsiębiorstw-w-polsce-2022>.
15. Skowrońska, A., Tarnawa, A. (2021). *Raport o stanie sektora małych i średnich przedsiębiorstw w Polsce*. Warszawa: PARP, ISBN 978-83-76-33-449-3.
16. SME Definition - user guide 2020, <https://ec.europa.eu/docsroom/documents/42921>.
17. SME Performance Review 2021, DIW Econ, 2021, https://single-market-economy.ec.europa.eu/smes/sme-strategy/sme-performance-review_en.
18. Sprava o stave maleho a stredneho podnikania v sr. Slovak Business Agency (2020).
19. Statistical Office of the Slovak Republic, <http://datacube.statistics.sk/>.
20. Statistics Poland, <https://stat.gov.pl/>.
21. *Statistika & My. Casopis Ceskeho Statistickeho Uradu, 11-12, 2020*.
22. The Accounting Act of 29 September 1994, *Journal of Laws of 1994, No. 121*, item 591.
23. The Civil Code of 23 April 1964, *Journal of Laws of 1964, No. 16*, item 93.
24. The Entrepreneurs Law Act of 6 March 2018, *Journal of Laws of 2018*, item 646.

POLICY OF GREEN FINANCING OF COMPANIES

Irena PYKA^{1*}, Jan PYKA²

¹ University of Economics in Katowice; i.pyka@ue.katowice.pl, ORCID: 0000-0001-5524-3550

² Katowice Business University; jan.pyka.@gwshl.com, ORCID: 0000-0001-8127-7076

* Correspondence author

Purpose: The policy of green financing of companies, together with the energy crisis caused by Russia's aggression against Ukraine, has returned as a significant research problem requiring a new opening strategy. The research analyzes the policy of green financing of companies from the perspective of the changing loan portfolio of banks. The fundamental objective of the research is to identify the scale of their involvement in green financing as well as an exegesis of the stimulants and destimulants accompanying the process during periods of financial and economic instability.

Design approach: The paper uses the results of a questionnaire survey of the 10 largest commercial banks in Poland. The research was conducted in the second quarter of 2021, that is in the situation of a slow recovery of the EU countries from the coronavirus pandemic and a rising awareness of the urgent necessity to rebuild the European economy in which its new green deal was embedded.

Findings: The conducted research shows that national banks have joined the green financing process by hedging their investment portfolio against ESG risk. However, their involvement in financing green investments has been cautious and frequently divergent. Some of them quickly joined the process. In contrast, a significant part of them accepted green financing making it conditional upon rapid progress of sustainable economic development and transparency in green investment financing.

Oryginality/value: The research undertaken in the study fairly clearly confirms the fact that there is a growing interest in the Polish banking sector to increase the share of green loans in the investment portfolio. Although the involvement of banks in financing green investments is cautious and frequently divergent, the confirmation of the European Commission's action towards the implementation of the Fit for 55 package, in spite of the energy crisis, also makes it possible to positively assess the banks' anticipation of more transparent terms and conditions for green financing.

Keywords: green financing policy, ESG package, EU taxonomy, energy crisis, ESG risk, bank risk management.

Category of the paper: viewpoint.

1. Introduction

The issues of green investment financing in the global economy have been a significant research area for a long time. Indeed, in the age of globalization, it has become evident that the capacity of business entities to produce added value is very high, but that the negative economic, financial and social impacts can be equally high. The key to solving these problems has become a new political and economic doctrine called sustainable economic development. In the UN report of 1987, it was narrowed down to environmental protection (Dokument Roboczy...). Thus, environmental standards negotiated during international climate conferences have been for many years a fundamental criterion for the assessment of the economic policies of individual countries and regions. However, significant progress in environmental protection measures was made in 2015 with the adoption of the Agenda for Sustainable Development and the so-called Paris Agreement of 2018 (Rezolucja...). These documents specified the climate objectives aimed at creating a green economic deal conditioning the redirection of investment choices that shift global economy towards environmental sustainability by the middle of this century. However, it was not until the summit of world leaders in November 2021 at the UN climate conference COP26 that the new initiatives obliging humanity to immediately limit global warming were adopted (Konferencja klimatyczna ONZ...). The implementation of the doctrine of sustainable economic development, as it can be easily noticed, has therefore passed through various stages committing countries and their business entities to accelerate green investments just before the energy crisis of the global economy caused by Russia's military attack on Ukraine.

In the European Union, the determination to make green investments has aroused much emotion and controversy. The European Commission, without waiting for global agreements, adopted a strategy that assumes that by 2030 carbon dioxide emissions in the EU should drop by 50-55% in comparison with the level in 1990, and the objective of a net-zero emission economy should be achieved by 2050 (European Commission: Communication...). Meanwhile in the member states the preparation for energy transition was varied due to the level of development and high costs of switching national economies to zero CO₂ emissions. The ambitious climate goals of restoring and protecting ecosystems and biodiversity, clean, cheap and safe energy, fair transition, sustainable and intelligent mobility or fair, healthy and environmentally friendly food production system, and many other equally important goals aimed at creating a new green deal in Europe and Poland require significant, frequently very regionally diverse financial expenditure. The estimated costs of the energy transition in the European Union as well as in the global economy fluctuate and it is difficult to consider them reliable. The current energy crisis clearly proves this and makes the financing of the European Union's zero-carbon emission strategy not only require high EU and domestic public resources, but also a strong activation of the financial markets. Financial institutions have been searching

for their place in the green business for some time now, signaling the issues associated with it. In this paper, green bank loans are the research subject. This is because banks, observing the increasing lobbying for green investment in the European Union, have relatively quickly become interested in the resulting business benefits. The fundamental research objective is to identify the scale of their involvement in green financing as well as an exegesis of the stimulants and destimulants accompanying the process during periods of financial and economic instability. The main hypothesis assumes that there is a growing interest of domestic banks in increasing the share of green loans in their investment portfolio. The conducted research shows that EU regulations, whose assimilation is tightly related to the Polish economic, financial and geopolitical situation, are the primary factor determining the level and limits of interest in green financing in domestic banks.

Banks approached the issue of financing green investments with great caution and frequently differently. Some of them quickly joined the process. In contrast, a significant part of them accepted green financing making it conditional upon rapid progress of sustainable economic development and transparency in green investment financing. The conducted research has shown that national banks have joined the green financing process by hedging their investment portfolio against ESG risk. The research was conducted in the Polish banking sector, which does not entitle the conclusions to be generalized to other banking sectors of the European Union Member States. The conditions and needs of financing green investments are different and strongly determined by the financial support of the European Union.

2. Material and methods

Selecting the Polish banking sector for the research was justified by several considerations. The existing knowledge about green bank loans remains insufficient. The re-search was conducted in the second quarter of 2021, i.e., in the situation of a slow recovery of the EU countries from the coronavirus pandemic and a rising awareness of the urgent necessity to rebuild the European economy in which its new green deal was embedded. A serious impetus for their implementation was without doubt provided by the adoption of the European Green Deal in July 2021 (European Commission: Communication...). This was because the associated action plan assumed the mobilization of not only public but also private finance for sustainable investments in Europe. Whereas the so-called EU Taxonomy that accompanied ESG package made the procedure of greening investment portfolio significantly easier for lending institutions. It established a framework to facilitate the identification of green investments by relieving lending institutions of the responsibility for the misclassification of green investment financing. However, it should be noted that the period of stabilizing conditions for green investment financing is not very long and the lack of specific guidelines for shifting the global

economy onto a sustainable track has been a demotivating factor for the activity of financial institutions. Therefore, lending institutions have frequently approached the issue of green financing in a different manner. Only some of them joined this process. Meanwhile, a significant part was left anticipating increased transparency in green financing.

The conducted research was of a pilot nature, since both the preparation of the banking sector for green financing to companies and the general knowledge in this area are very superficial for the time being. The research was conducted using a questionnaire method among the representatives of the 10 largest commercial banks in Poland. These include PKO BP, Bank Pekao S.A., Santander Bank Polska, mBank, ING Bank Śląski, BNP Paribas, Bank Millennium, Alior Bank, Citi Handlowy and Getin Bank. The results of the conducted research can be regarded as representative since their share in the total assets of the Polish banking sector is 74.29% (Pyka, I., Pyka, J., 2020, pp. 57-74) and their total assets amount to PLN 1,486.32 billion (PFSA Office...). A total of 129 respondents participated in the research. 26.36% of them held managerial positions, and 73.64% represented other positions in the bank. 49.61% of the respondents had at least 10 years of experience working in a bank. The objective of the survey was to obtain information on the degree of acceptance by the respondents of the formulated micro-theses targeted at the problems of green financing using a five-point Likert scale, according to the following categories:

- definitely not – 1,
- rather not – 2,
- neither yes nor no – 3,
- rather yes – 4,
- definitely yes – 5.

A significance level of 0.05 was assumed in the research. The value of the Cronbach's alpha coefficient for the 36 questionnaire questions was 0.9306 confirming the very good structure of the developed questionnaire tool.

The results of the conducted research aimed at assessing the greening of bank loans in Poland indicate that there is a growing interest in this new category of loans. 38.76% of the respondents indicate that there are rather 'green' loan products available in their portfolios, whereas 30.23% of them take this fact for granted. Therefore, more than half of the respondents recognize green financing in their bank.

The respondents also notice that financing of fossil fuel projects, primarily coal and oil, has been declining at national banks. This is stated by 40.3% of the respondents. Given that only 15.50 % of the respondents answer this question with a definite yes, it may be assumed that the withdrawal of 'non-green' project financing from national banks is progressing, but not intensively (fig. 2). The ambivalent approach towards green credit products is confirmed by the high percentage (25.58) of the respondents who state that green investment financing is rather not prioritized by banks and, simultaneously, 28.68% of them state that they do not notice this financing being prioritized (fig. 1). The conducted surveys also indicate that there is

an atmosphere in domestic banks for in-creased green investment financing. This is confirmed by most respondents in the answers neither yes nor no, rather yes, and definitely yes, as well as a low percentage of those who do not notice this process (fig. 2). It is worth emphasizing that the respondents while answering this question notice an increase in green investment financing in the division of in-vestments into various forms of clean energy production.

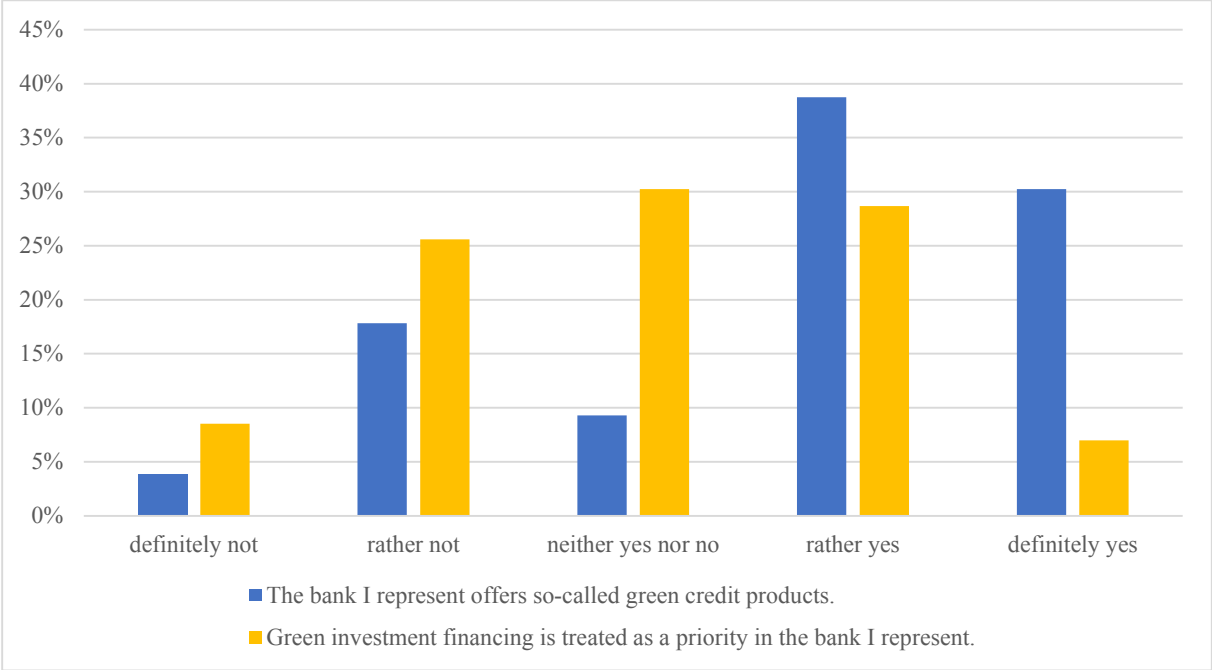


Figure 1. Survey results.

Source: own work.

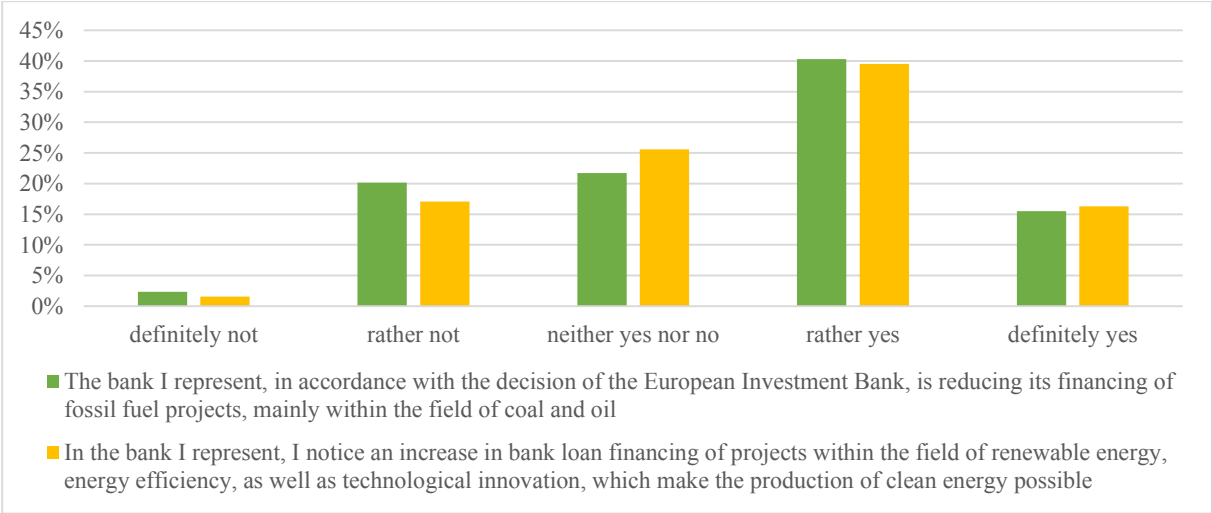


Figure 2. Survey results.

Source: own work.

The respondents also express the opinion that domestic banks have a high tendency to finance renewable energy (fig. 3). The significant inclination observed in the survey to undertake green financing initiatives signifies a change in the existing structure of the banks’

loan portfolio. 49.61% of the respondents associate this process with an increase in long-term loans in the bank portfolio with all business consequences (fig. 3).

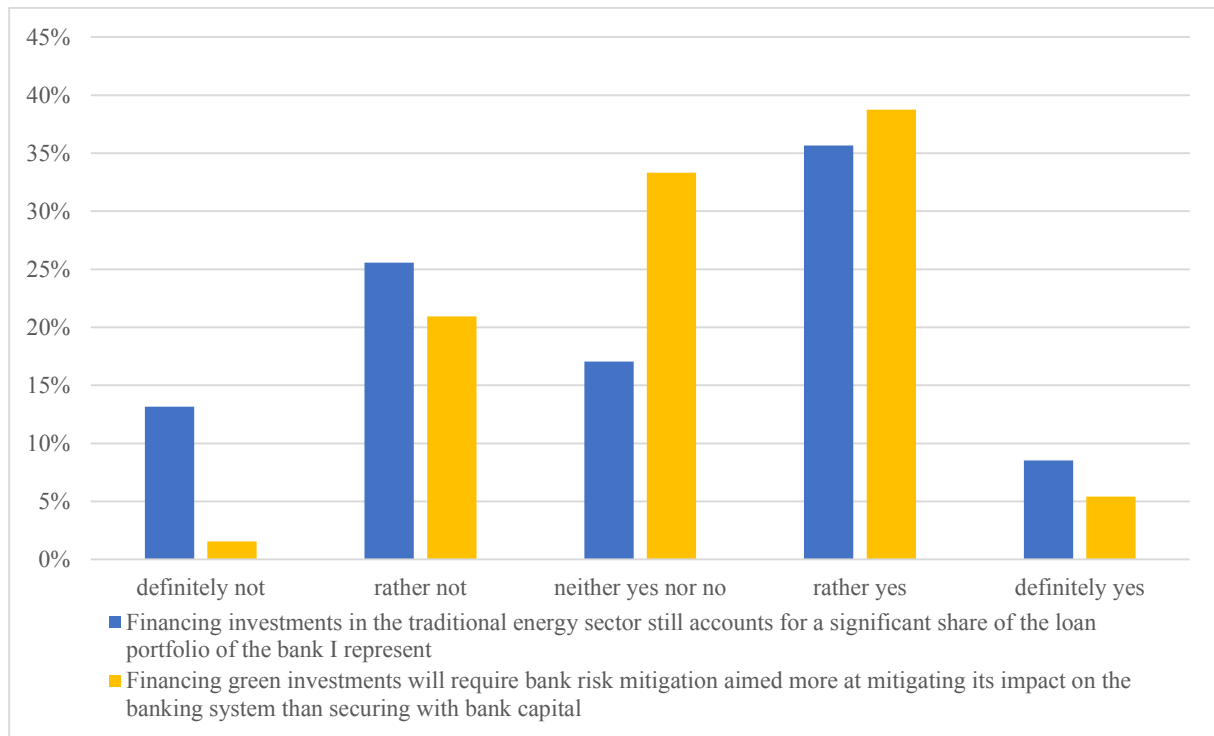


Figure 3. Survey results.

Source: own work.

From the perspective of the conducted survey, it is also apparent that the financing of investments in the so-called classic energy sector is not changing as intensely as could be inferred from the approach of banks towards green loans. More than 40% of the respondents say rather yes and definitely yes that financing of investment in the traditional energy sector still represents a significant share of the bank's loan portfolio. For this reason, it can be concluded that banks expressing an interest in green loans are constantly in anticipation of a change in the financing conditions for corporate investments. Stimulants and destimulants of green financing are constantly compensating each other. Therefore, a green future is positively perceived in the banking sector, but banks are aware of the business difficulties of changing their loan portfolio. This is partially confirmed by the respondents' answer related to bank risk mitigation. A significant part of the respondents answering positively the question whether financing green investments will require bank risk mitigation to a larger extent than securing a bank loan confirms concerns about the cost of financing green investments (fig. 4).

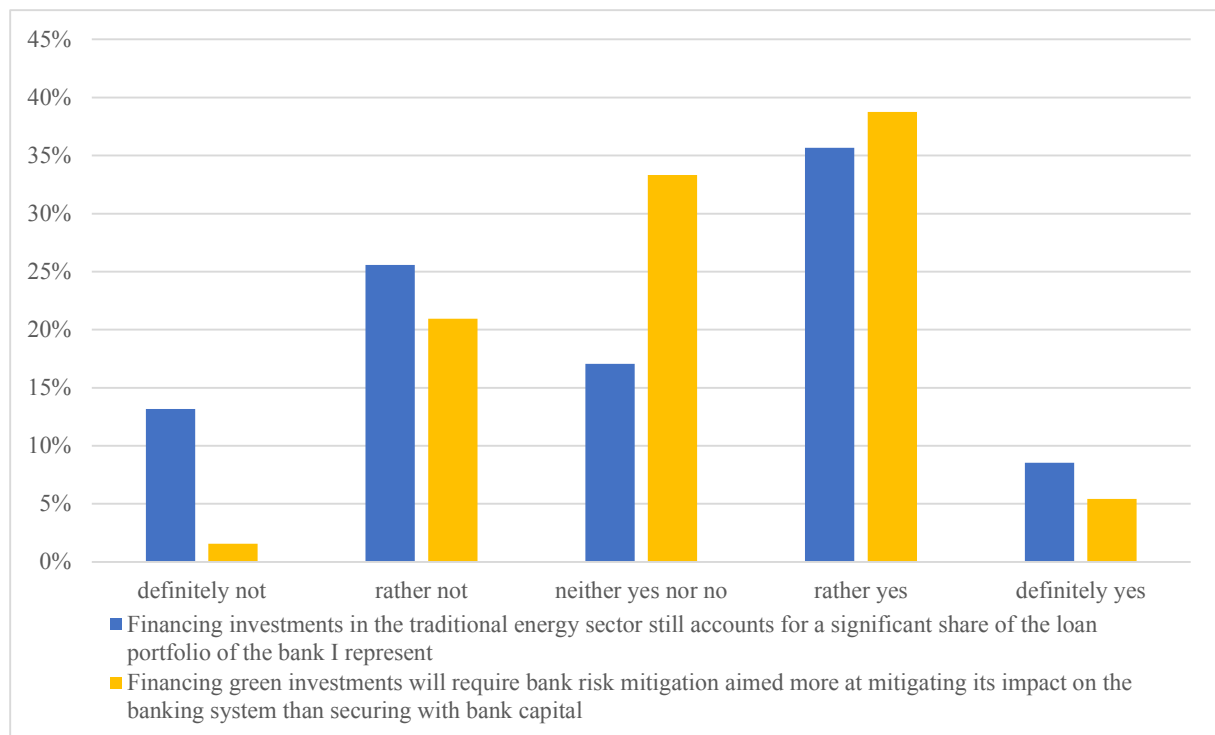


Figure 4. Survey results.

Source: own work.

The conducted research does not take into consideration the assessment of the impact of issues resulting from Russia's aggression against Ukraine, and thus the energy crisis tightly related to it, on green financing. Although the Polish banking sector needed to quickly adapt its lending action to the new area of bank risk resulting from the COVID-19 pandemic, the results of this process were not directly related to green financing. In national banks, the interest rate cut caused by the coronavirus pandemic turned out to be very acute. In Poland, it happened on 18 March 2020 and was induced by a deterioration in the outlook for the global economic situation ultimately resulting in an increased risk of the impact of COVID-19-related disruption on the supply of loans in banks (Covid 19..., p. 5). It happened exactly over five years after the previous interest rate cut and when globally, primarily with regard to the FED and the ECB, expectations were increasing for an end to the low interest rate policy that was implemented during the global financial crisis (Covid 19..., p. 5). In addition to the National Bank of Poland, also Australia, Canada, the United Kingdom, and Saudi Arabia decided on so-called March interest rate cuts. This was due to the fact that these banks had the space to respond in this way to the pandemic crisis since interest rates in these countries were not at near zero or negative levels. In the face of the COVID-19 pandemic, the Fed also cut interest rates by withdrawing from its commenced 'exit strategy'. In the Polish banking sector, low interest rates have caused a quite significant decrease in the profitability of lending activity and have contributed to the increase in the bank risk in other areas of their activity. Especially due to the low profitability of bank deposits in the Polish banking sector, the risk of their financing structure appeared.

There was also an increase in the number of unreliable bank customers who noticed their own financial benefit in the low interest rate of a bank loan (Pyka, I., Pyka, J., 2020). The main problem of green financing to companies in Poland, however, emerged along with the energy crisis caused by the Russian aggression against Ukraine. Interest rate risk, together with the war in Ukraine, has become the major problem in the Polish banking sector. Indeed, Russia's energy blackmail resulted in price Armageddon in the raw material market. As a consequence of Russia's aggression against Ukraine, the idea of a Green Deal has also been thoroughly revised. Although it has not been formally directionally questioned, the prospect of a crisis caused by the derusification of gas, coal and oil supply treated by Russia as an instrument of political pressure is reorienting the behavior of EU countries towards measures aimed at ensuring energy security by subordinating climate objectives to them. In March 2022, already in the early stages of Russia's attack on Ukraine, the European Commission presented the EU's REPower plan aimed at reducing the import of gas from Russia by 100 billion m³ by the end of 2022. However, apart from diversification of supply sources, measures to implement the Fit for 55 package were prioritized. In May 2022, the European Council decided on a 90% reduction in oil from Russia. At the same time, EU leaders suggested the intensification of efforts to:

- diversify sources of energy raw materials,
- develop renewable energy sources,
- increase energy efficiency,
- develop a system of connections of gas and electricity networks.

This does not change the overall picture of adjustments being made to the real energy policy of the European Union. The Fit for 55 package emphasized in scientific and political discussions, which aims to ensure the EU's climate neutrality, is subjected to a thorough real-world retouch. The assumed decarbonization process with the temporary use of gas and the phasing out of nuclear power is subject to a freezing. 'Pink' nuclear power, like gas power, has been recognized as green by the decision of the EC. The relevant EC taxonomy is to come into force at the beginning of the new year 2023. Therefore, the changes being made under the influence of the energy crisis will unquestionably condition loan portfolios of banks and ESG risks to a significant extent.

In 2022, dynamically developing inflation led to the return of increasing interest rates. In Poland, the National Bank of Poland first increased interest rates at the end of 2021, but interest rate risk in the Polish banking sector and economy did not become a reality until 2022. This is because with each interest rate rise, banks experience reduced demand for bank loans and the economy is heading more and more towards recession. This scenario becoming a reality with a difficult-to-define boundary is highly likely to impact green investment financing. Bearing in mind that the European Union has not withdrawn from its zero-carbon strategy in the face of such high financial instability and that Russia's raw material blackmail persists,

green financing of companies can be expected to intensify in the Polish banking sector. However, banks are pointing increasingly strongly to ESG risk as a significant determinant of the success of this process. This is due to the fact that banks must cover credit risk, or more broadly, investment risk. In the banking sector of the global economy, including, the European Union, credit risk ceased to be the primary concern for banks long time ago (cf. fig. 5). Therefore, the scope of bank risk regulation increases, and along with it the bank capital required to secure it, is increasing. Currently, the Basel Committee on Banking Supervision, and following it, the European Union supervisory authorities, require bank capital to cover credit risk, market, operational and liquidity risk (Iwanicz-Drozdowska, 2012, p. 12; Pyka, I., Pyka J., 2020, p. 598). Simultaneously, within the framework of the macro-prudential regulations resulting from the global financial crisis, banks have to create the following buffers: countercyclical, systemic risk and for systemically significant institutions. Therefore, risk and bank capital management is currently an important area of the banking industry. Meanwhile, ESG risk is a new, not always easy to identify, type of bank risk. The levels of ESG risks differ depending on the type of financing the activity of companies and sectors. On the other hand, banks need to recognize the risks involved and treat them as key risk identified in bank registers. The issue is essential due to the fact that in recent years banks have moved from fragmented to integrated bank risk management (ERM, Enterprise Risk Management) in their responsibility. With regard to the analyzed ESG risks, the model requires that ESG risk management is not one of many functions of the conducted banking business, but is spread throughout the entire organization, and linked to all processes. At the core of ERM is a new organizational culture based on responsibility for risk at every workplace. In essence, it should lead to the improvement in the bank's financial results and its greater financial stability (Helbekkmo, Levy, White, 2020). The fundamental question is whether banks are prepared to manage ESG risks efficiently in such complex green financing circumstances. Especially as the process of identifying, assessing, managing and reporting ESG issues shifts the focus from short-term profits to long-term positive results (Adamczyk, Haralampiewa, 2022, p. 46). Previous experience shows that banks and investors alike are uncertain how to reliably report progress in ESG area and avoid accusations of greenwashing and greenwishing. Thus, the key pillars of re-ported, whose aim is to provide investors and other stakeholders with coherent, comparable non-financial information useful for decision-making, remain controversial.

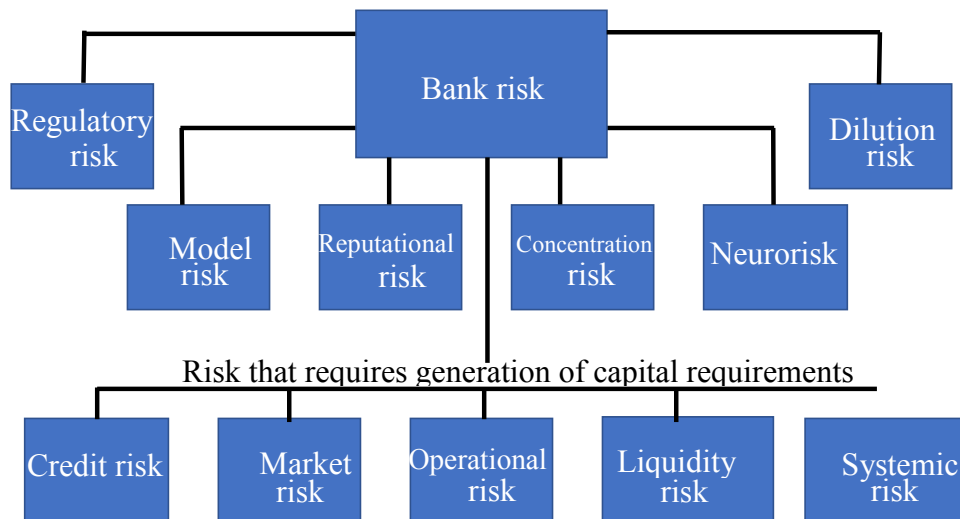


Figure 5. Key forms of bank risk.

Source: own work.

3. Results

The research undertaken in the study fairly clearly confirms the fact that there is a growing interest in the Polish banking sector to increase the share of green loans in the investment portfolio. Although the involvement of banks in financing green investments is cautious and frequently divergent, the confirmation of the European Commission's action towards the implementation of the Fit for 55 package, in spite of the energy crisis, also makes it possible to positively assess the banks' anticipation of more transparent terms and conditions for green financing. This is because the policy of green financing of companies together with destabilization of the global economy as a result of Russia's imperial goals proves to be difficult and complicated to implement. In the first place, due to the fact that banks are entering the process of changing their portfolio under a strong pressure of green solutions from the EU authorities, constantly identified with a considerable delay. Although this is a direct consequence of the idea of sustainable development remaining in the process of permanent crystallization of the rational use of resources, including energy resources in particular, it is also a result of unexpected, increasingly new social and economic phenomena destabilizing the conditions for the functioning of the global economy. When entering the path of green financing of companies, the banking sector must properly assess and mitigate the risk resulting from the indicated uncertainties. This is due to the fact that it is obliged to maintain the financial security of its customers and ultimately the financial stability of the economy. The global financial crisis

has caused lending institutions to be burdened with various prudential standards that significantly condition banks' business models. Their exposure in the body of the research indicates that the risk of banking activities in the global economy is significant, and the level of regulation is continuously increasing. For this reason, the unambiguously un-recognized ESG risk generates increasing pressure for its precise standardization. This directly implies serious consequences for bank risk management and bank capital exposures. Therefore, banks interested in green financing should define a green financing policy as precisely as possible - both its business objectives and its implementation tools with transparency of the effects and costs of green financing. The complexity of the problems is undoubtedly documented by the fact that on 1 April 2021, 43 financial institutions from around the world formed the Net Zero Banking Alliance (NZBA), which now includes more than 100 members representing 40 countries and more than 43% of global banking assets working towards reaching net zero greenhouse gas emission in their loan portfolios by 2050. The members of the established group support the implementation of decarbonization strategies through their members by providing inter-nationally coherent frameworks and guidelines for action. By designating scientifically developed 'transition plans,' they determine the heavily regulated sphere of green investment in the European Union. According to the CRD directive regarding the capital requirements, ESG risk requires a change in the terms and conditions of bank risk management. In the European Union, there is also an obligation for the bank's management board to approve, every two years, the strategy for addressing, monitoring and mitigating risks resulting from the "ongoing, short-, medium- and long-term effects of environmental, social and corporate governance factors." Member states are also obliged to ensure that the management board reviews these strategies and policies at least every two years. (Art. 76(1) CRD).

References

1. Adamczyk, R. Haralampiewa, V. (2020). Nie tylko rozgłos czyli jak skutecznie wywierać wpływ poprzez raportowanie danych o zrównoważonym rozwoju. In: *Zielone finanse w Polsce 2022*, p. 46.
2. *Covid 19, banki i technologia - w jaki sposób pandemia wpłynęła na sytuację w sektorze bankowym*, p. 5.
3. Dokument Roboczy w sprawie przygotowań do szczytu Rio+20 – międzyparlamentarne posiedzenie komisji Parlamentu Europejskiego i parlamentów krajowych <https://www.europarl.europa.eu/meet-docs/2009-2014/documents/envi/dt/893/893910/893910pl.pdf>.
4. *European Commission: 2030 climate & energy framework*, https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2030-climate-energy-framework_en, 22 June 2022.

5. *European Commission: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions: 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality.* COM(2021) 550 final, Brussels, 14.07.2021.
6. Helbekkmo, H., Levy, C. White, O. (March 2020). *Creating the bank enterprise risk management function of the future.* McKinsey & Company.
7. Iwanicz-Drozdowska, M. (2012). *Zarządzanie ryzykiem bankowym.* Warszawa: Poltext, p. 12.
8. *Konferencja klimatyczna ONZ w Glasgow (COP26) – światowy szczyt przywódców.* <https://www.consilium.europa.eu/pl/meetings/international-summit/2021/11/01/>, 1.11.2021.
9. PFSA Office. *Report on the Activities of the UKNF and the Polish Financial Supervision Authority in 2019.* Available online: <https://www.knf.gov.pl/knf/pl/komponenty/img/Sprawozdanie%202019.pdf>, 30 June 2021.
10. Pyka, I., Nocoń, A., Pyka, A. (2021). Interactions Between Effectiveness and Consolidation of Commercial Banks in the Polish Banking Sector. In: *Eurasian Economic Perspectives* (pp. 57-74). Springer.
11. Pyka, I., Pyka, J. (2020). The Concept of Sustainable Finance of Enterprises Versus Venture Capital, Silesian University of Technology Publishing House. *Scientific Papers of Silesian University of Technology, Organization and Management Series, No. 147.*
12. Rezolucja przyjęta przez Zgromadzenie Ogólne w dniu 25 września 2015 r. Zgromadzenie Ogólne. Porozumienie paryskie do Ramowej konwencji Narodów Zjednoczonych w sprawie zmian klimatu, sporządzonej w Nowym Jorku dnia 9 maja 1992 r., przyjęte w Paryżu dnia 12 grudnia 2015 r. Dz.U. 2017, poz. 3.
13. Zawadzka, Z. (2001). Ryzyko bankowe. In: W.L. Jaworski, Z. Zawadzka (eds.), *Bankowość. Podręcznik akademicki* (p. 598). Warszawa: Poltext.

GENERATION ZALPHA FACING EMOTIONAL INVESTMENTS

Agnieszka SAMSEL

University of Szczecin, Faculty of Economics, Finance and Management; agnieszka.samsel@usz.edu.pl,
ORCID: 0000-0003-0267-4677

Purpose: In the article the author presents the results of research into the subjective assessment of knowledge about investments and examples of emotional investing and investment choices of young people. The author tries to predict the directions of development and trends in the field of emotional investments. The main goal was to establish how emotional investments are perceived by young people in comparison to other age groups.

Methodology: The article uses a critical analysis of the literature, the method of a diagnostic survey and the method of statistical inference.

Findings: Most people describe their knowledge about investments as average. Most respondents indicated that an emotional investment means being involved in their own development. The smallest percentage of respondents described jewellery as an emotional investment. There is a statistically significant correlation between the perception of emotional investments and the gender of the respondents, education and the source of income. There are significant differences in the distribution of spare financial resources between Generation Zalpha and the rest of the population.

Value: This paper shows the approach of the young generation to investment. Do young people choose to "have" or "be"? What do young people understand by investing? And what it means for young people to invest in themselves. Paper allows young people to guess investment thoughts. It also allows you to try to define the direction of development and interests in the future. Paper is also a great inspiration for further research.

Keywords: household; personal finance; financial decisions; emotional investments.

Category of the paper: market research or surveys, empirical, scientific.

1. Introduction

In this article the author aims to understand the preferences of young people regarding emotional investments. People from Generation Z and Generation Alpha want to be independent and aware of their decisions, including financial ones. In the article the author discusses their knowledge about emotional investments, choices and perception of self-development as a form of emotional investment. The article points out the theoretical aspects

pertaining to households, financial knowledge and financial decisions as well as characteristics of the groups in question. In the article the author assumes that for members of Generation Z and Generation Alpha an emotional investment equates an investment in self-development. Additionally, the author subjectively assumes that young people are characterized by a high level of knowledge of investments.

2. Literature review

A household understood as an entity has been the oldest and the most numerous of the elements of the economy. Its multiple definitions found in the literature on the subject come from both individual authors and institutional ones. Various authors point out to various criteria that define whether a particular group of people can be classified as one (shared) household or not. These include: living together (Beaman, Dillon, 2012), being related to one another (Samuelson, 2004), jointly addressing consumption needs (Zalega, 2007), or acquiring financial resources (Kędzior, 1992). Other significant elements include joint housekeeping and taking financial decisions together (Samsel, 2021). In this article the author defines a household as a group of people whose aim is to acquire income, increase its value in time and jointly take financial decisions.

The household includes adults, children and teenagers, often also adult children. The definition suggested by the author does not require people from one household to actually live together. A good example are students who are still members of their parents' households despite the fact they are living separately from their parents who still provide for them. Furthermore, the concept of household lifecycle also gives an interesting insight (Wells, Gubar, 1966). According to it, the first out of nine phases of household lifecycle is a household run by young adults (Olejniczak, 2014) who form a separate entity no longer belonging to a household shared with their parents.

As mentioned above, a household includes working adults as well as their children. The differences between generations are usually easy to notice. Regarding financial decision-making, there are also significant differences in perception between the older and younger generations. What is more, there are also many similarities between people of the same age. Therefore on the one hand there are intergenerational differences and on the other there are similarities between people who are at a similar stage of life, who were born within a short time range of one another, who experience the same problems or operate within the same cultural environment. The two youngest living generations are called Generation Z and Generation Alpha. These people were born between 1995 and 2009 (Gen Z) and 2010-2014 (Gen Alpha). These people determine the future of many important elements around us, such as: trends in education, labour market, technological progress. Their voice in personal finances and making

financial decisions including investments will also be of great significance. Table 1 below shows the characteristics of the those generations.

Table 1.
Characteristics of Generation Z and Generation Alpha

Feature	Z	Alpha
Born	1995-2009	2010-2014
Attitude towards digitalisation	It penetrated all areas of life and relationships	Non-stop online (<i>hyperconnected</i>)
Attitude towards the world	Full globalization achieved (a world without borders due to being permanently signed in to the network)	Controlling the world and life through apps (<i>self-tracking</i>)
Attitude towards relations	Social interactions moved to the social media	Highly-educated, the most affluent, living the longest and in the smallest families.
Attitude towards technology	Giving up stationary devices for the sake of mobile ones	Screen is „natural environment”, the generation most closely attached to the technology
Attitude towards education	Choosing visual content over traditional one.	Children with „busy schedules” (pressure on good results at school, development of interests, good results in sports)

Source: own study based on Ziatdinov, Cilliers, 2021; McCrindle, Fell, 2020.

Generation Z and Generation Alpha gained a combined name ‘Zalpha’, a term first suggested in the annual Trends Map by the Infuture Institute. The study placed Zalpha in a megatrend related to the undergoing demographic changes at the boundary of the so-called new normal (a currently leading trend) and a reactive zone, a short-term perspective for establishing a trend. It was suggested that the COVID-19 pandemic was a defining element in the development of these generations. Hence a joint experience of pandemic gave the two generation the name Zalpha (Infuture Institute, 2022).

Another important aspect are the relations between different members of a household in the context of finances. Financial decisions include those related to consumption, debts, savings and investments (Samsel, 2021). It goes without saying that younger generations learn how to take financial decisions by observing their parents or grandparents. Generation Z and Generation Alpha can therefore follow decision-making patters of other members of their households. Those people can also make completely opposite financial decisions to those witnessed at home. Still, however, they gain knowledge of managing personal financial from older generations. Knowledge of finances allows to avoid excessive debts and to skilfully manage one’s debts (Lusardi, Tufano, 2015). Bad investment decisions are on the other hand often attributed to failed assessment of financial conditions caused by insufficient knowledge of finances. Additional factors include too high level of self-confidence, lack of self-control and emotional factors (impulsive consumption, character) (Gathergood, 2012; Petrov, Tonkova, 2022). Demographic factors, however, are also significant as they influence investment decisions. Demographic factors can have an influence on investment-related behaviours and on the whole process of managing personal finances (Hidayati, Kartawinata, 2017). Research

suggest that demographic factors and financial skills have a significant impact on investments of young people (Normalasari, Maslichah, Sudaryanti, 2022).

In the field of financial decisions taken by members of the youngest generations the author pays special attention to investment decisions. Investment decisions can be divided into traditional ones (e.g. shares, bonds, properties) and alternative ones (e.g. emotional investments). Adamska (2015) points out that emotional assets are gaining popularity. This new financial market trend is supported by financial intermediaries, banks, and commodities exchanges in order to address the expectations of individual investors. Emotional investments have not been given an unambiguous definition yet. The literature on the subject says that they form a part of alternative investments that are not classified as traditional investments (Wieprow, 2018). Emotional investments are also perceived as related to the passion of an investor (i.e. investments that combine economic and emotional approaches). The characteristics of emotional investments include low liquidity, difficulty in establishing their market value, information asymmetry, necessity to possess specialized knowledge, physical security risk, storage problems, investment decision based not only on financial motif (Borowski, 2012). Emotional investment is then such an investment that is based on positive emotions related to it, is not profit-oriented and provides non-material benefits (such as prestige, exclusivity, aesthetic feelings, the pleasure of ownership).

3. Research methods

For the purpose of this article the author carried out a diagnostic survey using CAWI method (*Computer-Assisted Web Interview*). The study involved filling in an electronic form. The study was carried out between April and July 2022 and involved 217 participants. Eventually 205 questionnaires were accepted for the analysis since the others contained mistakes, such as lack of answers to some questions or choosing multiple answers when only one was allowed. Having collected research material the author used the method of statistical inference to work on the results. The research stages are presented in Table 2 and the features of the studied groups are presented in Table 3. The analysis of variance (ANOVA) and Pearson correlation coefficient were also used in the analysis.

Table 2.
Stages of collecting empirical material

ACTION	PERIODS			
	April 2022	May 2022	June 2022	July 2022
Construction of questionnaire				
Data collection begins				
Partial verification of results				
Data collection continued				
Data collection finished				
Preliminary analysis of data				
Exclusion of faulty questionnaires				
Preliminary statistical analysis				
Deep statistical analysis				

Source: own study.

Table 3.
Statistical features of the control group

Number of respondents	in age groups						
	below 18	19-26	27-33	34-40	41-47	48-54	55-61 (and older)
	1	144	11	22	18	8	1
	based on gender						
	female			male			
	157			48			
	based on the level of education						
	below secondary		secondary			higher	
	1		147			57	
	based on job status						
	student		unemployed		employed		pensioner
	135		9		58		3
	based on place of residence						
	countryside				town/city		
	42				163		
	base on income (in PLN)						
	below 1000	1001-2000	2001-3000	3001-4000	4001-5000	5001-6000	above 6000
	42	64	35	22	21	8	13
based on the main source of income							
various, more than one	provided for by other people (e.g. parents)	disability payments/pensions	scholarship	employment	social benefits	self-employment	
61	50	6	3	69	1	15	

Source: own study.

4. Results

Respondents were asked to subjectively assess their knowledge about investments (Figure 1). Almost half of them assessed their knowledge as average (45.85%). Among them 6.34% said they had no financial knowledge at all, whereas 4.39% believed they have a high-level knowledge about investments. It is interesting that there is more indications of

no or low-level knowledge about finances than high or very high-level knowledge about investments (30.34% and 23.90% respectively).

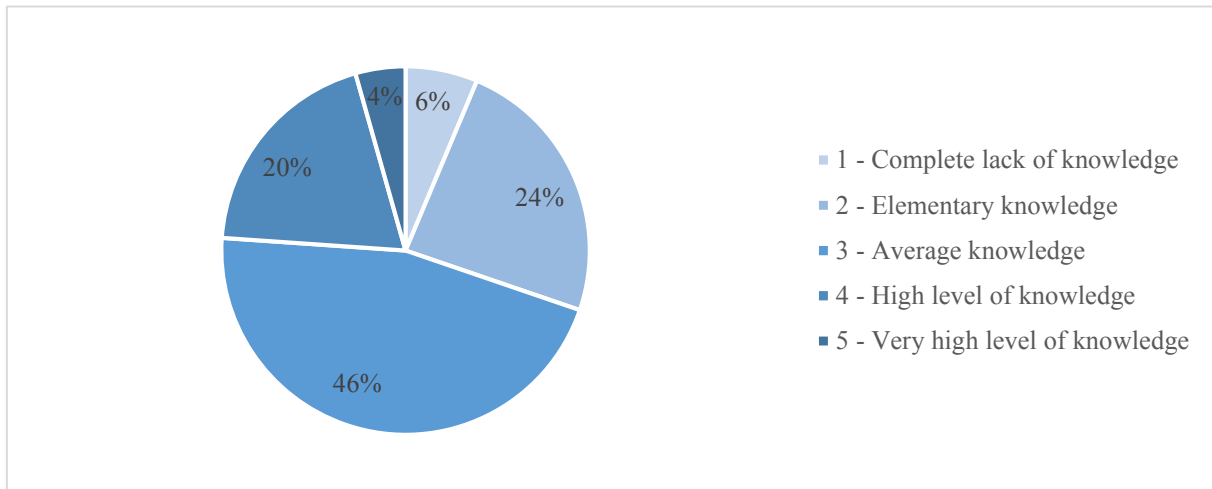


Figure 1. Subjective assessment of knowledge about investments in the entire group of respondents.

Source: own study.

Subjective assessment of financial knowledge by members of Generation Z and Generation Alpha do not differ from general observations. Majority of them say their knowledge about investments is average. The proportions change slightly when it comes to elementary-level knowledge about investments (26.21%). We can notice a difference when it comes to those who assess their knowledge as high-level or very high-level, namely 24.14% of Generation Z and Generation Alpha. The percentage of Generation Z and Generation Alpha with perceived total lack of knowledge about investments (4.14%) is also lower than among the entire group of respondents (Figure 2).

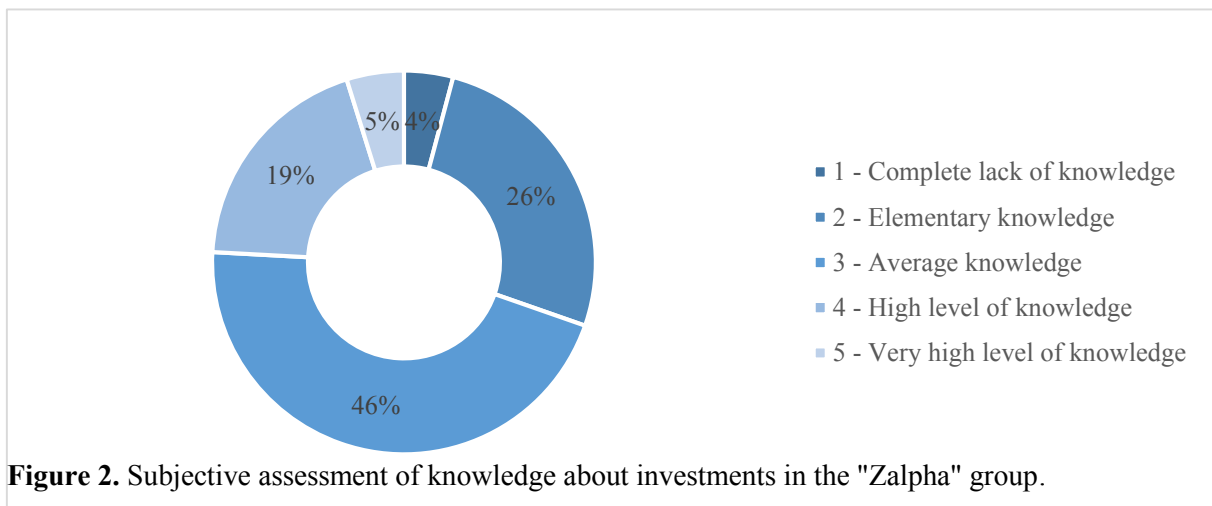
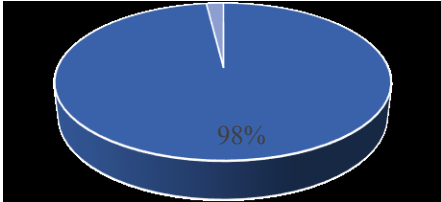
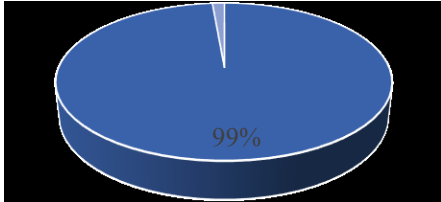


Figure 2. Subjective assessment of knowledge about investments in the "Zalpha" group.

Source: own study.

The research results suggest a connection between investments and personal development. The vast majority of respondents indicated that their personal development is a form of investment. In this case the results did not diverge between the entire group of respondents and selected age groups. In both cases more than 98% of respondents said that their personal development forms an investment.

Table 4.
Perception of your own development as an investment

The entire group	Generation Z and Alpha
<ul style="list-style-type: none"> Yes, self-development can be included in the category of investments No, self-development cannot be included in the category of investments 	<ul style="list-style-type: none"> Yes, self-development can be included in the category of investments No, self-development cannot be included in the category of investments 

Source: own study.

Respondents were asked to choose categories that in their opinion could be described as an emotional investment. In both the entire group of respondents and among the below 27-year-olds the vast majority (60%) said investments in self-development are connected with emotional investments. These were followed by autographs of famous people (13.17%) and works of art (11.22%). Collecting cars is perceived as an emotional investment by 5.85% of respondents. Jewellery is seen as an emotional investment by the smallest group among the respondents (2.44%). As already said, there are no differences between the entire group of respondents and the younger generations. Therefore the research results of the entire group are presented in one chart (Figure 3).

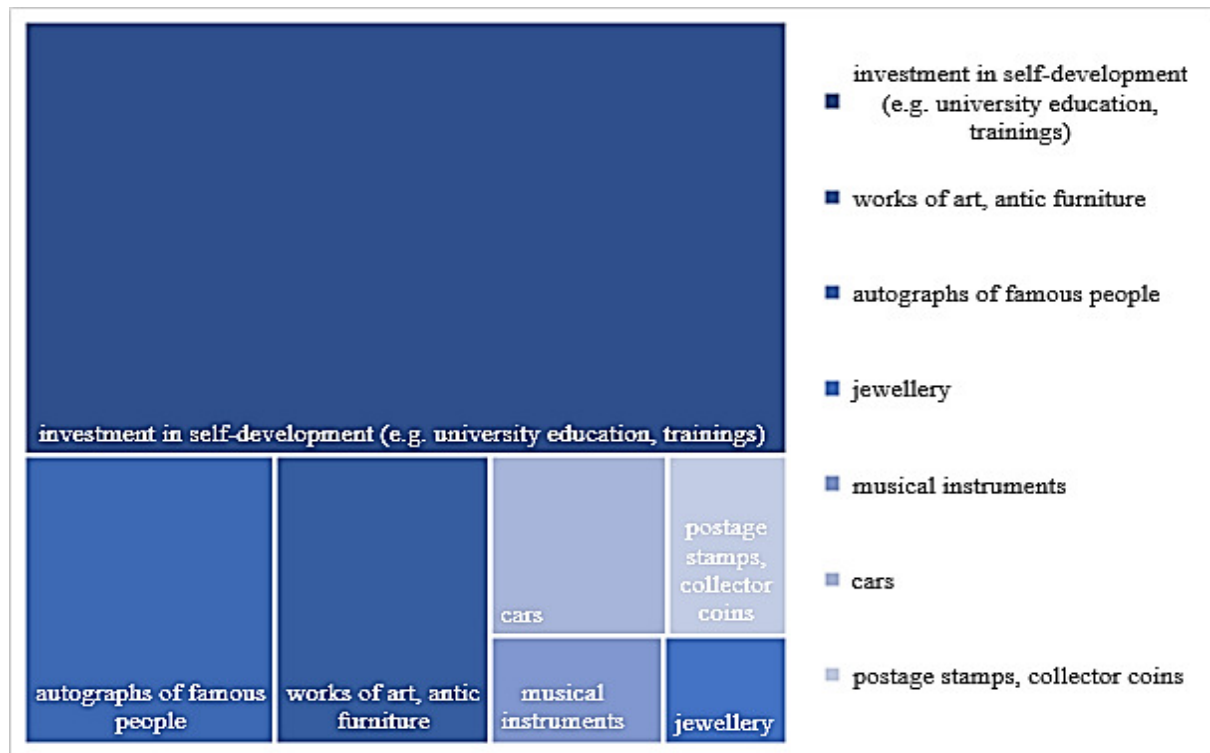


Figure 3. Seeing different categories as an emotional investment.

Source: own study.

To strengthen the validity of obtained information and for the purpose of this article respondents were asked to assign the total amount of one million Polish Zloty to goals of their own choice. They were informed that the “offered” money come from external sources, such as inheritance, donation, or lottery win. Respondents had to divide those financial means using the following pattern: 100,000, two times 200,000, and 500,000. The most popular option was to buy a property (for themselves). The second most often chosen option was to invest the spare financial resources. Many people were also interested in dedicating a significant amount of money to develop their own companies. The least interesting option was to pay the debts and to buy a vehicle (Figure 4).

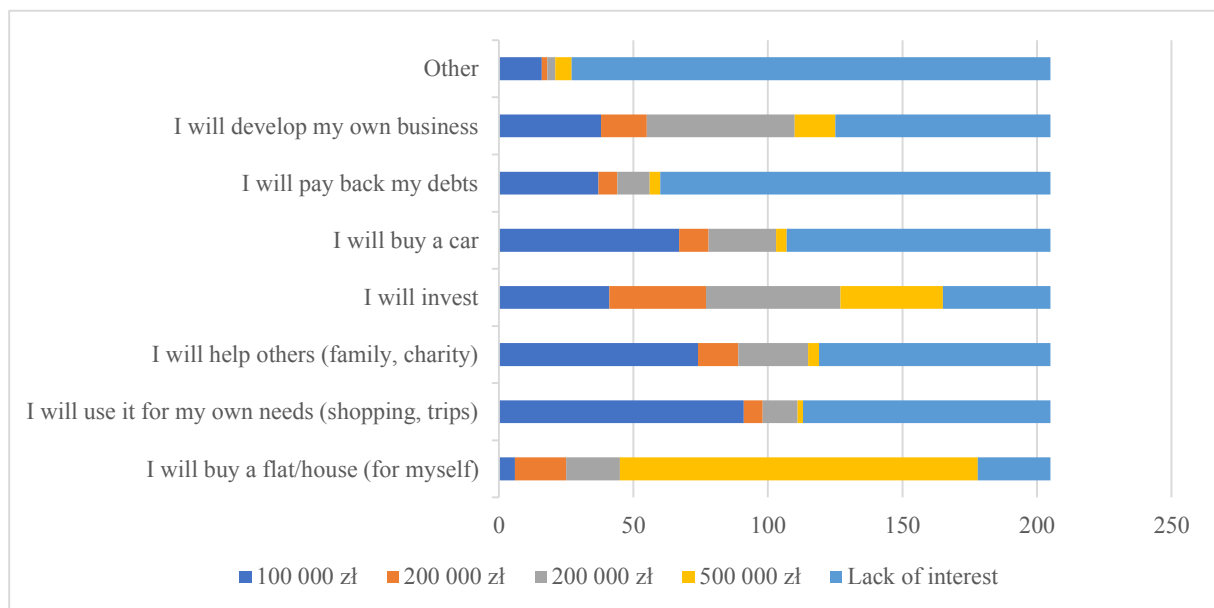


Figure 4. Interest in spending PLN 1,000,000 broken down by individual goals (in the entire study group).

Source: own study.

The analysis of the results show that Generation Zalpha’s interests differ from other groups. Their answers regarding buying property for themselves or investing some amount of spare financial resources were similar, but there were significant differences in other categories. Young people indicate that they would assign part of the money to their own needs or buy a vehicle. Some mention developing their own business, but in contrast to the entire group, Generation Z and Generation Alpha chose to spend less money but for more diversified options. Both the group as a whole and the selected age groups would assign half of the amount to buy their own property (Figure 5).

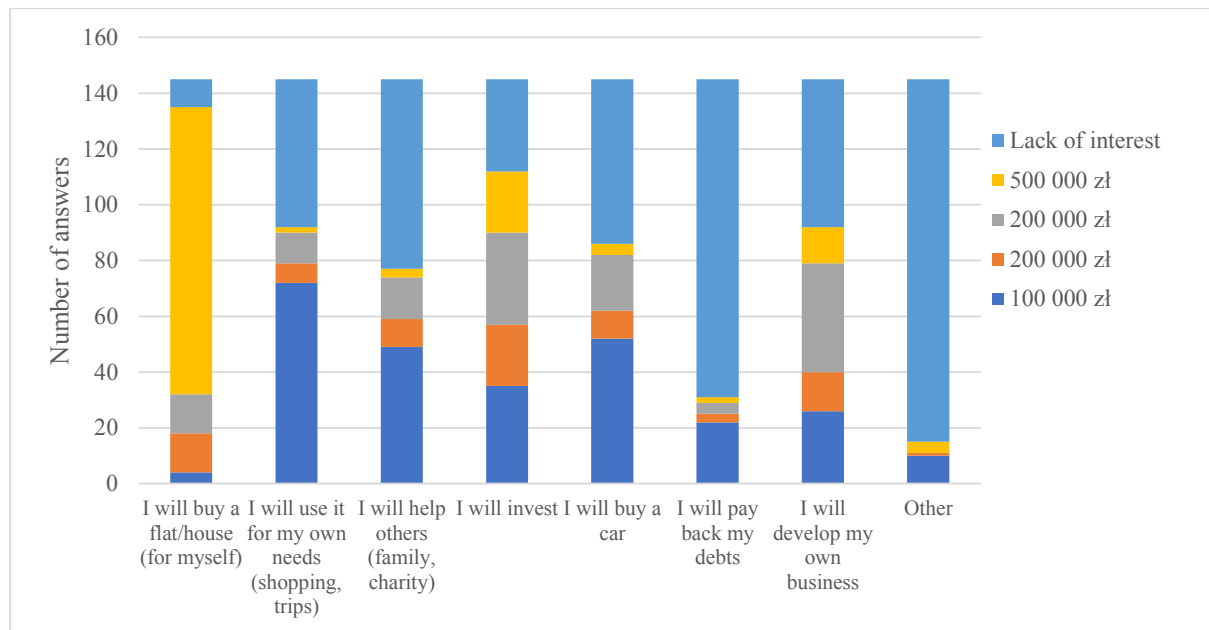


Figure 5. Interest in spending PLN 1,000,000 broken down by individual goals (in the Z and Alpha generation groups).

Source: own study.

The details of what Generation Zalpha put into the ‘other’ category are also worth a closer look. It included: health, passion, sessions with a coach or a mentor and plastic surgeries.

To make observations on investments, including emotional investments, the author verified the group (total) using a one-way variation analysis (ANOVA). Based on that the author concludes that there are no statistically significant dependencies between subjective assessment of the level of investment knowledge and demographic characteristics of the group (each analysed case returned $p > 0.05$). There are also no statistically significant dependencies in the analysis of the assignment of one’s own development as an investment. There are, however, statistically significant dependencies in the analysis of assigning categories as emotional investment. There are statistically significant dependencies regarding the gender of respondents, as well as their education and main source of income (other characteristics do not show statistically significant dependencies). The results are shown in Table 5.

Table 5.
P-value and Pearson's correlation coefficient for categorization of emotional investments

Feature	<i>p-value</i>	Pearson correlation coefficient
Gender	0,001	0,226
Education	0,033	-0,172
Main source of income	0,000	-0,184

Source: own study.

According to Guilford’s classification of correlations the obtained results show that the correlation between the gender and the assignment of emotional investments is low (the value range $0,1 < |r| \leq 0,3$). There is almost no correlation between education and main source of income ($0,0 < |r| \leq 0,1$). This indicates that the correlation is negative.

5. Discussion

Regarding emotional investments the author agrees with Borowski (2012). The interest in emotional investments (self-development, autographs of famous people, works of art and antique furniture) as indicated by respondents confirms assumed definitions (mainly regarding difficulties in establishing market value and related to low liquidity). The issue of lack of profit motif remains questionable. Investing in self-development often increases the value of an individual investor as a person (employee) on the labour market, which can then be reflected in their higher income. The author also agrees with Petrov and Tonkova (2022) who pointed out emotional factors and lack of self-control in taking investment decisions. In the experiment presented in this article respondents were offered to spend 1,000,000 Polish zloty. The results confirm that when allocating the money respondents were driven mainly by emotions and their own preferences. However, the results do not confirm Hidayati and Kartawinata's assumptions that there is a connection between demographic factors and investment decisions. As shown by research results there are not many differences between the entire group of respondents and Generation Z and Generation Alpha. The results provide important conclusions regarding preferences and the forming of the emotional investment market as well as financial education and knowledge. However, having analysed the obtained data the author rejects the assumption that demographic factors (as a separate category) have an influence on investment decisions.

6. Conclusion

To sum up, the author concludes that the set goal has been achieved. The study shows how various categories of emotional investments are seen by the entire group of respondents and by Generation Z and Alpha. The main hypothesis has been confirmed. It is confirmed that investments related to self-development are the most important category classified as emotional investments. The supporting hypothesis has been rejected. Young people show (subjectively) an average level of knowledge in the area of investments. The other conclusions are as follows:

1. Proving that living together is not a necessary condition for a group of people to be considered as one household.
2. Listing and comparing the main characteristics of members of Generation Z and Generation Alpha.
3. Detailing the factors that have an impact on investment decisions.
4. Narrowing the definition of emotional investments by indicating emotional connections and lack of profit motif.

5. Showing that Generation Z and Generation Alpha demonstrate large interest and assign high-priority status to spending related to their own needs (while the entire group had no interest in such a goal).
6. Finding out that younger generations are not interested in assigning their financial resources to helping others (e.g. family or charity).
7. Regarding spending, pointing out that the youngest generations prefer options related to personal fulfilment. This element could be vital from the perspective of investment market, and especially emotional investment market and creating an offer for young people (who are going to be the core participants of financial markets in the near future).
8. Drawing attention to other categories indicated by respondents that are also related to investments in self-development: improvement of physical health, sessions with a coach or a mentor (support for mental health), developing passions or undergoing plastic surgeries.
9. Demonstrating that there is a statistical significance in relation to the categories of emotional investments, gender, education level and the source of main income. Such information can also shape the direction of development in the market of international investments.

Acknowledgments

The author would like to thank Dominika Nawrocka, an entrepreneur and author of books on financial education, the founder of Klub Kobiety i Pieniądze, Klub Inwesterek and Szkoła Edukatorek Finansowych, for being so open to academic research and for her help with the distribution of questionnaires for this article.

The project is financed within the framework of the program of the Minister of Science and Higher Education under the name „Regional Excellence Initiative” in the years 2019-2022; project number 001/RID/2018/19; the amount of financing PLN 10,684,000.00.

References

1. Adamska, A. (2015). Inwestycje w aktywa emocjonalne. *Zeszyty Naukowe Uniwersytetu Szczecińskiego, nr 854, Finanse, Rynki Finansowe, Ubezpieczenia, no. 73*.
2. Beaman, L., Dillon, A. (2012). Do household definitions matter in survey design? Results from a randomized survey experiment in Mali. *Journal of Development Economics, 98(1)*. doi:10.1016/j.jdeveco.2011.06.005.

3. Borowski, K. (2012). *Inwestycje alternatywne w Polsce i na świecie na przykładzie rynku dzieł sztuki*. Oficyna Wydawnicza SGH.
4. Gathergood, J. (2011). Self-Control, Financial Literacy and Consumer Over-Indebtedness. *Journal of Economic Psychology*, 33(2012). doi: 10.1016/j.joep.2011.11.006.
5. Hidayati, F.F., Kartawinata, B.R. (2017). Pengaruh Literasi Keuangan Dan Faktor Demografi Terhadap Proses Keputusan Pengambilan Kredit Usaha Rakyat (KUR) Pada Bank Rakyat Indonesia (BRI) Kantor Unit Mantingan, Kabupaten Ngawi Jawa Timur. *Majalah Bisnis & IPTEK*, 10(1).
6. Infuture Institute (2022, June). *Mapa Trendów*. <https://infuture.institute/mapa-trendow/>.
7. Kędzior, Z. (1992). *Gospodarstwo domowe – podmiot gospodarujący*. IRWiK.
8. Lusardi, A., Tufano, P. (2015). Debt literacy, financial experience and over indebtedness. *Journal of Pension Economics and Finance*, vol. 14(04). doi: 10.3386/w14808.
9. McCrindle, M., Fell, A. (2020). *Understanding generation Alpha*. McCrindle Research.
10. Normalasari, N., Maslichah, M., Sudaryanti, D. (2022). The effect of financial behavior, financial literacy and demographic factor on students' investment decision making. *Jurnal Ilmiah Riset Akuntansi*, 11(02).
11. Olejniczak, T. (2014). Techniki badawcze wykorzystywane w badaniu cyklu życia gospodarstwa domowego. *Research Papers of the Wrocław University of Economics [Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu]*, 336. doi: 10.15611/pn.2014.336.17.
12. Petrov, D., Tonkova, E. (2022). *Applied aspects of study of financial literacy of households in Bulgaria*. Proceedings of INTCESS 2022. 9th International Conference on Education & Education of Social Sciences 17-18 January 2022. Online Conference.
13. Samsel, A. (2021). *Wpływ programu „Rodzina 500+” na decyzje finansowe gospodarstw domowych*. Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.
14. Samuelson, P.A., Nordhaus, W.D. (2004). *Ekonomia*, 1. PWN.
15. Wells, W.D., Gubar, G. (1966). Life cycle concept in marketing research. *Journal of Marketing Research*, 3(4). doi: 10.1177/002224376600300403.
16. Wieprow, J. (2018). Rynek inwestycji emocjonalnych w Polsce. *Finanse, Rynki Finansowe, Ubezpieczenia*, 92. doi: 10.18276/frfu.2018.92-30.
17. Zalega, T. (2007). Gospodarstwo domowe jako podmiot konsumpcji. *Studia i Materiały*, no. 1.
18. Ziatdinov, R., Cilliers, J. (2021). Generation Alpha: Understanding the Next Cohort of University Students. *European Journal of Contemporary Education*, 10(3).

TELEWORKERS AND THEIR IDENTIFICATION WITH THE COMPANY

Małgorzata SCHULZ

College of Economic and Social Sciences, Warsaw University of Technology;
malgorzata.schulz@pw.edu.pl, ORCID: 0000-0003-3005-5769

Purpose: This article is devoted to the identification of teleworkers with the company.

Design/methodology/approach: The theoretical part of the article is mainly devoted to the essence of identification and the factors shaping it. The second issue addressed in the theoretical part is teleworking. Within this part, the definitions of this concept, its essence and an attempt to show it from the perspective of the employee and the employer were cited. The practical part, on the other hand, includes a description of the research carried out for this article. The subject of the research was teleworkers employed in the organisation "Orange Polska INC.", for whom their homes and flats are the office.

Findings: As a result of the research, the degree of identification was diagnosed and the most important factors that influence the perceived identification with the company were identified, while proving that they are the same as in the case of stationary employees.

Originality/value: The results of the consideration are useful for small and large companies. They might help them with the issue of strategic planning and increasing of motivation among employees.

Keywords: employee identification with the organisation, company identification, telework, teleworker, job satisfaction.

Category of the paper: Research paper.

1. Introduction

The traditional employment model is based on an open-ended contract, but the development of the economy and competitiveness are forcing a search for factors that improve the profitability of companies. One of them is the cost of labour and, inter alia, this is why there has been a strong tendency to use atypical, more flexible and cheaper solutions on the labour market and to move away from the previous regulations based on the stability and security of employment. One atypical form of employment is teleworking. But the most important factor improving the profitability of companies is the people employed in it. Job satisfaction,

employees' sense of unity with the organisation, recommending it to others as a good place to work, promoting the company through the use of gadgets with its logo, participation in team-building events also allow the company to gain a competitive advantage and function better in its environment. Do teleworkers employed by 'Orange Polska INC.' feel identified with the company? and what factors influence this in the practice of the company surveyed.

2. Teleworking as one form of work provision

Teleworking is one of the newest forms of work provision, which owes its development to society's increasing access to modern ICT. It is a solution that is attractive to both employees and employers seeking flexibility in the labour market.

From the numerous definitions of teleworking that appear in the literature, one can quote, among others, the definition proposed by S. Ciupa (2007), 'teleworking is a new form of organising and performing work, in which the nature, place and time of work, the manner and conditions of its performance, order and organisation may be shaped through the use of advanced information and communication technologies.

Also at European Union level, a definition of teleworking has been developed and proposed by the European Commission. It reads as follows: "teleworking is a method of organising and performing work in which an employee works away from the employer's place of work for a significant part of his or her working time, delivering the results (output) of the work to the employer using information and data communication technologies, in particular the Internet" (Central Institute for Labour Protection).

It is clear from the above definitions of work that, thanks to the possibility of carrying out remote work, the place and time of work no longer plays an important role in many industries. Teleworking makes it possible for employees to carry out much of their work anywhere, at any time, and to send the results of their work very quickly via the network to any location.

Despite the fact that on the labour market one can currently find a large number of advertisements offering this form of employment, teleworking is still not a popular form of employment in Poland. According to Eurostat data, in 2019, only 4.6% of people aged 15-64 worked via telework. Such a low percentage of people employed in this form may be due, among other reasons, to the fact that employers are accustomed to the traditional way of managing a company, where an employee performs professional duties at the company's premises.

How does Poland compare to other countries in this respect? The percentage of employed people aged 15-64 in the European Union who usually work from home was in 2019. 5,4%. This figure was highest in the Netherlands and Finland (14.1%), followed by Luxembourg (11.6%), and lowest in Romania (0.8%) and Bulgaria (0.5%) (Ciupa, 2007).

A job free from the constraints of time and place is also a huge opportunity for women wishing to combine childcare with a professional life. It seems particularly attractive for young mothers, who are often faced with the choice of either raising a child or having a career.

Another occupational group that can effectively use modern ICT in their work and provide work in this way is people with disabilities. Thus, it is not only IT professionals who are considering teleworking as a profession. More and more industries are choosing to provide all or only part of their services via the Internet or multimedia devices, for example. Accounting, tax or legal advice, insurance or architectural services. These are just a few examples of professions where teleworking is possible.

Taking into account the results of the research so far, it can be concluded that teleworking as a form of employment generates some benefits for both the employee and the employer, but it is also not without some disadvantages. Below is a summary of the advantages and disadvantages of teleworking:

Advantages of teleworking for the employer:

- attracting highly qualified specialists in a particular field who are lacking in the local labour market, without them having to move to the locality where the company is based,
- the possibility of hiring workers from regions where labour costs are lower,
- avoiding expansion, reorganisation of the company in the event of an increase in employment,
- reduced expenditure on preparation and maintenance of the workplace,
- reduction in sick leave, as the employee often works from home,
- reducing staff costs by not paying overtime,
- reduction of running costs (heat and electricity consumption of employees due to off-site work),
- remuneration for the result of the work delivered and not for the time spent at work.

Advantages of teleworking for the employee:

- the possibility of reconciling domestic and professional responsibilities,
- the possibility of working for several employers at the same time,
- saving time and money by not having to commute,
- reduced stress, as the work is often carried out at home, which promotes a sense of security and a good working atmosphere,
- the absence of conflicts that arise in large groups working in the same place,
- people with disabilities do not have to overcome architectural barriers (Ježek, 2017).

Disadvantages of teleworking:

- a sense of isolation - teleworkers often feel that they are left to their own devices and that they lack support in situations that require consultation with their supervisor,
- weaker identification with the company - less sense of belonging to the company because the work is done off-site,

- management difficulties - the employer has limited ability to monitor the progress of employees, no direct face-to-face contact,
- a longer working day - teleworking can lead to a longer working day without remuneration, as the teleworker is often responsible for organising his or her own working time (Szluz, 2013),
- limited trust - employers may be reluctant to extend teleworking because they do not trust employees to perform tasks to their satisfaction and use their working time effectively (Information and Career Planning Centre in Warsaw, 2022).

Although at first the offer of teleworking is very advantageous and can be a good solution, like any other form of work it also has its drawbacks.

The biggest one - especially for the employer - may be the limited contact with the employee. Contact by text message, phone call or instant messaging cannot replace a so-called 'face-to-face' conversation. This problem also applies to the employee. Miscommunication or misunderstanding with the employer can result in mistakes in the work performed (Council of the European Union, 2014).

The teleworking form also has identical characteristics to the traditional employment relationship. These include: remuneration, personal performance, subordination (Nilles, 2003).

Teleworking can only be carried out with the employee's consent. Lack of consent cannot amount to termination, so the employer may propose but not impose such a form. Therefore, it is important to remember that teleworking is not a new type of employment, but just a form of work performance.

Although there is a widespread perception that teleworking is 'less valuable', the employee has the same privileges and responsibilities as one doing his or her job 'on-site' at the workplace.

3. Identification with the company and its role in management

In general, identification (Latin *idem* - same) means in the social sciences the identification of one person with another person or a group of persons; the term is also used to describe the process of an individual's identification with a function or social role (Radziewicz-Winnicki, 1977). In other words, it is the adoption of the values, beliefs of another person or group of people and accepting them as one's own. The concept of identification in contemporary social sciences is not always used in the same sense. Thus, it is not a clear concept; nevertheless, the usefulness of this term in making diagnoses and social analyses seems unquestionable (Reading, 1977).

The basis for identification is the strong emotional ties that bind the person identifying with someone else, while in the case of identification with a group, the important factor for fusion (consolidation) is the community of goals and principles of action.

One of the first sociologists to use the term identification was Ch.H. Cooley. He stated that there is a phenomenon that can be described as identification with a group, expressed by the use of the pronoun "we" or "us". Identification is greatly strengthened by the cooperation of the members within the group and the sense of separateness from the external world surrounding the group. Thus, the sociological approach pays particular attention to the fact that a member of a given group may, to one degree or another, identify with other members of the group and, in a certain way, also with the group as a whole (Cooley, 2012).

According to P. Sztompka (2007), the category of "we" is determined by three moral duties. "We" - are those whom we trust, towards whom we act loyally, whose affairs we care about in solidarity.

In sociological terms, identification is always seen in the member-group relationship.

The essence of identification as a psychological category is that, under certain circumstances, the characteristics of other people are assimilated and become elements of the character structure of the developing person.

The psychological approach to the problem of identification also deals with the identification of the individual with the group, which is conceptually closely related to the sociological approach. However, this approach talks about the individual's personal perception of the group. Emotions, individual feelings, personal relations with the member group are involved here. These issues are within the field of interest of social psychology.

An individual can relate to a group in both positive and negative ways. A positive relationship of the individual with the group is most often due to the fact that the individual has joined the group of his or her own free will. The group has proved attractive for a variety of reasons: e.g. instrumental - because it helps him/her to achieve his/her own goals; autotelic - because it satisfies the need for affiliation; axiological - because it confirms, strengthens him/her in the values he/she professes through contact with people professing similar values.

With attractive groups the individual identifies, solidifies, bestows trust and loyalty on them. A good indicator of such an attitude is the willingness to think and speak of the group as 'we' (Sztompka, 2007).

The term 'identification' is also used in management science and has two meanings: identification of the company and identification of the employees with the company. In the first sense, corporate identification is the set of all symbols, signs by which a company is recognised externally, which distinguish it from other companies on the market and which always evoke certain associations with it, which can be both positive and negative. Positive associations mean that when a company enjoys recognition and respect from society, it has a so-called "good brand", employees readily identify with it and the use of gadgets, corporate clothing bearing the company's logo does not bring them into disrepute.

In the second sense, the term 'identification' in management science is understood as a state in which the employee fully accepts the organisational culture, the climate and policies of the company, its strategy and goals, the procedures used in the company, as well as the purpose of his or her own job and its place and importance in the structure of the organisation. Identification makes the employee feel a part of the company in which he or she works, and is therefore dedicated and loyal to it (Alexander, 2008).

In the social sciences, attention is drawn to the fact that man is guided in his behaviour by a desire to satisfy his own needs. The more effective his actions are in this respect, the more willing he will be to return to them in the future (Jacewicz, Małkowska, 2020)

Each employee also has expectations regarding working conditions. These may include: working with professionals, a well-equipped workplace, job security, job satisfaction, tasks that arouse employee's commitment, professional training, working for a company with a good reputation, etc. If a company meets the expectations placed on it, "its subjective value increases in the eyes of employees, who respect it and see no reason to look around for another employer" (Alexander, 2008). The extent to which a company meets the expectations of its employees, the extent to which it allows them to develop themselves and achieve their own goals through the company's objectives, significantly influences employees' identification with the company. A transparent organisational culture, i.e. the company's unique values, rituals and cultural artefacts according to the theory of D. Ravasi and M. Schulz (2006), also contributes to an increase in employees' identification with the organisation.

An employee who identifies with a company is an employee for whom working for that particular company is a source of satisfaction and contentment. He or she is an employee who willingly comes to work, willingly commits his or her own time - not only during working hours, but also "after hours" or during days off. This is an employee who treats work as a natural part of life, is characterised by responsibility, self-control, a high level of professional ambition and, most importantly, a willingness to work of his or her own free will and not out of compulsion. The sense of personal satisfaction, closely linked to belonging to a company and functioning within its system, is a source of many positive effects for both parties (Nilles, 2003).

4. Identification with the company of teleworkers employed at "Orange Polska INC." Own research

The survey was conducted in the month of April 2022 on one of the largest mobile networks in Poland - "Orange Polska INC."

"Orange Polska S.A." is the leader on the Polish market of fixed telephony, Internet and data transmission. It is the largest provider of telecommunications services operating in all market segments. It currently has around 500 outlets and employs 10,452 people.

The aim of the research is to determine what degree of identification with the company - high, moderate or low - is presented by respondents employed in the form of teleworking. It is generally believed that teleworkers, due to limited direct contact with colleagues and superiors and the predominance of indirect communication, identify less with the company.

The research verified this thesis. How this situation presents itself in practice is shown by the results of the research carried out.

Main question: What is the degree of identification of teleworking employees with the company?

Hypothesis

It is assumed that the degree of identification of teleworkers with the company is low due to fewer opportunities to build social ties with co-workers.

Description of the research sample

The survey was conducted using a questionnaire constructed using the 'Google Forms' programme. It contained 17 closed-ended single-choice questions, 2 multiple-choice questions and a metric

Five questions were selected from the survey questions (which were treated as a reflection of the variable that was intended to be studied). These included the questions:

1. Question. Do you feel connected to your workplace and can refer to it as 'my business'?
2. Question. On how many percentages (on a scale of 1-100%) would you rate your attachment to the company?
 - high (100-81%),
 - medium (80-41%),
 - low (40% and less).
3. Question. Do you intend to change your workplace in the next six months?
4. Question. Do you recommend your company to family or friends as a good place of employment?
5. Question. Do you use the items offered by the company, gadgets containing its logo?
6. Question. Do you participate in integration events organised by the company?

The study¹ involved 117 employees of the company from different branches in Poland: 67 women and 50 men. They mostly had a university degree (44%) and secondary education (31%). They were aged:

¹ The survey was conducted by Aneta Józefowicz.

Table 1.*Age*

Age	Number of people	%
18-26	47	40,2
27-40	43	36,8
41-55	21	17,9
56-70	6	5,1
Total	117	100,0

Source: own elaboration.

The respondents are most often young people in the age group 18-26 (over 40%) and 27-40 (almost 37%). Employees aged 41-55 took part in the survey twice as seldom (around 18%) and those aged 56-70 the least often (only 5.1%).

In terms of place of residence, more than half of them (52.1%) live in medium-sized cities, followed by 34.2% in large cities. Respondents living in rural areas accounted for 13.7% of the total.

More than half of the respondents were employed as clerks (54.7%). The second largest group were specialists (40.2%). Those in a managerial position were the least numerous (5.1%).

In order to be able to determine on the basis of which work experience respondents were completing this survey, they were asked to indicate the length of time they had been in their current workplace as a teleworker.

Table 2.*Telework placement in current workplace*

Teleworking internship	Number of people	%
up to six months	23	19,7
over 6 months - 1 year	31	26,5
over 1 year - 2 years	26	22,2
over 2-3 years	26	22,2
over 3 years	11	9,4
Total	117	100,0

Source: own elaboration.

The largest group was made up of people with short work experience of up to one year (46.2%). One in five people have been working for 1 year -2 years, one in five people have also been working for more than 2-3 years. The group with the longest seniority (more than 3 years) in this company accounted for less than 10%. These results probably illustrate the current situation in the labour market, where the majority of employees are employed on short-term contracts.

For the vast majority of respondents (84.6%), the current company is the only place of work. The remainder also work for other employers (15.4%).

The information collected will be presented in the order in which the questions are posed in the survey.

What is the degree of identification of teleworkers?

Before determining the degree of identification of the employee with the company, information was collected on what respondents understood by the term.

Q. What, for you, best defines the term 'identification with the company'? (you had to choose up to 3 answers):

- for nearly 40 per cent of respondents, identification with the company means 'enjoying the work',
- for one in five respondents, 'loyalty to their employer' and 'pride in their work and their company',
- identification with the company for around 16% of employees means "tying their professional future to the company".

Do respondents feel connected to the company?

The question 'Do you feel connected to your workplace?'

- Yes, I can say that, that it is "my company" - 69 people - 59.0%.
- Difficult to say - 44 persons - 37.6%
- No - 4 persons - 3.4%².

The majority of employees surveyed (59%) feel connected to their workplace and can say "my company" about it. But a large percentage of people (40%) choose the option "difficult to say", probably related to their short seniority in this form of work and the difficulty of forming a clear opinion. Of the respondents, only 3% declare no ties to the company.

How strong is the attachment of teleworkers to the organisation?

Table 3.

Attachment of teleworkers to the organisation

Question 9: On a scale of 1-100%, how many percent would you rate your attachment to the organisation?	
Over 90%	High level of identification 82 persons - 70%
90-81%	
80-61%	Moderate degree of identification 27 persons - 23%
60-41%	
40-21%	Low level of identification 8 persons - 7%
Less than 20%	

Source: own elaboration.

Teleworkers declare a high attachment to the company. "High" is rated by 70% of respondents as being attached to the company. As "medium" about 30% of respondents. Low attachment to the organisation is declared by only 7% of employees.

² 117 people - 100%.

Is there a correlation between attachment to the organisation and length of tenure as a teleworker?

Table 4.
Employee attachment to the organisation by seniority

How long have you been teleworking?	How many percent would you rate your attachment to the organisation?				
	HIGH 81% and above	%	MODERATE 80-41%	LOW 40-0%	Total (100%)
Less than 1 month to six months	14	60,8%	6	3	23 (100%)
Over 6 months to one year	20	64,5%	8	3	31(100%)
Over one to two years	17	65,3%	7	2	26 (100%)
Over two years to three years	21	80,7%	5		26(100%)
Over three years	10	99,9%	1		11(100%)
Total	82 (70%)		27 (23%)	8 (7%)	117 (100%)

Source: own elaboration.

Such a relationship exists. As seniority increases, the percentage of people who declare a high attachment to the organisation increases. 61% of employees with up to six months' seniority describe their attachment to the company as high. On the other hand, as many as 99.9% of those with the longest seniority (over three years) do so.

It is therefore necessary to reject the thesis that "**The degree of identification is low in teleworkers**" because as many as three-quarters of respondents declare a high attachment to the company.

Do teleworkers want to stabilise in their current company?

Question. Do you intend to change your workplace in the next six months?

- yes, I will definitely look for another job - 33 people - 28.2%,
- I don't know, it depends on whether the company will change its attitude towards employees to a more positive - 23 people - 19.7%,
- no, I think this company is the right place for me - 61 people - 52.1%³.

In the short term (six months), more than half of the respondents do not intend to change their workplace. Approximately one third of the respondents have such an intention, and almost 20% make their decision contingent on their superiors changing their attitude towards employees to a more positive one.

Question. What do you think most influences your sense of 'belonging to the company'?

- length of seniority 48 people - 41.0%,
- good cooperation with supervisor 16 people - 13.7%,
- amount of salary 15 people - 12.8%,

³ 117 people - 100%.

- possibility of professional development 6 people - 5.1%,
- good cooperation with co-workers 11 people - 9.4%,
- possibility of stationary work 11 people - 9.4%,
- satisfaction with work 10 people - 8.5%.

For more than 40% of the respondents, the feeling of belonging to the company is most influenced by the length of seniority, for about 14% by good cooperation with the supervisor. Slightly less influential is the amount of salary (12.8%). As well as the possibility of stationary work (9.4%) job satisfaction (8.5%), good cooperation with colleagues and supervisor (9.4%). In contrast, only about 5% believe that the opportunity for professional development has the greatest impact on their sense of belonging to a company.

Question. Do respondents recommend their company as a good place to work to family/friends?

- Yes 50 persons - 42.7%.
- Difficult to say 53 persons - 45.3%.
- No 14 persons - 12.0%⁴.

The predominant answer is "hard to say". This is given by almost half of the respondents (45.3%) - mostly those working for a short time (up to 1 year). Just over 40% of respondents recommend their company to their family/friends as a good place of employment. 12% of respondents do not recommend their company to their relatives.

Do those declaring a high attachment to the organisation promote their company as a 'good place of employment' to their loved ones?

Table 5.

Attachment to the company versus promoting it as a good place to work

Would you recommend your company to family or friends as a good place to work?	How many percent would you rate your attachment to the organisation?				
	HIGH 81% and above	%	MODERATE 80-41%	LOW 40-0%	Total (100%)
Not	1	7,1%	6	7	14 (100%)
Difficult to say	32	60,4%	20	1	53 (100%)
Yes	49	98%	1		50 (100%)
Total	82	100%	27	8	117

Source: own elaboration.

Here, a close relationship is observed between attachment to the company and its promotion as a good place to work. The higher the degree of identification with the organisation, the more often it is recommended to those closest to them as a good place to work. Of the 50 people recommending their company to others - 49 people declare their high attachment to the organisation.

⁴ 117 persons - 100%.

Does the job give respondents satisfaction?

Question 11: Do you find your job satisfactory?

- Yes 48 people - 41.0%.
- Rather yes 49 people - 41.9%.
- Difficult to say 9 people - 7.7%.
- Rather no 10 people - 8.5%.
- No 1 person - 0.9%.

For 83% of respondents, the job is satisfying (for 41% "fully"; for 41.9% "rather satisfying"). Those whose work is rather unsatisfying are 8.5%. The remainder chose the answer "difficult to say".

Table 6.

Do respondents feel they are appreciated for a job well done?

Q Do you feel that you are appreciated for a job well done?	Number of persons	%
such	45	38,5
rather yes	48	41,0
hard to say	15	12,8
rather not	8	6,8
no	1	0,9
Total	117	100%

Source: own elaboration.

The vast majority of employees (79.5%) feel appreciated for a job well done. "Not appreciated" or "rather unappreciated" - is a group of people accounting for 7.7%. The answer "difficult to say" is given by 12.8% of respondents.

Table 7.

Employees' appreciation of their supervisor versus willingness to change employment

Do you feel that you are appreciated for a job well done?	Do you intend to change your workplace over the next six months?			Grand total
	I don't know, it depends on whether the company will positively change its attitude towards employees	No, I think this company is the right place for me	Yes, I will certainly be looking for another job	
Not			1	1
Rather not	2		6	8
Rather yes	13	27	8	48
Yes	4	31	10	45
Difficult to say	4	3	8	15
Grand total	23	61	33	117

Source: own elaboration.

People who feel valued for a job well done are more likely to link their professional future with their current company. 95% of people who feel valued for a job well done consider the company to be a suitable workplace for them.

Do teleworkers use the gadgets offered by the company that contain the organisation's logo?

Question 17. Do you use the gadgets offered by the company containing its logo?

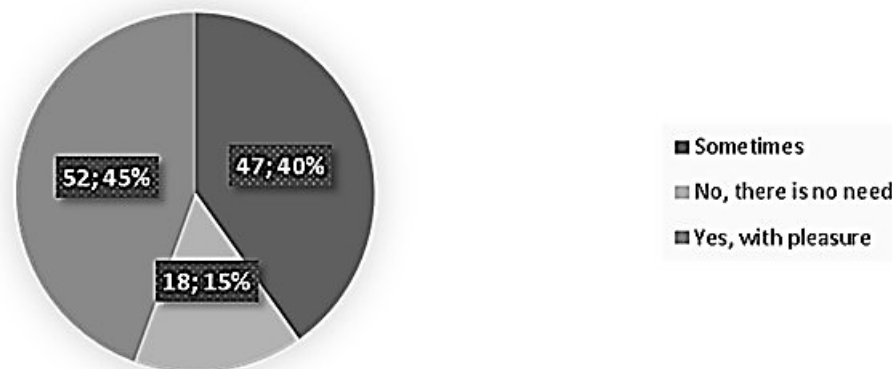


Figure 1. Do you use the gadgets offered by the company containing its logo?

Source: own elaboration.

Gadgets with the company logo are willingly used by 44.4% of employees, while they are only sometimes used by 40.2% of respondents, 15.4% see no need for them.

A sign of identification with the company is also the participation of employees in team-building events organised by the company.

"Orange Polska INC" is taking the following measures in this regard:

- integration meetings, e.g. going out to the cinema, restaurant, theatre... - 50 people - 42.7%,
- integration trips, e.g. sports and recreational activities - 33 people - 28.2%,
- joint cyclical meetings - 21 persons - 17.9%,
- workshops - thematic activities - arts, cooking... - 5 people - 4.3%,
- special events (Christmas Eve, Easter) - 3 persons - 2.6%,
- the company is not in the habit of organising time together - 5 people - 4.3%⁵.

The above-mentioned forms of integration meetings are used by 83.9% of respondents ("regularly" by 51% and more than 1/3 - sometimes "if I have the possibility"). One in five respondents does not participate in them.

⁵ 117 persons - 100%.

5. Completion

The surveys made it possible to assess the employees' level of identification (from five areas of work: sense of attachment to their place of work/'my company', degree of attachment to the company, desire to stabilise in the company, recommend the company to friends, use items containing the company logo, job satisfaction, sense of appreciation for work).

It was hypothesised that employees working in the form of teleworking, due to its specific nature, working outside the company, identify poorly with the company. The research rejected this hypothesis and proved that 60-70% of employees rated their level of identification with the company as high. The factors that influence their perceived identification are the same as for stationary employees.

Managing people professionally, taking steps to increase organisational integration - all of these factors that increase the degree of identification fall within the bounds of well-understood internal marketing and, more specifically, HR marketing.

References

1. Alexander, A. (2008). Pojęcie identyfikacji pracownika z organizacją w świetle badań literaturowych oraz w praktyce działalności przedsiębiorstw. *Organizacja i Zarządzanie*, No. 4, p. 146.
2. Central Institute for Labour Protection. Retrived from: https://www.ciop.pl/CIOPPortalWAR/appmanager/ciop/pl?_nfpb=true&_pageLabel=P1200520201334756707682&_prvPage=1104, 25.10.2022.
3. Ciupa, S. (2007). Zatrudnienie telepracowników w formie telepracy według Kodeksu Pracy. *Monitor Prawa Pracy*, No. 12, p. 623.
4. Cooley, C.A. (2012). *Human Nature and the Social Order*. New York: HardPress Publishing.
5. Council of the European Union. (2014). *Press Release: 3339th Council meeting, Employment, Social Policy, Health and Consumer Affairs*. Retrived from: <https://www.consilium.europa.eu/media/25095/145133.pdf>, 15.09.2022.
6. Information and Career Planning Centre in Warsaw (2022). *Telework* [Information booklet].
7. Jacewicz, A., Małkowska, D. (2020). *Kadry i płace 2020*. Gdańsk: ODDK.
8. Jeżek, P. (2017). *Elastyczne formy zatrudnienia korzyści i zagrożenia*. Warszawa: Infor PL.
9. Mięka, B., Pietruszka-Ortyl, A., Potocki, A. (2002). *Zarządzanie przedsiębiorstwem XXI wieku*. Warszawa: Difin.

10. Nilles, J. (2003). *Zarządzanie telepracą. Strategie zarządzania wirtualną siłą roboczą*. Warszawa: WNT.
11. *Poradnik Pracownika*. Retrived from: <https://poradnikpracownika.pl/-satysfakcja-jako-jeden-z-glownych-motywowatorow-w-naszej-pracy>, 29.10.2022.
12. Radziejewicz-Winnicki, A. (1979). *Identyfikacja z zawodem, grupą roboczą i zakładem pracy*. Katowice: University of Silesia.
13. Ravasi, D., Schulz, M. (2006). Responding to organisational identity threats: Exploring the role of organisational culture. *Academy of Management Journal*, Vol. 49, No. 3, p. 437.
14. Reading, H.F. (1977). *A Dictionary of the Social Sciences*. London-Boston-Henley: Routledge & Kegan Paul.
15. Romańska, K. (2009). *Elastyczne formy zatrudnienia. Telepraca*. Publikacja wydana w ramach realizacji projektu współfinansowanego przez UE ze środków Europejskiego Funduszu Społecznego. Warsaw-Łódź: Laboratorium elastycznych form zatrudnienia materiały edukacyjno-szkoleniowe.
16. Szluz, B. (2013). Telepraca – nowoczesna, elastyczna forma zatrudnienia i organizacji pracy – szansa czy zagrożenie? *Modern Management Review*, No. 4, pp. 253-266.
17. Sztompka, P. (2007). *Socjologia. Analiza społeczeństwa*. Kraków: Znak.
18. Tyrała, P. (2004). *Zachowanie organizacyjne w procesach zarządzania*. Toruń: Adam Marszałek.

CSR IN THE MISSION STATEMENTS OF POLISH CHEMICAL COMPANIES (RESEARCH REPORT)

Bartosz SEILER^{1*}, Hanna BORTNOWSKA²

¹ University of Zielona Góra; b.seiler@wez.uz.zgora.pl, ORCID: 0000-0003-0380-746x

² University of Zielona Góra; h.bortnowska@wez.uz.zgora.pl, ORCID: 0000-0002-7327-7524

* Correspondence author

Purpose: The aim of the article is to answer the following research questions: Q₁: What types of values do chemical companies in Poland declare in their mission statements? Q₂: Do chemical companies in Poland declare values such as responsibility and ethics in their mission statements? Q₃: Do these companies differ from other chemical companies¹ in Poland in terms of declaring responsibility and ethics in mission statements?

Design/methodology/approach: Independent research was carried out in 2021. Mission content in selected chemical organizations was analyzed. This was achieved by defining the coding scheme, testing it, cleaning and/or detailing it, and collecting, coding and analyzing the data. It was verified which values were displayed in those missions, using to this end the mission typology proposed by S. Cunningham, T.B. Cornwell and L.V. Coote. The hypotheses were verified using the Mann-Whitney U test (with continuity correction).

Findings: Half of the chemical companies in Poland mention responsibility in their mission statement, while only one in eight (12.50%) mention ethics. Chemical companies in Poland involved in production and trade (i.e. those that pose a direct threat to the natural and social environment) are more likely to mention responsibility and ethics in their missions than service and/or trade companies in the same industry.

Research limitations/implications: Only mission statements published on company websites were analyzed, perhaps excluding those that existed but were not posted online. The research was carried out only among Polish companies and so the conclusions should be limited to them only. To explore this trend in more depth, comparative analyses with companies from other industries and based in other countries should be conducted. This exploration would be facilitated by the use of techniques requiring direct contact, interviews, observations, surveys, case studies, etc.

Originality/value: No research on the missions of chemical companies in Poland in terms of communicating specific types of values, or respective comparative studies, have been identified. In the course of this independent research, an attempt was made to partially fill this research gap.

Keywords: chemical industry, mission statement, values, responsibility, ethics.

Category of the paper: Research paper.

¹ Trade and/or service.

1. Introduction

Chemical producers deal with products that improve the quality of life but also generate a wide range of threats the scale of which may be catastrophic (Sun, Stuebs, 2013; Dąbrowski, 2012). It is a particular line of business that comes burdened with high reputational risk towards which companies should take a proactive approach (Dąbrowski, 2012). The basis of this approach is the implementation of activities based on declared environmental and social values.

Chemical companies have a special need to signal to their surroundings their responsibility for the natural environment and social issues. This can be done from a strategic level, therefore the core values relating to such matters should be included in the companies' mission statements. Mission statement is a form of expression of organizational identity (Leuthesser, Kohli, 1997; Stuart 1999; Gray, Balmer 1998; Cunningham et al., 2009; Moss et al., 2010; Hirota et al., 2010; Scherer, 2017; Gauthier, Josien, 2017) which prioritizes values important for the organization (Helmig et al., 2015). At the same time it is a useful communication tool for companies and their inside and outside stakeholders to influence their perceptions (cf. Bartkus et al., 2004; Campbell, 1997; Law, Breznik, 2018; Lin et al., 2018; Lin, Ryan, 2016; Kemp, Dwyer, 2003).

No research has been found that would tackle mission statements of chemical companies in Poland in terms of communicating specific types of values. No respective comparative studies have been found either. The aim of the article is to answer the following research questions: Q₁: What types of values do chemical companies in Poland declare in their mission statements? Q₂: Do chemical companies in Poland declare values such as responsibility and ethics in their mission statements? Q₃: Do these companies differ from other chemical companies² in Poland in terms of declaring responsibility and ethics in mission statements?

The article consists of the following sections: introduction, literature review, methods, results, and conclusion.

2. Values as components of an organization's mission statement

Mission statement is an enduring organizational document of purpose that distinguishes one entity from other similar ones (Pearce, 1982; cf. Lin et al., 2018; Wheelen, Hunger, 2010; Vogt, 1994). The organization's 'credo', 'philosophy', 'core values', 'raison d'être', 'image creator' or 'distinguishing factor' are commonly used terms that describe the importance of the mission to the company (Dermol, Breznik, 2012; cf. Drucker, 1974; cf. Bartkus et al., 2000; Campbell, Yeung, 1991; Pearce, David, 1987; Vogt, 1994). It can be reactive (it describes what the

² Trade and/or service.

organization is doing now) or proactive (it contains forward-looking statements) (Bartkus et al., 2006). As a written declaration, it can be a useful tool for a company to communicate with its internal and external stakeholders (such as employees, customers, investors, suppliers, local communities, the public, or the media, etc.) and to influence their perceptions (cf. Bartkus et al., 2004; Campbell, 1997; Dermol, Nada, 2018; Kemp, Dwyer, 2003; Law, Breznik, 2018; Lin et al., 2018). Mission statement briefly explains to the environment what the organization stands for (Hirota et al., 2010).

Several authors enumerate different components of mission statements, e.g. customers, products/services, markets, technology, philosophy, commitment to stakeholders, desired public image etc. (cf. Ackoff, 1986; Bart, Tabone, 1999; David, 2005; Pearce, David, 1987; Rarick, Vitton, 1995). According to Campbell and Yeung (1991), De Wit and Meyer (2014), Jovanov Marjanova and Sofijanov (2014), Piercy and Morgan (1994), Wert (1986), the significant components of the mission statement are also values. Helmig et al. (2015; cf. Rokeach, 1968) emphasize that the declaration of the mission prioritizes values that are important to the organization.

Value is a key research category in sociology and cultural anthropology. It denotes a rule the subject of which is the right and desired goal of social action. Let us note that psychologists tend to understand the term 'value' slightly differently. Take Rokeach (1973; cf. Graeber, 2001; Giddens, 2008; Malmaeus, 2016) who defined a value as 'an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence'. Schwartz (1992), building on Rokeach's definition, termed values as desirable trans-situational goals, serving as the guiding principles in the life of a person or other social entity. He adopts a conception of values that specifies six main features: (1) Values are beliefs linked inextricably to affect, (2) Values refer to desirable goals that motivate action, (3) Values transcend specific actions and situations, (4) Values serve as standards or criteria, (5) Values are ordered by importance relative to one another, (6) The relative importance of multiple values guides action (Schwartz, 2012).

The category of 'values' has also become very important in management research. It enables understanding the priorities that organizations, both profit and non-profit, are governed by. Organizational values are different from, but related to, individual, cultural and societal values (Bourne et al., 2019). They are perceived as key to concepts such as organizational culture (Schein, 1985; Hofstede, 2001) and organizational identity (Albert, Whetten, 1985; Ashforth, Mael, 1989; Hatch, Schultz, 1997). There is still no consensus among scholars on the definition and conceptualization of organizational values (Bourne, Jenkins, 2013). Argandoña (2003, p. 21) states broadly that organizational values are accepted and shared values within an organization. They reflect the individual values of founders, aggregated 'shared' values of groups of members, those attributed to the organization, embedded in structures and processes, and those that represent collective beliefs with regard to its effective functioning, sanctioned and espoused by senior managers (Bourne, Jenkins, 2013). Bourne and Jenkins (2013) go on

to distinguish four distinct forms of organizational values – espoused, attributed, shared, and aspirational. The values presented in the text of the mission statement are 'espoused values' and it is on those specifically that we will focus in the remainder of this article.

Lastly, let us also point out that the literature body contains an enumeration of the main values present in different types of organizations. Calori and Samin (1991), Marcoulides and Heck (1993), as well as Cunningham et al. (2009) list the main values in trade companies, while van der Wal, de Graf and Lasthuizen (2008) do the same for public organizations. Non-trade entities, meanwhile, were researched by Helmig et al. (2015) who developed a catalog of economic values in the non-profit sector, whereas Whitman (2009) did the same for social values in philanthropic foundations.

3. Methods

The empirical research concerned the prevalence of exposing specific values in the mission statements of chemical companies in Poland. It was carried out in the third quarter of 2021. The procedure began with determining research questions, goals and hypotheses. Subsequently, the content of the mission of selected organizations representing the chemical industry was analyzed. This was achieved by defining the coding scheme, testing it, cleaning and or detailing it, and collecting, coding and analyzing the data.

Four business catalogues were used to identify chemical companies in Poland:

1. the Business Navigator website (<https://www.baza-firm.com.pl/...>; companies from the categories: 'construction chemicals', 'household chemicals', 'car chemicals and cosmetics', 'chemical raw materials and reagents', 'chemical agents, products - production, sale' were included);
2. the 'Chemia i Biznes' industry platform (<https://www.chemiaibiznes.com.pl/...>; companies from the 'chemical industry' category were included);
3. the financial website Wnp.pl (<https://www.wnp.pl/>; companies from the chemical sector were included);
4. the website of the Polish Chamber of Chemical Industry (PIPC) (<https://www.pipc.org.pl/>, PIPC members representing the chemical industry were included).

Eventually, a database with nearly 3,000 entries was developed. The companies were analyzed for whether they posted their missions on their corporate websites. This narrowed the sample down to 197 missions³ - 112 by production and trade companies, and 85 by service and/or trade companies). Next, it was verified which values were declared in those missions.

³ The websites were searched for terms other than just 'mission'. They were: 'strategic purpose', 'overriding goal' or 'main goal'.

When coding the values, the mission typology proposed by Cunningham et al. (2009) was used along with the following categories of values distinguished by them: company success, product superiority, competition focus, innovation, being the best, customer focus, diversity, value, ethics, employee focus, being helpful, responsibility and improving the quality of life.

The following research hypotheses were formulated:

H₁: Most of the surveyed chemical companies in Poland declare responsibility in their mission statements.

H₂: Most of the surveyed chemical companies in Poland declare ethics in their missions.

H₃: The surveyed chemical companies in Poland more often than other surveyed organizations⁴ in the same industry declare responsibility in their mission statements.

H₄: The surveyed chemical companies in Poland more often than other surveyed organizations in the same industry declare ethics in their mission statements.

The hypotheses were tested, among other methods, using a non-parametric test for independent random samples - the Mann-Whitney U test (with continuity correction)⁵.

4. Values declared in the missions of the surveyed chemical companies in Poland

Let us recall that when coding the values included in the missions of the surveyed chemical companies in Poland, the taxonomy of Cunningham et al. (2009) was used and the following categories of values were distinguished after them: company success, product superiority, competition focus, innovation, being the best, customer focus, diversity, value, ethics, employee focus, being helpful, responsibility, and improving quality of life .

The vast majority (95.94%) of the companies stressed in their mission statements the values included in the typology developed by Cunningham et al. (2009). It was found that most of the analyzed organizations (74.11%) claimed customer focus in their missions. Less frequently would they allude to values such as: responsibility (35.03%), innovation (28.93%), product superiority (28.93%). Relatively few companies emphasized the importance of the diversity of their activities (2.54%) or company success (1.02%) (Figure 1).

⁴ Trade and/or service.

⁵ It is used when the data is measurable but its distribution is not a normal distribution and when the variables are of the ordinal type (Blalock, 1975) [or when the variables are measured on a dichotomous scale (i.e. 0-1), as is the case of the categorical variable which is also an ordinal variable; http://www.naukowiec.org/wiedza/statystyka/test-u-manna-whitneya_755.html]. These conditions were met. As for the Mann-Whitney U test, the null hypothesis assumes that the types of distributions of the analyzed samples do not differ significantly from each other, while the alternative hypothesis - that they differ significantly from each other (Rabiej, 2012; Józwiak, Podgórski, 2009). If the p-value is below the adopted significance threshold, then we have grounds for rejecting the null hypothesis (Moczko, 2014).

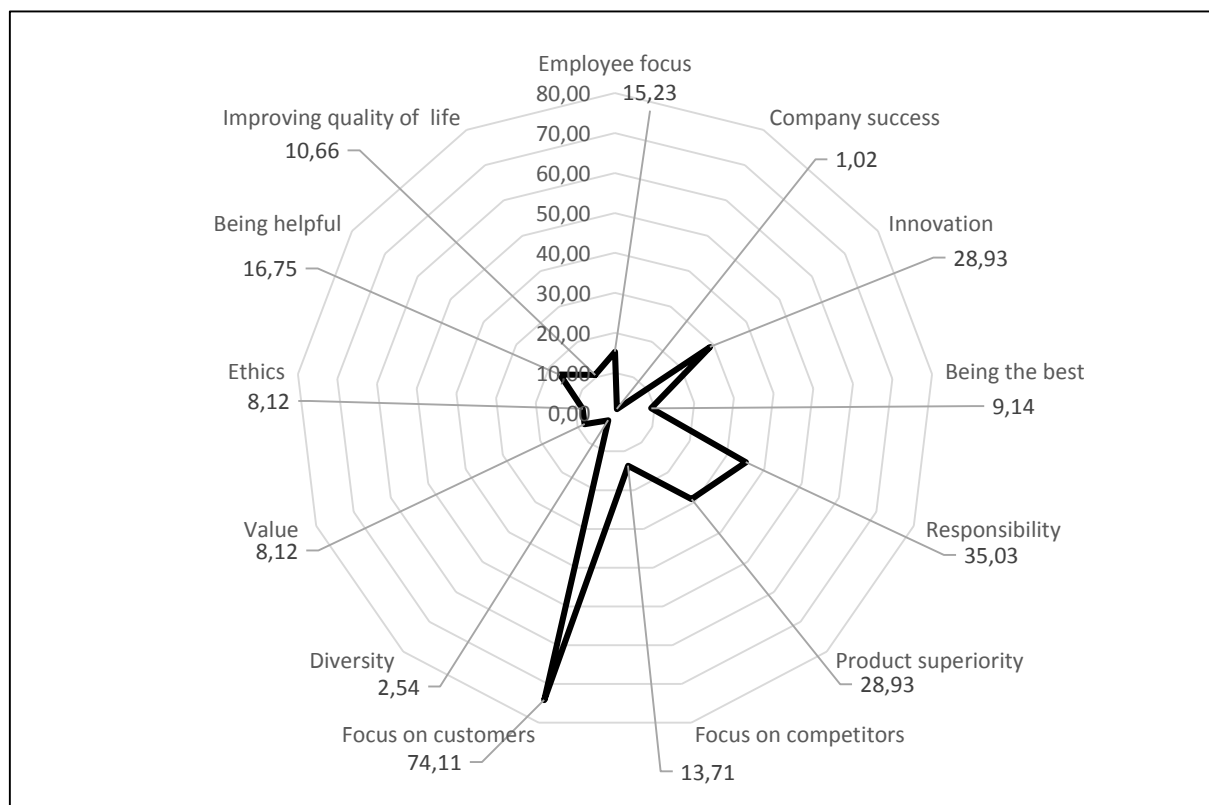


Figure 1. Categories of values in the mission statements of the surveyed chemical companies in Poland.
Source: own study.

During the research, possible correlations were searched for between the inclusion of individual types of values in mission statements and the type of business (production and trade vs. other). The Mann-Whitney U test used to this end showed grounds for rejecting 8 (out of 13) partial-conjunction null hypotheses concerning the following value categories: employee focus, innovation, responsibility, value, ethics, customer focus, being helpful, improving the quality of life (Table 1).

Table 1.

Mann-Whitney U test results (with continuity correction) (including company type and value type in the mission statement)

Values	Mann-Whitney U test (with continuity correction) (company type and type of values in the mission statement)								
	Rank sum – Group 1	Rank sum – Group 2	U	Z	P	Z adjusted	p	N valid - Group 1	N valid - Group 2
Employee focus	15567,00	2199,000	1734,000	2,325874	0,020026	2,715941	0,006609	158	30
Company success	17986,00	929,0000	595,0000	-0,954989	0,339584	-1,11275	0,265817	186	8
Innovation	13437,50	4328,500	2675,500	3,083664	0,002045	3,600818	0,000317	131	57
Being the best	16221,00	1545,000	1374,000	0,708320	0,478747	0,827111	0,408175	170	18
Responsibility	4928,000	12838,00	2582,000	-4,17716	0,000030	-4,87771	0,000001	68	120

Cont. table 1.

Product superiority	12309,50	5456,500	3663,500	-0,202662	0,839400	-0,236650	0,812929	131	57
Focus on competitors	2639,000	15127,00	1924,000	0,704680	0,481010	0,822861	0,410588	26	162
Diversity	16934,00	644,0000	281,0000	-1,45308	0,146202	-1,69562	0,089959	182	5
Value	1060,000	16706,00	924,0000	-2,16867	0,030109	-2,53237	0,011330	16	172
Ethics	16706,00	1060,000	924,0000	2,168669	0,030109	2,532372	0,011330	172	16
Focus on customers	14388,50	3377,500	2431,500	2,187504	0,028706	2,554366	0,010639	145	43
Being helpful	13778,50	3799,500	1997,500	-2,11224	0,034666	-2,46480	0,013709	153	34
Improving quality of life	16191,00	1575,000	1322,000	2,099393	0,035783	2,451478	0,014228	166	22

Note:

* U – Mann-Whitney test value used for small numbers < 20

* Z – Mann-Whitney test value used when number of both groups is greater than 20

* P – significance level for the test for the Z test value

* Z adjusted – test value adjusted for combined weights

* p – significance level for Z adjusted

* N valid – numerical amount of groups

– highlighted results significant at $p < ,05000$

Source: own study.

Research also showed that production and trade companies more often than others in the same industry stressed values such as: responsibility (50.00% vs. 15.29%), innovation (40.18% vs. 15.29%), focus on employees (21.43% vs. 7.06%), improved quality of life (07/16 vs. 4.71%), value (12.50% vs. 2.35%), ethics (12.50% vs. 2.35%) (Table 2).

Table 2.

Categories of values in the missions of chemical companies in Poland - production and trade vs. others (trade and/or service)

Values	Company type					
	production and trade		others (trade and/or service)		sum	
	N	[%]	N	[%]	N	[%]
Focus on customers	77	68,75	69	81,18	146	74,11
Responsibility	56	50,00	13	15,29	69	35,03
Innovation	45	40,18	13	15,29	58	29,44
Product superiority	32	28,57	25	29,41	57	28,93
Being helpful	13	11,61	21	24,71	34	17,26
Employee focus	24	21,43	6	7,06	30	15,23
Focus on competitors	14	12,50	13	15,29	27	13,71
Improving quality of life	18	16,07	4	4,71	22	11,17
Being the best	12	10,71	6	7,06	18	9,14
Value	14	12,50	2	2,35	16	8,12
Ethics	14	12,50	2	2,35	16	8,12
Diversity	1	0,89	4	4,71	5	2,54
Company success	1	0,89	1	1,18	2	1,02

Source: own study.

Meanwhile, the opposite turned out to be true for values such as customer focus (68.75% vs. 81.18%) and being helpful (11.61% vs. 24.71%).

5. Conclusions

The activity of chemical companies comes burdened with high risk related to the occurrence of ecological and social threats. This entails the presence of a significant reputational risk in their functioning. They must therefore do business in a particular way on the basis of declared values, signaling to their surroundings that they are not indifferent to the natural environment and social issues.

Mission statement is the basic strategic document which is why we used it as a benchmark to assess whether chemical companies in Poland communicate through it values related to responsibility and ethics. The results show that everyone in two (50.00%) companies mentions responsibility in their mission statement, while every eighth (12.50%) mentions ethics. Consequently, the H₁ and H₂ hypotheses were not confirmed. Let us note, however, that the surveyed chemical companies much more often communicate responsibility than ethics in their mission statements.

During the research, a comparative study was also carried out. The analysis of the collected empirical data showed that chemical companies involved in production and trade more frequently emphasized responsibility and ethics in their mission statements as compared with service and/or trade companies in the same industry. Consequently, the H₃ and H₄ hypotheses were confirmed. It seems that producers that pose a direct threat to the natural and social environment are more likely to communicate responsibility and ethics in mission statements.

Having said all that, the conducted research had its limitations. Only mission statements published on company websites were analyzed, perhaps excluding those that existed but were not posted online. The research was carried out only among Polish companies and so the conclusions should be limited to them only. To explore this trend in more depth, comparative analyses with companies from other industries and based in other countries should be conducted. This exploration would be facilitated by the use of techniques requiring direct contact, interviews, observations, surveys, case studies, etc.

References

1. Albert, S., Whetten, D.A. (1985). Organizational Identity. In: B.M. Staw, L.L. Cummings (Eds.), *Research in Organizational Behavior* (pp. 263-295). Greenwich: JAI Press.
2. Argandona, A. (2003). Fostering Values in Organizations. *Journal of Business Ethics*, No. 45, pp. 15-28.
3. Ashforth, B.E., Mael, F. (1989). Social Identity Theory and the Organization. *Academy of Management Review*, No. 14(1), pp. 20-39.

4. Babbie, E. (2008). *Podstawy badań społecznych*. Warszawa: PWN.
5. Bartkus B., Glassman M., McAfee, B. (2006). Mission Statement Quality and Financial Performance. *European Management Journal*, Vol. 24(1), pp. 86-94, doi:10.1016/j.emj.2005.12.010.
6. Bartkus, B., Glassman, M., McAfee, B. (2000). Mission statements: are they smoke and mirrors? *Business Horizons*, XI/XII, p. 23, doi: 10.1016/S0007-6813(00)80018-X.
7. Bartkus, B.R., Glassman, M., McAfee, B. (2004). A Comparison of the quality of European, Japanese and U.S. mission statements. *European Management Journal*, Vol. 22(4), pp. 393-401, doi: 10.1016/j.emj.2004.06.013.
8. *Baza Firm Business Navigator*. Retrieved from: <https://www.baza-firm.com.pl/Chemia-budowlana/strona-2/>, 15.07.2021.
9. Blalock, H. (1975). *Statystyka dla socjologów*. Warszawa: PWN.
10. Bourne, H., Jenkins, M. (2013). Organizational Values: A Dynamic Perspective. *Organization Studies*, No .34(4), pp. 495-514, doi: 10.1177/01708406124671.
11. Bourne, H., Jenkins, M., Parry, E. (2019). Mapping Espoused Organizational Values. *Journal of Business Ethics*, Vol. 159, pp. 133-148, doi: 10.1007/s10551-017-3734-9.
12. Calori, R., Samin, Ph. (1991). Corporate culture and economic performance: a French 18 study. *Organization Studies*, Vol. 12, No. 1, pp. 49-74, doi: org/10.1177/19017084069101200104.
13. Campbell, A. (1989). Does your organisation need a mission? *Leadership & Organization Development Journal*, No. 10(3), pp. 3-9, doi: 10.1108/EUM0000000001134.
14. Campbell, A. (1997). Mission Statements, *Long Range Planning*, Vol. 30(6), pp. 931-933, doi: 10.1016/S0024-6301(97)00084-8.
15. Campbell, A., Yeung, S. (1991). Creating a sense of mission. *Long Range Planning*, Vol. 24, pp. 17-23, doi: 10.1016/0024-6301(91)90002-6.
16. *Chemia i Biznes*. Retrieved from: <https://www.chemiaibiznes.com.pl/katalog-firm/przemysl-chemiczny>, 15.07.2021.
17. Cunningham, S., Cornwell, T.B., Coote, L.V. (2009). Expressing Identity and Shaping Image: The Relationship Between Corporate Mission and Corporate Sponsorship. *Journal of Sport Management*, Vol. 23, pp. 65-86, doi: 10.1123/jsm.23.1.65.
18. Dąbrowski, T.J. (2012). Zagrożenie reputacji firm chemicznych. *Przemysł Chemiczny*, No. 94(11), pp. 2095-2098.
19. De Wit, B., Meyer, R. (2014). *Strategy Synthesis: Resolving Strategy Paradoxes To Create Competitive Advantage*. Hampshire: Cengage Learning.
20. Dermol, V., Breznik, K. (2012). Identifying the mission statement's clusters in Slovenian economy. In: Z. Pastuszak (Ed.), *Competences, Synergy and International Competitiveness Influence on the Technology Innovation and Industrial Management* (pp. 798-806). Lublin: Maria Skłodowska-Curie University.

21. Dermal, V., Nada, T. (2018). Communication, Company Mission, Organizational Values, and Company Performance. *Procedia - Social and Behavioral Sciences, Vol. 238*, pp. 542-551, doi:10.1016/j.sbspro.2018.04.034.
22. Drucker, P. (1974). *Management: Tasks, Responsibilities, and Practices*. New York: Harper & Row.
23. Gauthier, J., Josien, L. (2017). Mission statements and responsiveness to stakeholders: an exploratory study of social ventures. *Global Journal of Business Disciplines, Vol. 1(1)*, pp. 111-121.
24. Giddens A. (2008). *Socjologia*. Warszawa: PWN.
25. Graeber, D. (2001). *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams*. New York: Palgrave.
26. Gray, E.R., Balmer, J.M. (1998). Managing corporate image and corporate reputation. *Long Range Planning, Vol. 31, No. 5*, pp. 695-702, doi: 10.1016/S0024-6301(98)00074-0.
27. Hatch, M.J., Schultz, M. (1997). Relations between organizational culture, identity and image. *European Journal of Marketing, No. 31(5-6)*, pp. 356-365.
28. Helmig, B., Hinz, V., Ingerfurth, S. (2015). Valuing organizational values: assessing the uniqueness of nonprofit values. *Voluntas, Vol. 26(6)*, pp. 2554-2580, doi: 10.1007/s11266-014-9530-6.
29. Hirota, S., Kubo, K., Miyajima, H., Hong, P., Park, Y.W. (2010). Corporate mission, corporate policies and business outcomes: evidence from Japan. *Management Decision, No. 48(7)*, pp. 1134-1153, doi: 10.1108/00251741011068815.
30. Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations*. Thousand Oaks: Sage.
31. Józwiak, J., Podgórski, J. (2009). *Statystyka od podstaw*. Warszawa: PWE.
32. Kemp, S., Dwyer, L. (2003). Mission statements of international airlines: A content analysis. *Tourism Management, Vol. 24(6)*, pp. 635-653, doi: 10.1016/S0261-5177(03)00049-9.
33. Law, K.M.Y., Breznik, K. (2018). What do airline mission statements reveal about value and strategy? *Journal of Air Transport Management, Vol. 70*, pp. 36-44, doi: 10.1016/j.jairtraman.2018.04.015.
34. Leuthesser, L., Kohli, C. (1997). Corporate identity: the role of mission statements. *Business Horizons, Vol. 40, No. 3*, pp. 59-66.
35. Lin, Y., Ryan, C., Wise, N. Low, L.W. (2018). A content analysis of airline mission statements: Changing trends and contemporary component. *Tourism Management Perspectives, Vol. 28*, pp. 156-165, doi: 10.1016/j.tmp.2018.08.005.
36. Malmaeus, M. (2016). Economic Values and Resource Use. *Sustainability, Vol. 8*, p. 490. doi:10.3390/su8050490.

37. Marcoulides, G.A., Heck, R.H. (1993). Organizational culture and performance: proposing and testing a model. *Organization Science*, Vol. 4, No. 2, pp. 209-225. doi: 10.1287/orsc.4.2.209.
38. Moczko, J.A. (2014). Czy zawsze prawidłowo interpretujemy wyniki statystycznych testów nieparametrycznych. *Prace Poglądowe*. Retrieved from: http://www.wple.net/plek/numery_2014/numer-11-2014/654-658.pdf, 1.07.2019.
39. Moss, T.W., Short, J.C., Payne, G.T., Lumpkin, G.T. (2011). Dual identities in social ventures: an exploratory study. *Entrepreneurship Theory and Practice*, July, pp. 805-830, doi: 10.1111/j.1540-6520.2010.00372.x.
40. *Naukowiec.org*. Retrieved from: http://www.naukowiec.org/wiedza/statystyka/test-u-manna-whitneya_755.html, 20.12.2021.
41. Pearce, J.A. II (1982). The company mission as a strategic tool. *Sloan Management Review*, No. 23, pp. 74-85.
42. Pearce, J.A. II, David, F. (1987). Corporate mission statements: the bottom line. *Academy of Management Executive*, No. 1(2), pp. 109-116, doi: 10.5465/AME.1987.4275821.
43. *Polska Izba Przemysłu Chemicznego*. Retrieved from: <https://www.pipc.org.pl/>, 15.07.2021.
44. Rabiej, M. (2012). *Statystyka z programem STATISTICA*. Gliwice: Helion.
45. Rokeach, M. (1968). *Beliefs, attitudes, and values: A theory of organization and change*. San Francisco: Jossey-Bass.
46. Rokeach, M. (1973), *The Nature of Human Values*. New York: Free Press.
47. Schein, E. (1985). *Organizational culture and leadership*. San Fransisco: Jossey-Bass.
48. Scherer, S.C. (2017). Organizational identity and philanthropic institutions. Patterns of strategy, structure, and grant making practices. *Nonprofit Management and Leadership*, Vol. 28(1), pp. 105-123, doi:10.1002/nml.21266.
49. Schwartz, S.H. (1992). Universals in the content and structure of values: Theory and empirical tests in 20 countries. In: M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 25, pp. 1-65). New York: Academic Press.
50. Schwartz, S.H. (2012). An Overview of the Schwartz Theory of Basic Values. *Online Readings in Psychology and Culture*, No. 2(1), pp. 1-20, doi:10.9707/2307-0919.1116.
51. Silverman, D. (2009). *Interpretacja danych jakościowych*. Warszawa: PWN.
52. Stuart, H. (1999). Towards a definitive model of the corporate identity management process. *Corporate Communications: an International Journal*, No. 4(4), pp. 200-207, doi:10.1108/13563289910299328.
53. Sun, L., Stuebs, M. (2013). Corporate Social Responsibility and Firm Productivity: Evidence from the Chemical Industry in the United States. *Journal of Business Ethics*, Vol. 118, pp. 251-263, doi: 10.1007/s10551-012-1579-9.
54. van der Wal, Z., de Graf, G., Lasthuizen, K. (2008). What's Valued Most? A Comparative Empirical Study on the Differences and Similarities between the Organizational Values of

- the Public and Private Sector. *Public Administration*, Vol. 86(2), pp. 465-482. doi:10.1111/j.1467-9299.2008.00719.x.
55. Vogt, J. (1994). Demystifying the mission statement, *Nonprofit World*, No. 12(1), pp. 29-31.
56. Wheelen, T., Hunger, J. (2010). *Strategic Management and Business Policy*. Upper Saddle River: Pearson Prentice Hall.
57. Whitman, J.R. (2009). Measuring social values in philanthropic foundations. *Nonprofit Management and Leadership*, Vol. 19, pp. 305-325, doi: 10.1002/nml.221.
58. *Wnp.pl Portal Gospodarczy*. Retrieved from: <https://www.wnp.pl/>, 15.07.2021.

RELIABILITY OF RESEARCH INSTRUMENTS IN MANAGEMENT SCIENCES RESEARCH: AN EXPLANATORY PERSPECTIVE

Olayinka Abideen SHODIYA^{1*}, Tijani Abideen ADEKUNLE²

¹ Department of Business & Finance, Crescent University, Abeokuta, Nigeria; olayinkashodiya@yahoo.com, ORCID: 0000-0002-5551-3335

² Department of Business Administration, Lagos State University, Ojo, Lagos State; abadeen080@yahoo.com, ORCID: 0000-0002-8530-5959

* Correspondence author

Purpose: The reliability of test scores is the extent to which they are consistent across different occasions of testing, different editions of the test, or different raters scoring the test taker's responses. The purpose of this study is to assess the various approaches in determining the reliability of research instruments in management sciences research.

Design/methodology/approach: The study used an exploratory research technique and relied on information from previous studies and publications, including journals, textbooks, periodicals, and the internet.

Findings: Consequence upon several articles reviewed on the subject matter by different researchers on reliability of research instrument, it was observed that some scholars were able to test and measure data credibility through different modes such as internal consistency, inter rater, alternate form and reliability coefficient.

Practical implications: The paper explored all of the pertinent concerns surrounding quantitative research instrument reliability and reviewed test reliability which include but not limited to: "alternate-forms reliability," "inter-rater reliability," "internal consistency," "reliability coefficient," "classification consistency," with illustrations.

Originality/value: Popular and commonly used reliability assessment approaches in Nigeria and in the field of management are the use of Cronbach alpha and Test-retest reliability tests for instrument reliability. Despite these, there are different types of reliabilities which are less reported in the field of management in the Nigeria academia. Based on this, the study reviewed various approaches and types of reliability test commonly utilised in Management sciences.

Keywords: Research Instrument, Reliability, Alternate-forms Reliability, Inter-rater Reliability, Internal Consistency.

JEL CODE: M30.

1. Introduction

Questionnaire surveys are a valuable technique for gathering information from respondents in a range of situations, including self-reported outcomes in management research. Research always utilise surveys to gauge something, as such, surveys may be thought of as a measuring tool. Surveys can evaluate behaviours, attitudes, and views in the same manner that thermometers measure temperature and potential of hydrogen metres detect acidity. Surveys are frequently used to assess more sophisticated and varied human behaviours or qualities, referred to as constructs. Because they are complicated and varied, they are better assessed by asking a series of linked questions about various facets of the construct of interest. Individual replies to these questions can then be used to generate a score or scale measure along a continuum. In any research, estimating reliability is critical (Imasuen, 2022). To attain the research aim, we are generally faced with the question of whether we can be certain that when the repeated measurements are made, we will receive the same result. The amount to which an investigation, test, or measurement process delivers the same result on multiple testing is referred to as reliability. If a test is completely reliable, there really is no measurement error; everything we see is the true score (Imasuen, 2022). In every research, estimating reliability and validity is critical. To reach the study aim, the researcher is frequently faced with two difficulties. The first is how can the researcher ensure that research instruments are evaluating whatever he/she want to measure?" "How sure is researcher that he/she will receive the same result if he/she reruns the measurement?" As a result, the researcher of this study feel that a critical review of the idea, as well as assessment tools in the dependability of data gathered through tests or questionnaires, is necessary to improve management sciences research.

Statement of the Problem

In business and management research, utilising data at face value without screening for potential errors and bias or measuring dependability cannot be trusted (Flintermann, 2014). Several academics have sought to build tools and procedures for gauging reliability in order to boost researchers' trust in the use of quantitative data. The most popular and commonly used reliability assessment approach in Nigeria and in the field of management sciences as far as researcher knowledge is concerned are the use of Cronbach alpha and Test-retest reliability tests for instrument reliability (Imasuen, 2022). Despite this, there are different types of reliabilities which are less reported in the field of management in the Nigeria academia. Based on this, the study carryout a review of the various approaches and types of reliability test commonly utilised in Management sciences.

Objective of the Study

To assess the various approaches in determining the reliability of research instruments in management sciences research.

Methodology of the Study

The study used an explanatory research technique and relied on information from previous studies and publications, including journals, textbooks, periodicals, and the internet. The paper explores all of the pertinent concerns surrounding quantitative research instrument reliability.

Reliability in Management Research

In quantitative management sciences research, measurements of social concepts are carried out by using measuring instruments (i.e. questionnaire). The measuring instrument is reliable when it yields consistently the same or comparable results over repeated measures (Ahmed et al., 2022). That is, regardless of who performs the measurement, and the occasion and condition under which measurement was carried out, the results produced by the measuring instrument is consistent (or comparably consistent) (Mohajan, 2017). Therefore, reliability in management sciences is regarded as the accuracy of a measuring instrument in quantitative management sciences research (Heale, Twycross, 2015). Therefore, for the management sciences researcher, the challenge of reliability is to develop measuring instruments to obtain the true values of measured concepts to reduce error in measurement process. This requires the testing of reliability of measuring instruments (Heale, Twycross, 2015). The three attributes of reliability that are often tested are: stability, homogeneity or internal consistency and equivalence.

Stability

Stability refers to the ability of a measure to remain the same over time without controlling the testing conditions or respondent themselves (Mohajan, 2017). Therefore, a perfectly stable measuring instrument will produce the same results when administered time after time to collect data (Bannigan, Watson, 2009) and this is obtained by performing the test-retest reliability method.

Internal consistency

Internal consistency (or homogeneity) concerns the reliability within the measuring instrument and it questions how well a set of items (or variables) measures a concept that is being tested (or measured) (Ahmed et al., 2022). According to Kimberlin et al. (2008), the assumption of internal consistency is that items (or variables) measuring the same concept should correlate, and therefore, the coefficient of internal consistency provides an estimate of the reliability of measurement. In other words, the more interrelated (undimensional) the items

are, the higher the calculated reliability coefficient (estimate) (Ekolu, Quainoo, 2019). The estimate is obtained by calculating the average inter correlations among all single items (or variables) in a concept, or a test ((Ahmed et al., 2022) using one or more of the following methods: split-half reliability, Kuder-Richardson coefficient, Cronbach's alpha and inter-item consistency (inter-rater reliability) (Ahmed et al., 2022). However, there is no clarity around the interpretation of reliability estimates but estimates < 0.5 have been considered acceptable in research (Ekolu, Quainoo, 2019).

Equivalence

Equivalence establishes the extent to which the measuring instrument collects information in a consistent manner. According to Heale et al. (2015), equivalence is established by evaluating the consistency among (1) responses of multiple users of an instrument (inter-rater reliability) and (2) among alternate forms of an instrument (parallel-form or alternate-form reliability). Often, observational instruments or rating scales are developed to evaluate the behaviours of subjects who are being directly observed. However, any measure that relies on the judgments of raters or reviewers requires evidence that any independent, trained expert would come to the same conclusion (Ahmed et al., 2022). It is useful because human observers will not necessarily interpret answers the same way; raters may disagree as to how well certain responses or material demonstrate knowledge of the construct being assessed (Mohajan, 2017).

2. When to apply reliability testing for instrument

2.1. During a new scale or measure development

In Psychometric analysis, the researcher must assess whether the new scale has construct reliability. Once a new scale of measurement there is an important need to test to see if it is reliable; that is, to see if the scale items are internally consistent (Badenes-Ribera, Silver, Pedroli, 2020). Scale development and validation of scores is not a job to be taken on lightly. Development is a rigorous process which is based on item generation and content validation using expert feedback and pre-testing. In fact, it may take numerous iterations for the scale to be economically feasible and yet convey the appropriate construct (Badenes-Ribera, Silver, Pedroli, 2020). Reliability is usually done after item generation where items through pilot testing, in a larger sample after scale or measure has been established and follow-up when tested in another study location.

2.2. Pre-testing before a main study

A pilot survey is essentially a copy and trail of the main survey. The goal of doing a pilot study is to identify any flaws in the measurement device. It is concerned with whether the respondents decode the information intended to be measured very well before administering it to a larger sample to avoid wastage or to reduce number of items. The key advantage of pilot testing is that it allows the researcher to spot problems before launching the complete survey. The purpose of pilot testing is to determine the reliability as part of the validity for of each question. Items with poor reliability are removed at this stage (Kimberlin, Winterstein, 2008).

2.3. During main Cross-sectional studies and large survey to eliminate response bias detect measurement errors

Reliability implies consistency but not accuracy. Self-reports of behavior are particularly subject to problems with social desirability biases. Subjects may provide responses that are socially acceptable or that are in line with the impression they want to create. In addition, self-report questions may elicit an estimation of behavioral frequency rather than the recall and count response desired by the researcher (Kimberlin, Winterstein, 2008).

2.4. Repeated studies

Part of Reliability is that a condition where a measurement process yields consistent scores (given an unchanged measured phenomenon) over *repeat* measurements. A repeated measurements design is a type of study design in which several measures from same variable are performed with the same or matched participants under variable circumstances or over two different time periods. In longitudinal research, for example, repeated measures are gathered to analyse change over time. Therefore, every trial includes the assessment foe consistency over time (Badenes-Ribera, Silver, Pedroli, 2020).

2.5. When a scale or measurement is adapted or adopted

Whenever a measure is adopted, the validity and reliability research from previous studies on that instrument may be applied to the present study, such that a new validity is not established but requires reliability evidence. Adopting an instrument connects the study to all prior research studies that utilised the same instrument by showing that the measure has the same consistency level as the previous studies. However, when an instrument is modified, it has been drastically altered, and earlier reliability and validity results will no longer apply to the current investigation. Thus, while adopting or altering an existing scale, dependability is achieved (Korb, 2013).

3. Types of reliability

There are four categories of dependability. Each of the four broad groups of reliability estimations evaluates dependability in a different way. They are as follows:

1. Internal Consistency Reliability: This term is used to describe the consistency of outcomes across items in a test.
2. Test-Retest Reliability: Used to analyse a measure's consistency from one time to the next.
3. Inter-Rater or Inter-Observer Reliability: This term refers to how well various raters/observers estimate the same phenomena.
4. Parallel-Forms Reliability: A measure of the consistency of the outcomes of two tests built in the same fashion from the same content domain.

4. Internal consistency reliability tools

Internal consistency measures the relationship between many items in a test which are meant to evaluate the same construct. Internal consistency is assessed without having to repeat the test or involve additional researchers. If there's only one data set, it is an excellent technique to measure reliability. The researcher creates a number of questions or ratings which is merged into an aggregate score, ensuring that all of the things truly represent the same thing. If replies to multiple items contradict each other, the test may be untrustworthy. This is carried out in three-ways which include:

4.1. Average Inter-item Correlation

The average inter-item correlation employs all of our instrument's items that are meant to assess the same construct. As shown in Figure 1, the analyst will first calculate the significant relation amongst each pair of items. For instance, if there are six things, there will be 15 potential item pairs generated (i.e., 15 correlations). The average inter-item correlation is summation of all these correlations. The researcher discovers an average inter-item correlation of .90 in the illustration, with participant correlations ranging from .84 to .95.

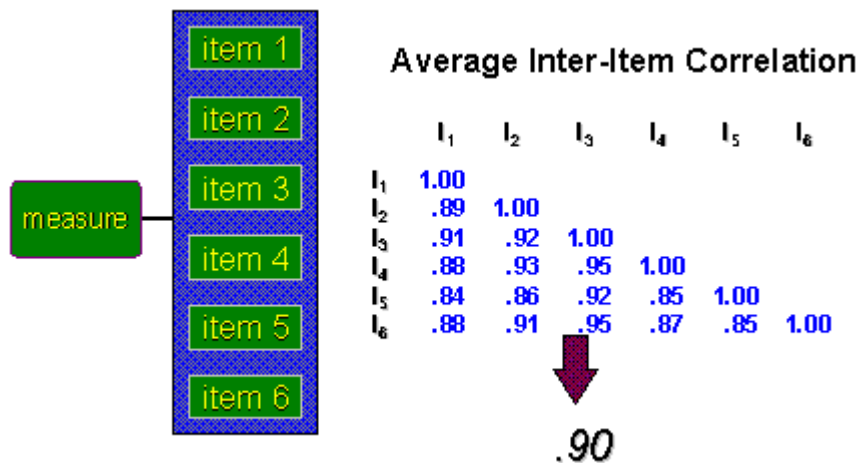


Figure 1. Average total correlation of 6 -item scale.

Source: Retrieved July 21, 2022, from <https://conjointly.com/kb/types-of-reliability/>.

4.2. Split-half

The split-half method measures the degree of internal consistency by checking one half of the results of a set of scaled items in a measuring instrument against the other half (Ahmed et al., 2022). It requires only one administration of the measuring instrument (Mohajan, 2017), but the items in the instrument are split in half in several ways, for example, first half and second half, or by odd and even numbered items, to form two new measures testing the same social phenomena (Ahmed et al., 2022). In contrast to the test-retest reliability, the split-half method is usually measured in the same time (Ahmed et al., 2022). When the results are divided into in half, correlations are calculated comparing both halves (Heale, Twycross, 2015). Indeed, strong correlations indicate high reliability, while weak correlations indicate the instrument may not be reliable (Ahmed et al., 2022; Heale, Twycross, 2015). The method demands equal item representation across the two halves of the instrument, otherwise, the comparison of dissimilar sample items will not yield an accurate reliability estimate (Ahmed et al., 2022). In split-half reliability we randomly divide all items that purport to measure the same construct into two sets. The researcher administer the entire instrument to a sample of people and calculates the total score for each randomly divided half. The split-half reliability estimate, as shown in the figure, is simply the correlation between these two total scores. In the example it is .87.

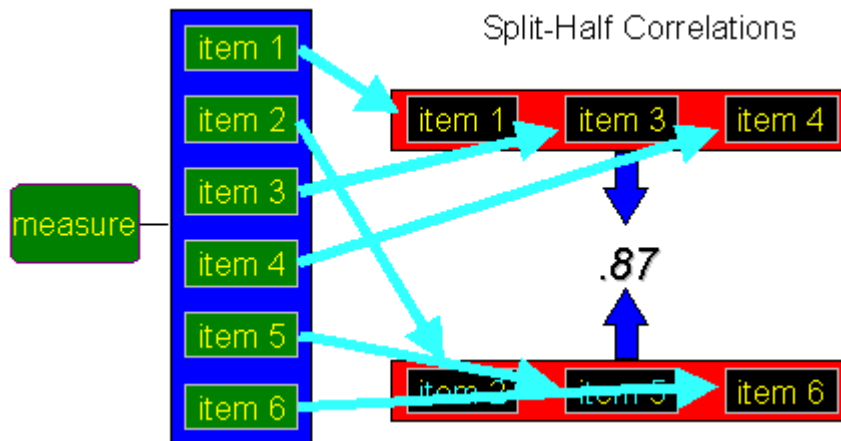


Figure 2. Split half-reliability for 6 -item scale.

Source: Retrieved July 21, 2022, from <https://conjointly.com/kb/types-of-reliability/>.

4.3. Cronbach alpha

The Cronbach alpha is used to measure the internal consistency of a set of items/variables measuring a construct/concept. Therefore, it measures the degree to which the different items/variables, especially those that each yield numerical response (Lam et al., 2010), but measuring the same construct/concept attains consistent results (Ahmed et al., 2022). The scores on the items/variables designed to measure the same construct/concept should be highly correlated (Ahmed et al., 2022). Therefore, Cronbach's alpha is a function of the average inter-correlations of items and the number of items in the scale (Ahmed et al., 2022; Mohajan, 2017). Of note is that having multiple items to measure a construct/concept aids in the determination of the reliability of measurement and, in general, improves the reliability or precision of the measurement (Ahmed et al., 2022). Instruments with questions that have more than two responses can be used in this test (Heale, Twycross, 2015), but the greater the number of items in a summated scale, the higher Cronbach's alpha tends to be (Ahmed et al., 2022). The Cronbach's alpha result is a number between 0 and 1. An acceptable reliability score is one that is 0.7 and higher (Heale, Twycross, 2015). Most analytic tools will also automatically calculate the value of Cronbach's alpha if a question or survey item in the scale is eliminated. These values can indeed be examined to determine if the scale's reliability can be improved by discarding any one of the questionnaire items, as shown in the example below.

Table 1.

Summary of the Reliability value of 6-item scale using Cronbach Alpha

Reliability statistics

Cronbach's alpha	Corrected item-total correlation	Cronbach's alpha if item deleted
0.866	Q1: 0.830	0.820
	Q2: 0.682	0.839
	Q3: 0.746	0.831
	Q4: 0.494	0.893
	Q5: 0.700	0.838
	Q6: 0.682	0.840

Source: Morrison, J. (2019, May 30). *Assessing Questionnaire Reliability - Select Statistical Consultants*. Select Statistical Consultants; <https://select-statistics.co.uk/blog/assessing-questionnaire-reliability/>.

Cronbach's alpha for the scale created from these six survey questions is 0.866. The fourth survey item (Q4) does have the poorest association with another questions, and eliminating it from the measure will enhance reliability, raising Cronbach's alpha to 0.893. However, these tests only apply to instruments with a likert scale; however, the Kuder Richardson reliability test is an option for bivariate rating.

4.4. Kuder-Richardson

According to Sarmah and Hazarika (2012), the Kuder-Richardson method was introduced by Kuder-Richardson, a psychometrist, in 1937. The Kuder Richardson method is like the split-half method except that it is used to measure the degree of internal consistency of items consisting of only two responses (e.g. yes or no, 0 or 1) in a measuring instrument. The method assumes that all items of a test are of equal or almost equal difficulty and inter correlated (Sarmah, Hazarika, 2012). The common Kuder-Richardson method formula is known to be Kuder-Richardson formula 20 or KR20, which was later simplified to be Kuder-Richardson formula 21 or KR21 (equation shown below). Their difference is that KR21 can produce a direct estimation of reliability using a minimal dataset with only the number of test items, mean and variance (Ekolu, Quainoo, 2019). According to Heale et al. (2015), it is calculated by the average of all possible split-half combinations and a correlation between 0 and 1 is generated. Like the split-half method, strong correlations indicate high reliability; while weak correlations indicate the instrument may not be reliable (Kaji, Lewis, 2008). In applying the KR formula, it is assumed that all the test items are of the same level of difficulty. KR21 gives reliability index values lying between 0 and 1, as does Cronbach's alpha (Ekolu, Quainoo, 2019). The Kuder-Richardson Formula 20 is as follows:

$$KR-20 = (k / (k-1)) * (1 - \sum p_j q_j / \sigma^2)$$

where:

k - Total number of questions.

p_j - Proportion of individuals who answered question j correctly.

q_j - Proportion of individuals who answered question j incorrectly.

σ^2 -Variance of scores for all individuals who took the test.

The value for KR-20 ranges from 0 to 1, with higher values indicating higher reliability. The following example shows how to calculate the value for KR-20 in practice. Suppose a questionnaire with 7 questions was administered a test to 10 students to rate their knowledge about a particular product. The perception was rated on a yes or no scoring and the scores is rendered the in Excel, with 1 indicating a correct answer and 0 indicating an incorrect answer.

Table 2.

Summary of the Reliability value of 7-item using Kurder-Richardson KR-20

	A	B	C	D	E	F	G	H	I
1	Student	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total Correct
2	1	0	1	1	0	1	1	1	5
3	2	1	1	1	1	0	0	0	4
4	3	1	1	1	1	0	1	1	6
5	4	1	1	0	0	1	1	0	4
6	5	0	1	1	1	1	0	1	5
7	6	1	0	1	0	1	1	0	4
8	7	1	1	0	0	0	0	0	2
9	8	1	1	0	1	0	1	0	4
10	9	0	0	1	1	0	0	0	2
11	10	1	1	1	0	1	0	1	5
12									
13	p	0.7	0.8	0.7	0.5	0.5	0.5	0.4	
14	q	0.3	0.2	0.3	0.5	0.5	0.5	0.6	
15	pq	0.21	0.16	0.21	0.25	0.25	0.25	0.24	
16									
17	k	7.0000							
18	Σpq	1.5700							
19	σ^2	1.6556							
20	KR-20	0.0603							

Source: Zach, V. (2022, January 7). *Kuder-Richardson Formula 20 (Definition & Example)* - Statology. Statology; [www.statology.org. https://www.statology.org/kuder-richardson-20/](https://www.statology.org/kuder-richardson-20/).

Here are the formulas used in various cells:

B13: =SUM(B2:B11)/10.

B14: =1-B13.

B15: =B13*B14.

B17: =COUNTA(B1:H1).

B18: =SUM(B15:H15).

B19: =VAR.S(I2:I11).

B20: =(B17/(B17-1))*(1-B18/B19).

The KR-20 value turns out to be 0.0603. Because this number is so low, it shows that the test is unreliable. This means that the items may have to be rewritten or restructured in order to improve the test's reliability.

5. Test-retest reliability method

The test-retest reliability refers to the temporal stability of test from one measurement session to another (Ahmed et al., 2022). It is obtained by administering the same test twice, or more over a period ranging from few weeks to months, on a group of individuals (respondents) (Mohajan, 2017) under similar circumstances (Heale, Twycross, 2015). The procedure is to administer the test to a group of respondents and then administer the same test to the same respondents later (Ahmed et al., 2022). Thereafter, a statistical comparison is made between participant's test scores (values) for each of the times they have completed it to provide an indication of the reliability of the instrument (Heale, Twycross, 2015). For example, construction workers may be asked to complete the same questionnaire about safety satisfaction twice in three months so that test results can be compared to assess stability of scores. The correlation coefficient calculated between two sets of data, and the higher the coefficient, the better the test-retest reliability (and stability) (Mohajan, 2017). Test-retest reliability is defined by the correlation between scores (values) on the identical tests given at different times (Ahmed et al., 2022) and this leads to some limitations. For instance, when the interval between the first and second test is too short, respondents might remember what was on the first test and their answers on the second test could be affected by memory. Alternatively, when the interval between the two tests is too long, maturation happens – which is the changes in the subject factors (measured variables) or respondents that occur over time and cause a change from the initial measurements to the later (Ahmed et al., 2022). During the time between the two tests, the respondents could have been exposed to things which changed their opinions, feelings or attitudes about the behaviour under study (Ahmed et al., 2022). Ideally, the interval between administrations should management sciences long enough that values obtained from the second administration will not management sciences affected by the previous measurement but not so

distant that learning or a change in health status could alter the way subjects respond during the second administration.

Consider a group of students who have been asked to describe how knowledgeable they are about a particular available at the time. The reported responses were recorded using the following scale, 0 = Not at all, 1 = Somewhat knowledgeable, 2 = Very knowledgeable, and so on. Later, the same group was asked the identical questions, and their responses were recorded exactly the same way. The correlation coefficient calculated from these two sets of scores gives us an indication of stability. The outcome is shown in the table below, and the product-moment correlation coefficient is obtained as follows.

Table 3.

Test-retest scores on job performance

Subject	Test scores	Retest scores
1	1	2
2	0	3
3	2	2
4	4	5
5	3	5
6	2	3
7	1	2
8	5	6
9	1	4
10	1	4
	20	36

Source: Author computation (2022).

Table 4.

Pearson correlation analysis of Test-retest scores on job performance

	Mean	Std. Deviation	N	Pearson Correlation	Sig. (2-tailed)
Test scores	2.0000	1.56347	10	.746*	.013
Retest scores	3.6000	1.42984	10		

* Correlation is significant at the 0.05 level (2-tailed).

Source: Author computation (2022).

The Pearson r is significant at .05 with a 10-person sample size (a table value of .632 is required for r to be significant). As a result, the reliability is set at .746, which is an acceptable score for this sort of test. The main disadvantage of this strategy is that when the retake is administered too soon, the initial test sensitises the responders to the issue, and as a consequence, the respondent will recall and repeat the answers already given. This results in upwardly skewed dependability indicators. Second, attitudes may alter as a result of situational effects prior to the retest. The stability scores are biased downward in these circumstances. This implies that longer the time interval between two successive administrations, the lower the correlation coefficient indicating poor reliability.

6. Inter-rater reliability

The more that individual judgment is involved in a rating, the more crucial it is that independent observers agree when applying the scoring criteria (Ahmed et al., 2022). Inter-rater reliability establishes the equivalence of ratings obtained with a measuring instrument when used by different raters (Mohajan, 2017). Therefore, it is used to determine the level of agreement between two or more raters (Heale, Twycross, 2015; Ahmed et al., 2022). On the other hand, intra-rater reliability establishes the equivalence of ratings obtained with a measuring instrument used by a single rater over a period (McHugh, 2012). The researcher formed a matrix wherein the columns depicted the different raters as well as the rows depicted variables whereby the raters had obtained data to find the estimate of percent agreement (Table 5). The data collectors' scores for each variable were stored in the cells of the matrix. Table 5 provides an illustration of this procedure. In this example, five raters measured their rankings for variables one through ten. To calculate the % agreement, the researcher deducted the number of incorrectly scored questions from the total number of zeros. The number of zeros divide it by the number of variables offers a measure of agreement among the raters. In Table 5, the agreement is 90%. This suggests that 10% of the data acquired in the research is incorrect. This metric is immediately translated as the percentage of accurate data. The number 1.00 - percent agreement might be interpreted as the percentage of wrong data. In other words, if the percent agreement is 90, $1.00 - 0.90 = 0.10$, and 10% is the quantity of data that misrepresents the study findings.

Table 5.
Percent agreement across multiple data collectors (fictitious data)

Var#	Raters					% Agreement
	Mark	Susan	Tom	Ann	Joyce	
1	1	1	1	1	1	1.00
2	1	1	1	1	1	1.00
3	1	1	1	1	1	1.00
4	0	1	1	1	1	0.80
5	0	1	0	0	0	0.80
6	0	0	0	0	0	1.00
7	1	1	1	1	1	1.00
8	1	1	1	1	0	0.80
9	0	0	0	0	0	1.00
10	1	1	0	0	1	0.60
Study Interrater Reliability						0.90
<hr/>						
Is a rater an Outlier?		Mark	Susan	Tom	Ann	Joyce
#of unlike responses:		1	1	1	1	1

Source: McHugh, M.L. (2012). Interrater reliability: the kappa statistic. *Biochemiamedica*, 22(3), 276-282.

Table 5, which exhibits an overall interrater reliability of 90%, it can be seen that no data collector had an excessive number of outlier scores (scores that disagreed with the majority of raters' scores).

7. Parallel-form reliability

Parallel-form reliability (or alternate-form reliability) is like test-retest reliability but with an exception that a different (or an alternate) form of the original test is administered at different times (Ahmed et al., 2022). According to Heale et al. (2015), the concepts being tested are the same in both versions, but the expressions may be presented differently. As the name implies, two or more versions of the test are constructed that are equivalent in content and level of difficulty, e.g. professors use this technique to create makeup or replacement exams because students may already know the questions from the earlier exam (Ahmed et al., 2022). The measuring instrument used is stable when there is a high correlation between the scores (values) obtained each time the tests are completed (Heale, Twycross, 2015). A low correlation indicates the presence of measurement error, which is construed as using two different scales in both tests (Ahmed et al., 2022).

Example of parallel form reliability: To calculate parallel form's reliability, first administer the two different tests to the same participants in a short period of time (perhaps with one week of each other). Then calculate the total score for each variable on the two separate tests.

Table 6.

Parallel form reliability of sales person job performance and sale performance

Participants	Sales person job performance	Sales Performance
1	67.00	68.00
2	53.00	56.00
3	67.00	61.00
4	55.00	59.00
5	46.00	42.00
6	59.00	57.00
7	52.00	51.00
8	59.00	55.00
9	38.00	54.00
10	41.00	44.00
11	40.00	54.00

Total scores for Sales person job performance scores were correlated with another performance rating, sales performance. This was calculated using the Pearson's Product Moment Correlation between sales person job performance and sales performance.

Table 7.

Pearson correlation analysis of Parallel scores on job performance and sales performance

Variable	Variable	Statistic				
		Correlation	Count	Lower C.I.	Upper C.I.	Notes
Language Proficiency	Sales Performance	.720	11	.211	.922	Significant
Missing value handling: PAIRWISE, EXCLUDE. C.I. Level: 95.0						

This is the parallel form's reliability coefficient was 0.720 for sales person job performance and sales performance.

Reliability Method in Research Study

Table 8.

Showed Reliability of Research Instrument by Previous Researcher(s) Useful for Further Research

S/N	Author(s)	Year	Title	Methodology	Remarks
2.	Taherdoost H.	2016	Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/ Survey in a Research	Research Instrument, Questionnaire, Survey, Survey Validity, Questionnaire Reliability, Content Validity, Face Validity, Construct Validity, and Criterion Validity	This study review article explores and describes the validity and reliability of a questionnaire/survey and also discusses various forms of validity and reliability tests
3.	Ibiyemi, A., Yasmin Mohd Adnan, Md Nasir Daud, Segun Olanrele & Abiodun Jogunola (2019)	2019	A content validity study of the test of valuers' support for capturing sustainability in the valuation process in Nigeria	Content validity Face validity	The study presents the content domain of the valuers' perception of sustainability reporting in Nigeria for the purpose of identification and eliciting the character. It carried out the content validity index (i-CVI), the scale content validity index (s-CVI) and the content validity ratio (CVR). The paper argued for consistent and explicit content validation in sustainability research to avoid probable chance effects. Content validation helps to provide reliable data for causal model development of the knowledge management (KM) requirements for the integration of sustainability into real estate valuation.

Cont. table 8.

4.	Taherdoost. H.	2022	What are Different Research Approaches? Comprehensive Review of Qualitative, Quantitative, and Mixed Method Research, Their Applications, Types, and Limitations	Research methodology; Research approach; Qualitative research; Quantitative research; Mixed methods approach; Research design	This study provides a comprehensive review of qualitative, quantitative, and mixed-method research methods. Each method is clearly defined and specifically discussed based on applications, types, advantages, and limitations to help researchers identify select the most relevant type based on each study and navigate accordingly
5.	Berteau, P.E & Zait, A.	2013	Scale Validity in Exploratory Stages of Research	Construct validity Content Validity Ratio Q-sorting	The paper draw the attention on alternative methods for scale validation that should be used in the exploratory phase. The role of these methods is to improve validity of results of the further confirmatory phases of research. The Lawshe (1975) content validity ratio and the Q-sorting procedure for testing construct validity are applied in the process of developing a scale for perceived risk
6.	Nnorom, G.K, Asikhia, O.U, Magaji, N, Makinde, O.G, Akpa, V.O & Obianwu, N.E		Contextual Factors and Organizational Performance: A Validity and Reliability Approach	Construct Validity Confirmatory Factor Analysis Convergent validity Discriminant validity	This study validated an instrument to aid research efforts in the area of contextual factors and organizational performance. After an initial questionnaire administration, the data was tested using validity and reliability tools. It was established that scale was fit for application in other studies as all scientific conditions were met.
7.	Ursachi, G., Horodnic, I.A., Zait, A.	2015	How Reliable are Measurement Scales? External Factors with Indirect Influence on Reliability Estimators	Research methods, instruments, validity, scale reliability	The study investigates role of external factors influence a largely used reliability estimator - Cronbach Alpha. Several scales commonly used in marketing researches were tested, using a bootstrapping technique. Results show that important differences in the values of Cronbach Alpha are possible due to indirect influence from external factors - respondents' age, gender, level of study, religiousness, rural/urban living, survey type and relevance of the research subject for the participants to the survey.

Source: Researcher (2022).

Discussion of Findings

Consequence upon several articles reviewed on the subject matter by different researchers on reliability of research instrument, it was observed that some scholars were able to test and measure data credibility through different modes such as validity, reliability and generalisability. The concept of reliability and generalisability have been identified and redefined for its usefulness for improving quantitative research study. Researchers assess their measurements using two independent criteria: reliability and validity. Test-retest reliability, internal consistency, and consistency between researchers are all examples of dependability (interrater reliability) (Ahmed et al., 2022).

8. Conclusion

Management scientists do not just presume that instrument is reliable. Instead, studies have always shown that instruments are reliable before going on to make analysis and conclusions from these results thus emphasizing the reliability essential for study validity. Over time, reliability represents consistency and replicability. Furthermore, reliability is seen as the degree to which a test is devoid of measurement errors, because the greater the number of measurement mistakes, the less trustworthy the test. Researchers are concerns on how far the same test would generate the same findings if given to the similar populations under the same settings. This enables researchers and management scientists to conduct valid comparisons. The more inaccuracies identified in an evaluation, the less reliable it is, and vice versa. The study conclude that reliability is an important factor in assessment, and it is presented as an aspect that contributes to validity rather than as an aspect that is opposed to validity.

References

1. Ahmed, V., Opoku, A., Olanipekun, A., Sutrisna, M. (2022). *Validity and Reliability in Built Environment Research A Selection of Case Studies*. New York: Routledge.
2. Badenes-Ribera, L., Silver, N.C., Pedroli, E. (2020). Editorial: Scale Development and Score Validation. *Frontier Psychology, 11*, 799. doi: 10.3389/fpsyg.2020.00799.
3. Bannigan, K., Watson, R. (2009). Reliability and validity in a nutshell. *Journal of Clinical Nursing, 18*(23), 3237-3243.
4. Berteau, P.E Zait, A. (2013). Scale Validity in Exploratory Stages of Research. *Management & Marketing, 11*(1), 36-49.

5. Ekolu, S.O., Quainoo, H. (2019). Reliability of assessments in engineering education using Cronbach's alpha, KR and split-half methods. *Global Journal of Engineering Education*, 21(1), 24-29.
6. Flintermann, B. (2014). *The quality of market research reports: The case of Market line Advantage and the automobile industry*. Retrieved from http://essay.utwente.nl/66122/1/Flintermann_MA_MB.pdf, 29.05.2017.
7. Heale, R., Twycross, A. (2015) Validity and reliability in quantitative studies. *Evidence-Based Nursing*, 18, 66-67.
8. Ibiyemi, A., Mohd Adnan, Y., Daud, M.N., Olanrele, S., Jogunola, A. (2019). A content validity study of the test of valuers' support for capturing sustainability in the valuation process in Nigeria. *Pacific Rim Property Research Journal*, 25(3), 177-193. doi:10.1080/14445921.2019.1703700.
9. Imasuen, K. (2022). Sample Size Determination in Test-Retest and Cronbach Alpha Reliability Estimates. *British Journal of Contemporary Education*, 2(1), 17-29. DOI: 10.52589/BJCE-FY266HK9.
10. Kaji, A.H., Lewis, R.J. (2008). Assessment of the reliability of the Johns Hopkins/Agency for Healthcare Research and Quality hospital disaster drill evaluation tool. *Annals of Emergency Medicine*, 52(3), 204-210.
11. Kimberlin, C.L., Winterstein, A.G. (2008). Validity and reliability of measurement instruments used in research. *American Journal of Health-System Pharmacy*, 65(23), 2276-2284. doi:10.2146/ajhp070364.
12. Korb, K.A. (2013). *Educational Research Steps*. Educational Research Steps, <http://korbedpsych.com/R00Steps.html>.
13. Lam, P.T., Chan, E.H., Poon, C.S., Chau, C.K., Chun, K.P. (2010). Factors affecting the implementation of green specifications in construction. *Journal of Environmental Management*, 91(3), 654-661.
14. McHugh, M.L. (2012). Interrater reliability: the kappa statistic. *Biochemiamedica*, 22(3), 276-282.
15. Mohajan, H.K. (2017). Two criteria for good measurements in research: Validity and reliability. *Annals of SpiruHaret University. Economic Series*, 17(4), 59-82.
16. Morrison, J. (2019). *Assessing Questionnaire Reliability - Select Statistical Consultants*. Select Statistical Consultants. [select-statistics.co.uk. https://select-statistics.co.uk/blog/assessing-questionnaire-reliability/](https://select-statistics.co.uk/blog/assessing-questionnaire-reliability/).
17. Nnorom, G.K., Asikhia, O.U., Akpa, V.O., Magaji, N., Obianwu, N.E. (2020). Contextual Factors and Organizational Performance: A Validity and Reliability Approach. *The International Journal of Business & Management*, 8(6), 1-8.
18. Sarmah, H.K., Hazarika, B.B. (2012). Determination of Reliability and Validity measures of a questionnaire. *Indian Journal of Education and Information Management*, 5(11), 508-517.

19. Taherdoost, H. (2016). Validity and reliability of the research instrument; How to test the validation of a questionnaire/survey in research. *International Journal of Academic Research in Management*, 5(3), 28-36.
20. Taherdoost, H. (2022). What are Different Research Approaches? Comprehensive Review of Qualitative, Quantitative, and Mixed Method Research, Their Applications, Types, and Limitations. *Journal of Management Science & Engineering Research*, 5(1), 53-63. doi: <https://doi.org/10.30564/jmser.v5i1.4538>.
21. Ursachi, G., Horodnic, I.A., Zait, A. (2015). How Reliable are Measurement Scales? External Factors with Indirect Influence on Reliability Estimators. *Procedia Economics and Finance*, 20, 679-686. doi: 10.1016/s2212-5671(15)00123-9.
22. Zach, V. (2022). *Kuder-Richardson Formula 20 (Definition & Example) - Statology*. Statology, <https://www.statology.org/kuder-richardson-20/>.

MANAGEMENT SYSTEM FOR INNOVATIONS CREATED IN THE OPEN MODEL (WITH MANAGERIAL TOOLS)

Ewa STAWIARSKA

Silesian University of Technology; ewa.stawiarska@polsl.pl, ORCID: 0000-0003-1198-1134

Purpose: The main objective of the article was to define an innovation management system, which consists of:

1. Subsystem for managing their own innovative maturity.
2. Subsystem for managing the processes of obtaining product innovations from suppliers.
3. Subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies.
4. Subsystem for innovation performance management.

The results of the literature and empirical research formed the basis for the development and test of two subsystems:

- Subsystem for managing their own innovative maturity.
- Subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies.

Design/methodology/approach: The main objective of the literature study was to prepare tools to review the elements, which consist of the innovation management subsystems. The main objective of the own research was to compare the elements of innovation management used by the three automotive concerns that produce propulsion systems in Poland. Comparing the elements used allowed the definition of a complex model of a network and supply chain innovation management system (especially the two subsystems and propose to retrofit them). The proposed research tools can also be used to assess the maturity for managing innovations arising in collaboration. The tools will also serve as an inspiration (for manager R&D) for supplementing a functioning system with missing elements.

Findings: The first chapter presents the importance of developing a system from a theoretical, methodological and empirical point of view. The second chapter presents research methodology. The appendices 1 and 2 present the author's managerial tools for evaluative assessment of the two subsystems belong to innovation management system. The third chapter presents the results of surveys conducted using the developed managerial tools.

Research limitations/implications: Research limitations/implications: The main purpose of the work was to develop a systemic innovation management model for the supply chain in the automotive industry and to assess the possibility of its implementation in business practice. This goal was partially achieved. The possibility of implementing a systemic model only at car manufacturers was examined. The enterprises cooperating in the supply chain (suppliers, customers) were not examined. In connection with the above, it can be stated that two subsystems have been verified (subsystem for managing their own innovative maturity;

subsystem for innovative maturity management of suppliers from the supply chain). The others will be the subject of further research.

Keywords: Innovation management, OI Open innovation model.

Introduction

A management system is a collection of roles, methods, managerial tools, related processes, with specific properties and evaluations. Such a collection can be called a system if it also fulfils the other requirements (rigours) of systemicity: the orderliness of the collection; the coherence of the collection; the boundaries of the collection; the interaction with the environment; the ability to perform a given function or achieve a given goal (Bertalanffy, 1984).

In innovation science, a balance between control and freedom is required (Foster, Kaplan, 2001). Therefore, researchers are still reluctant to deal with innovation management systems and practitioners are not in favour of them, claiming that when implementing innovation processes, it is difficult to behave strictly according to decisions and guidelines.

An innovation management system has been defined as a set of interrelated or interacting organisational elements as well as processes that enable the achievement of innovation goals. An innovation management system is thus made up of two groups of elements (Checklist, 2020). The first includes those fostering the development of innovation within the company (roles, methods, managerial tools). The second includes innovation processes (including the process of generating ideas, processes of acquiring innovative solutions from outside), methods of evaluating and analysing its individual sub-processes, methods of indicating possibilities for their improvement.

The implementation of an innovation management system into an enterprise brings a specific range of benefits for companies. Among the benefits are (Standard CEN/TS 16555-1:2014 - Part 1: Innovation Management System):

- increased profits from innovation,
- a change in approach to problem solving and a new/different set of values,
- ease of identifying areas of risk and mitigating its impact,
- increased creativity and intelligence of the organisation,
- increased value from collaborating with business partners on innovation development,
- greater employee involvement, fostering teamwork.

An innovation management system encompasses all the activities that are necessary to generate innovation on a continuous basis, regardless of the size of the organisation. An innovation management system consists of all the elements that are essential to the innovation process, including: organisational conditions, leadership in the area of strategy and innovation, planning of activities to increase the market success of innovations, development

of enablers and drivers of innovation, the innovation management process, tools to assess the performance of the innovation management system, activities to improve the innovation management system, innovation management techniques (Standard CEN/TS 16555-1:2014 - Part 1: Innovation Management System). The foundations for configuring innovation management systems were laid by European Standards established by CEN - the European Standardisation Organisation. The established technical committee CEN/TC 389 - Innovation Management, established six standards with the status of technical specifications.

- CEN/TS 16555-1 Innovation Management - Part 1: Innovation management system.
- CEN/TS 16555-2 Innovation management - Part 2: Strategic intelligence management.
- CEN/TS 16555-3 Innovation Management - Part 3: Innovative thinking.
- CEN/TS 16555-4 Innovation Management - Part 4: Intellectual property management.
- CEN/TS 16555-5 Innovation Management - Part 5: Collaborative management
- CEN/TS 16555-6 Innovation Management - Part 6: Creativity management.

The standards developed are designed to provide methods, processes and tools aimed at: improving the competitiveness of organizations, enabling the emergence of innovative ventures, ensuring the optimization of the effects of inter-organizational cooperation. The first document was released in July 2013. Important for this study is: CEN/TS 16555-5: 2014 Managing Innovation - Part 5: Managing Collaboration. This document describes variants of cooperation in different circumstances and different ways and possibilities of managing cooperation. It provides guidance on managing cooperation between individuals, teams and different organizations, as well as the difficulties and benefits of cooperation. It gives guidelines for actions conducive to significantly improving the organization's innovative performance resulting from cooperation.

The literature distinguishes between two types of innovation management systems: independent (systems of R&D departments aimed at increasing innovative performance) and integrated (whose elements co-create the management system of the whole enterprise). The set of elements developed for innovation management can also be an inter-organizational system (if its elements are implemented in the systems of cooperators). Independent systems can evolve from independent to inter-organizational. Inter-organizational systems in which innovations are created can be called the OI open innovation model (Chesbrough, 2006). Virtually every organization has certain elements of an innovation management system, with the larger the organization, the more of these elements are in place. If the innovation management system is to operate effectively and efficiently, it is necessary to review, organize, document the elements currently in use and supplement them with missing elements (and those operating in competing companies). When supplementing the management system for the development of innovation in the open model, the first step should be to assess its state of maturity (maturity to work in the IO). In the next step, supplement the system with elements supporting its own and cooperators' innovativeness (i.e.: methods of initiating innovation in

IOs, processes of acquiring innovative solutions, methods of protecting its own and cooperators' intellectual property, methods of identifying risks arising in jointly conducted innovation processes, drivers of change in innovation processes, introduce ICT infrastructure into the innovation management system). Figure 1 shows a model of an innovation management system aimed at developing innovation in an open model. The figure is meant to suggest that supplier portfolio management, along with strategy, knowledge flow organization structure, culture, standardization of the innovation process, are key success factors in innovation management (Cooper, 2004).

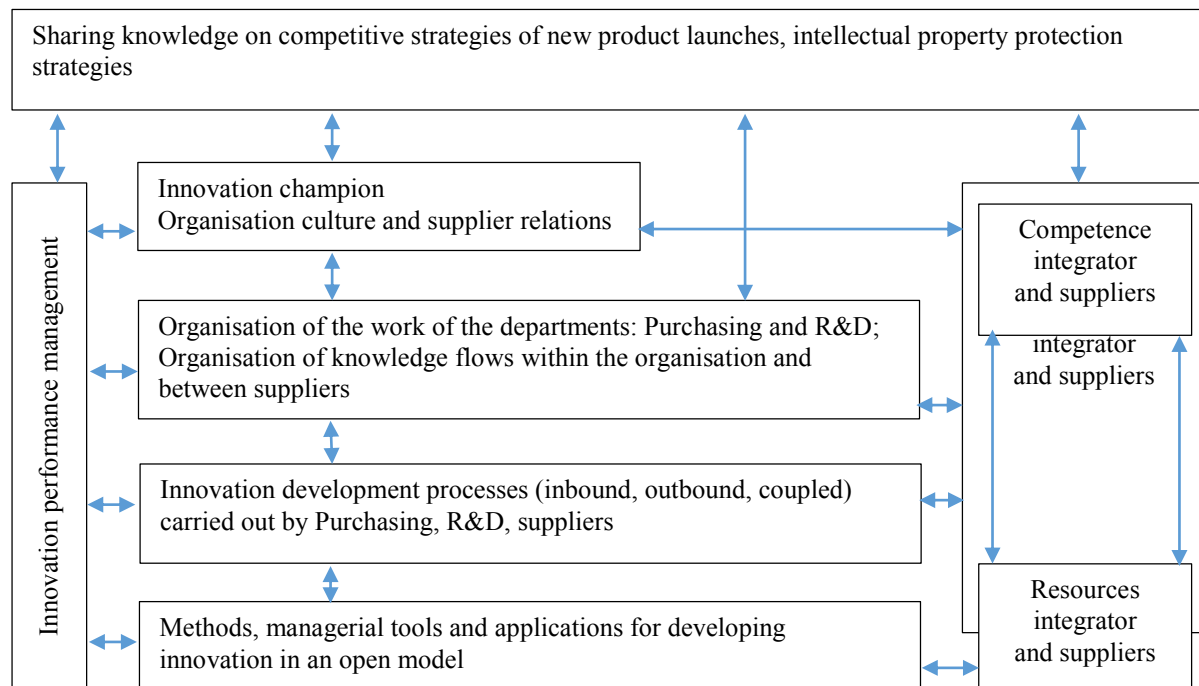


Figure 1. Innovation management system prepared for the development of innovation in the open model.

Source: Own elaboration based on: Cooper, R.G. (2004). *Product Leadership: pathways to profitable innovation*. New York: Basic Books.

As can be seen from the argument above, it is in the first instance within one's own organisation that the innovation capacity required to perpetuate work in the OI model should be assessed. Lamberti et al (2017) have developed scorecards with a set of indicators that give R&D managers a quick and holistic view of an organisation's capacity to work in an open innovation model. The paper goes on to present another managerial tool, e.g., the Smart Gird Maturity Model, which can be used to assess the innovation maturity of an organisation's own, as well as that of its collaborators to work in OI. Companies need to learn how to source innovation from a variety of internal and external sources using business models (Piller, West, 2014). Based on literature studies, it has been inferred that there is an ongoing intensification of conceptualisation, operationalisation, testing and implementation of innovation management systemów in companies across industries (Afuach, 2014). A body of researchers believes that innovation growth should be systematically monitored, preparing qualitative and quantitative

measures for this purpose (Forslund, 2007; Ryan, 2010). Following the guidance of these researchers monitoring areas have been selected. These areas were named innovation management subsystems. Listed:

1. subsystem for managing their own innovative maturity,
2. subsystem for managing the processes of obtaining product innovations from suppliers,
3. subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies,
4. subsystem for innovation performance management.

The results of the literature research formed the tools for all the subsystems mentioned. In this work, two subsystems in particular have received attention:

1. subsystem for managing their own innovative maturity,
2. subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies. Figure 2 shows an exemplary model of system innovation management that could be computerized.

Literature study has shown that managing: innovation in an own organization, supplier organizations and innovation processes translates into an increase in the innovation performance of the leader (Stawiarska, 2019). Systemic model of innovation management may consist of four applied subsystems i.e.: 1. Management subsystem of own innovation maturity; 2. Management subsystem for the processes of acquiring product innovations from suppliers; 3. Subsystem of managing the innovative maturity of suppliers from the supply chain; 4. Subsystem for innovation performance management (marked with different shades in Figure 2). The practical message of the implement systematic model of innovation management is an increase in innovation efficiency of leaders supply chain and their suppliers. Practical usefulness of the model may be used in supply chains and network different industries.

System of innovation management was described and presented to the respondents in a graphic form (Figure 2). The respondents - managers of the surveyed concerns, employees of purchasing and R&D departments, gave their opinions on the system of innovation management. Supply chain leaders/surveyed companies expressed interest in the systemic model. The respondents believed that in the future it is worth using a computerized, system of innovation management.

The versatility of the proposed system innovation management enables supply chain leaders from different industries to put it into practice. Conversations with experts, which indicated possibility to integrate models and create one 'systemic model of innovation management' on an IT platform were held as well. Activities tests, interviews with managers of the studied organizations confirmed, giving the green light to development of the concept of system of innovation management.

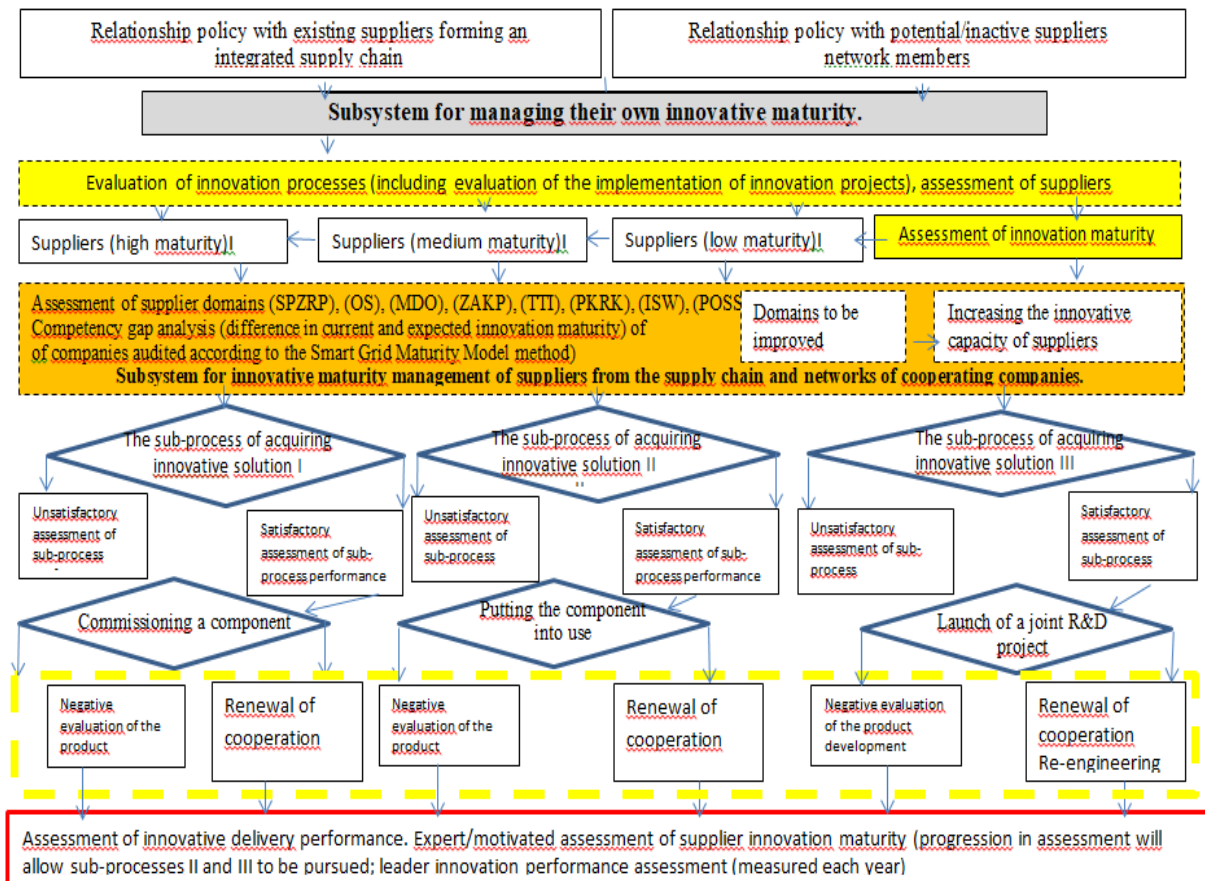


Figure 2. The system innovation management in supply chain and network.

Source: own study.

Using information from different sources makes it possible to substantiate the need to create systemic model of innovation management, and the collected empirical material (obtained with the use of complex set of tools) made it possible to propose integration of the tested models.

When implementing whole system of innovation management (each subsystem), one may expect growth in innovation efficiency of a leader and collaborating enterprises. Test only two subsystems was support users in increasing innovation efficiency. The study of only two subsystems authorizes the research hypothesis that "there are competence gaps in the pro-innovation performance of the surveyed enterprises. Periodic assessment of the competency gap (its own and that of its cooperators) will contribute to the growth of innovation".

Subsystems study has its own subject of research, method and technique and research tool. Developed an innovation management system give contribution to development of management science in the following area: The development of the innovation management concept towards a systemic innovation management.

1. Literature review

The elements of the innovation management system that foster the development of innovation in the open model are: roles, methods, managerial tools. Researchers have given these and other elements an assessment in the context of developing open model innovations, among the many elements of the system, as highly assess competences, leadership, information level, organisational culture, set of managerial methods and techniques, technology (Sopinska, Mierzejewska, 2017). In preparation for the description of the subsystem for managing one's own innovation maturity and the subsystem for managing suppliers' innovation maturity in the supply chain, the importance of the following elements was traced in the literature.

Leaders/managers play ten distinct roles. These roles fall into three categories: interpersonal, informational and decision-making (Griffin, 2012). One of the informational roles is played by the promoter (also called the innovation champion), who presents the action plan to the co-operators, develops and sends reports, periodicals and letters. The propagator in the following is also referred to as the innovation champion. Beltz (2011) explores how organisational structure theories can be linked to the development of innovation in an open model. He makes an attempt to answer: the question: which traditional concepts of organisational structure meet the needs of open innovation. The author believes that decentralisation, formalisation and specialisation in co-operation with suppliers should be introduced because they positively influence the innovation performance of co-operators.

Deal and Kennedy (1982) define **organisational culture** as 'an integrated pattern of human behaviour' including thoughts, words, actions and artefacts. The pattern depends on the leader and the ability of the members of the organisation to learn and transfer knowledge within the organisation and to collaborators. Organisational culture is to be adhered to and visible to the supplier at three levels: artefacts (including at the level of organisational structure and processes), beliefs and values (exhibited in strategy, mission, functional missions, intra- and inter-organisational interpersonal contacts), basic assumptions (taken for granted in the organisation and therefore extremely difficult to change in a clash with a different culture of the co-operator). In building an organisational culture that remains in line with the IO concept, the right balance must be found between fostering the creativity and inventiveness of suppliers and the right and control of suppliers.

TOM (Tools Organisation Management) methods and management tools. Methods are ways of proceeding, leading to the solution of a given problem and the achievement of a defined objective. Methods consist of specific and repeatable steps (Schuman, 2013). Without going into the differences and similarities between terms such as management methods and techniques, it is assumed that they are instruments in the hand of the manager to facilitate the solution of management problems. The managerial methods and tools that support the OI concept, can be defined as a combination of routines, practices and incentives that enhance

an organisation's innovation performance (Giannopoulou et al., 2011). Adopting the OI concept can threaten conventional managerial methods and tools practised in the company and vice versa (Ollila, Elmquist, 2011). The literature identifies reviews of formal, institutionalised methods and tools that are used to enhance self-innovation and that of suppliers and other collaborators (Aloini et al., 2017). Researchers believe that there is a need to develop new methods and tools for innovation management that also impact beyond the boundaries of one's own organisation.

Figure 3 shows the methods used to source innovation from outside the automotive industry.

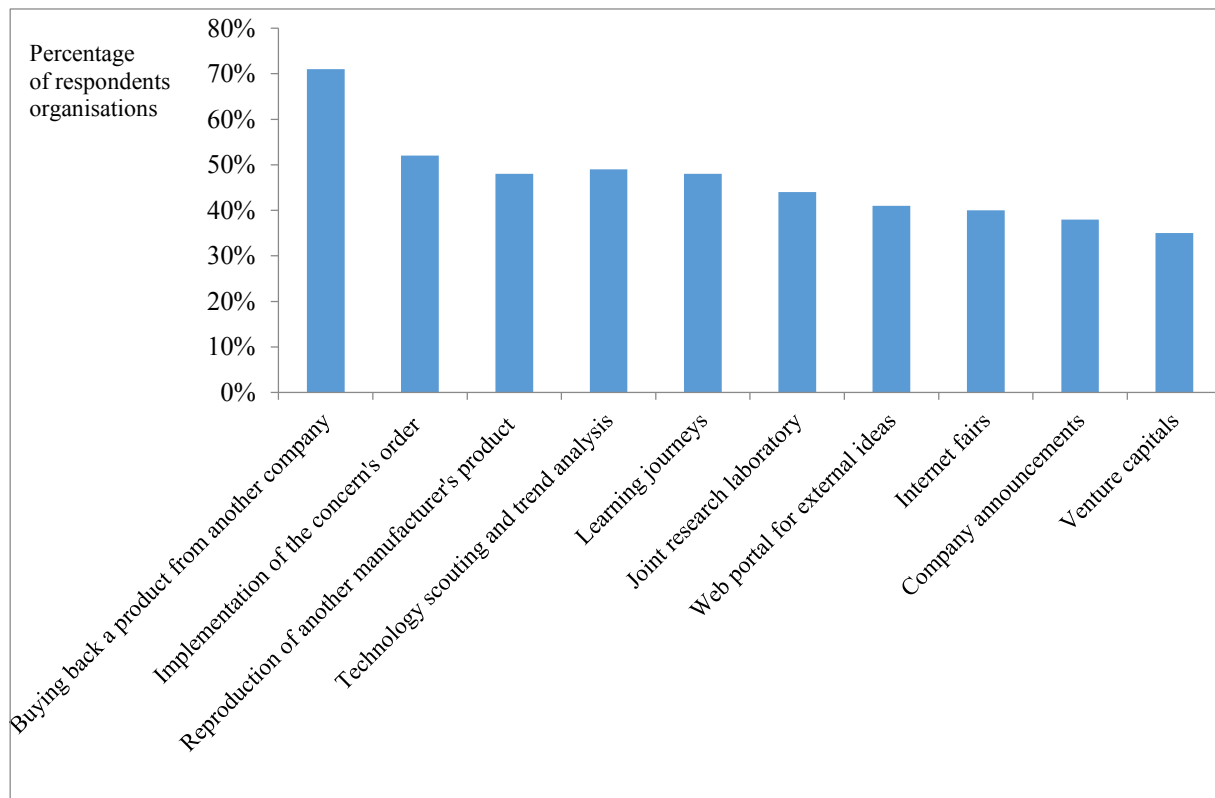


Figure 3. Use of external innovation sourcing methods in the automotive industry in % of organisations surveyed (selected from 45 suggested methods).

Source: Slovakia, J. (after) Chesbrough, H.W. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Publishing, pp. 35-41.

Information technology, resource databases and collaborative capabilities are tools to support the transition from a closed to an open model of innovation development. The first desirable tool is an idiosyncratic resource base (Dougherty, Dunne, 2011); (Zott, Amit, Massa, 2011) and methods for managing non-owner resources. Supplier resource management methods in the automotive industry have been developed by researchers: (Aggarwal, Hsu, 2009; Lee, Cavusgil, 2006). Other researchers recommend the use of ICT with embedded methods for sustainable value creation, supported by the principles of equitable value capture from co-operators (Afuah, Bogers, 2016; Wang, Rajagopalan, 2015). The following are methods that support the management of innovations developed in an open model in the automotive industry. In describing them, an attempt has been made to provide literature that defines them more

broadly and gives examples of their application in the industry. Attention was drawn to the fact that the methods listed are applicable at different stages of the innovation process. For some of the listed management methods, tools have already been developed. For the automotive industry, selected management methods and tools are recommended for the management of innovations arising in an open model:

- **The Smart Gird Maturity Model** is a method, based on the concept of the Smart Gird Maturity Model, that can be used to self-assess and evaluate the innovation maturity of co-operators. If the tool is implemented in the innovation management systems of co-operating companies it will be easier to manage resources for innovative projects (Katz, Allen, 1985). In order to successfully implement an IO strategy, organisations need to develop a range of cooperators' capabilities. The SGMM tool can be used to identify the competence gap of suppliers in developing innovation in an open model (measure the state of progress in OI from the perspective of the expected state). After modifications, the tool can be used to periodically assess different groups of suppliers segmented e.g. based on the criterion of the degree of involvement in R&D activities in selected research areas. The author's SGMM tool is presented in the appendix of this thesis (the tool can be informative). Respondents considered the SGMM as a tool that could complement their innovation management system.
- **Learnig trip/Learnig journeys** a method based on scautig theory, involves continuous exploration and idea generation (Ili et al., 2010). The basic steps are: participation in trade fairs (not only industry trade fairs), organisation of innovation days, technical meetings with selected suppliers, informal events on dedicated topics, invitations to innovation projects from meeting and trade fair participants. The learnig trip method is used by Volkswagen with benefits translating into the number of ideas acquired.
- **Short-term employee exchanges** between links in the supply chain for innovation development are not common in the automotive industry, and there is a lack of procedures and guidelines for employee protection of intellectual property (Husanudin, 2018). Employee exchanges between network and cluster companies are more common. The transfer of innovative knowledge is more effective if it takes place at all stages of the innovation process (Torre, 2008; Torre, Rallet, 2005). Staff exchanges are supported by the EU Commission by launching sectorally dedicated programmes such as the Research and Innovation Staff Exchange - Maria Skłodowska-Curie Actions and highly valuing this activity for the innovation performance of companies. Methods of proceeding in organising staff exchanges have already been prepared in many EU countries ([www.cedr.eu/...](http://www.cedr.eu/)).
- **Strengthening personal ties.** The personal aspects of cooperative business relationships have received increasing attention in recent years and have been conceptualised as the foundation of supply chain relational capital (Cousins et al., 2006), particularly in the context of product innovation (Lawson et al., 2015). The importance

of building inter-organisational relationships through interpersonal ties has not only been suggested by empirically grounded research in Eastern business cultures (Michailova and Worm, 2003), but also in Western cultures. Japanese corporations (Toyota and Honda) are leading the way in developing bonds between employees of collaborating organisations in the automotive industry. Ties intensify especially during the R&D project phase (Stawiarska, 2016).

- **Finding affinities between firms and combining them for innovation development.** The method is recommended by Mitrega and Pfajfar (2015) Research (Mitrega et al., 2017) shows that searching for affinities in innovation activities improves the innovation performance of leaders in the Indian automotive industry from the idea generation stage through to the prototyping stage. The authors suggest sharing the experiences of members of collaborative groups. Bendkowski (2016) believes that good results for the innovation performance of an organisation/integrator can be achieved by connecting specialists in so-called informal communities of action. Searching for experts and specialists can be done through portals e.g. Linked-in or professionally as Tesla does - using the IT integration platform Jabil (Wincewicz-Bosy et al., 2017).
- **Training, continuous education and supplier incentives strengthen existing relationships.** Training is where new product concepts are born and incentives are the catalyst for working through the next stages of product development. One-size-fits-all educational and motivational activities do not fit all suppliers, especially those from different cultures, as GM found out when it tried to apply the Toyota Production System to its US supply chain. Motivation can be achieved through three types of action: rewarding innovative suppliers and organising events dedicated to innovation for selected suppliers, asking for innovation suggestions. All these activities motivate suppliers to develop specific knowledge. Also important are annual meetings (in the presence of the purchasing director), where companies exchange results and present prospects for innovation solutions. All the above-mentioned activities are practised by Volkswagen.
- **Routine activities like audits,** assessment of specific resources and processes dedicated to relationships, request for self-assessment. The mentioned activities are described by (Jean et al., 2014). The FCA asked for periodic supplier self-assessments for the development of socially responsible supplier businesses. The enhancement of the environmental value of the components put into production is acknowledged by the FCA, suppliers are willing to self-assess via a supplier IT portal. The assessments are averaged and presented, the supplier in a dedicated portal can easily identify a competence gap and an area worth improving (Stawiarska, 2014).
- **Monitoring the relationship dedicated to the development of innovation projects** - the automotive industry pursues breakthrough (radical) and incremental projects. Kastensson's (2014) research shows differences in the approach to innovation projects

between the two car manufacturers. Saab focuses on radical product development, building collaborative supplier structures from scratch. Volvo focuses on incremental development based on a fixed structure of strategic suppliers who undertake short-term component modification. Volvo's body technology also makes it difficult to implement radical component changes. Kastensson draws the paradoxical conclusion that both highly regarded automotive manufacturers, fail to effectively monitor projects and supplier relationships, which undermines innovation performance to date. Monitoring can include: project duration/co-operator time, value-added contribution, financial contribution (Gutiérrez, 2012). Researchers argue that appropriate calibration and monitoring of these three dimensions will allow one to determine whether the relationship with the supplier was strong, medium or weak (to assess the commitment to the project implemented in the IO model). Long-term use of a project monitoring system (even radical ones that use R&D suppliers from outside the integrated chain), measuring the strength of the relationship, will allow the integrator to more accurately assess suppliers, managing the relationship towards increasing their innovation and alignment with the integrator's needs. All automotive concerns use project monitoring. R&D and Purchasing departments - participate in each monthly innovation project evaluation committee (at FCA). They have validation and veto rights at every stage of the project involving external partners (suppliers or research consortia). However, according to research, project monitoring in automotive corporations does not affect their innovation performance equally.

- **Supplier portfolio management and relationship termination mechanisms.** Until recently, the literature did not suggest the implementation of systematic measures at the company level to help end unfavourable supplier relationships (Dyer, Singh, 1998). "Unrecoverable investments" in a certain group of suppliers have prompted managers and researchers (Tähtinen, Halinen, 2002; Moeller et al., 2006) to make analyses related to this issue. Other researchers have shown that innovation performance declines from mature supplier relationships as well as from mature supplier portfolios (Wagner, 2006; Capaldo, 2007). The process of ending relationships with suppliers that inhibit innovation is linked to the need for a systematic reconfiguration of firms' strategic resources. Zaefarian et al (2016) consider relationship termination to have two components: final preparation using routines and relationship termination. The aim is to identify ineffective supplier relationships by assessing their innovative performance and establishing procedures to end the collaboration (perhaps only at the level of new product development) and to bring the relationship down to transactional levels. Innovatively inefficient supplier relationships tie up resources that could be used more optimally for innovation. For this to happen, it is necessary to monitor inactive/potential suppliers operating in the network as well as those with whom relationships have been terminated. Wagner (2006) tells us to assess the cost of terminating the relationship and

to prepare resources for activities that end the relationship. The end-of-relationship assessment should be prepared as a document and kept, as well as provided to the supplier. Rather, it should be a document that motivates suppliers to improve their performance for future relationships (Yam, Chan, 2015). When dissolving collaborations, it is important to remember to safeguard one's intellectual property and recover resources located in the relationship that can be used in alternative supplier relationships. A portfolio of innovative suppliers is managed by Toyota.

- **Innovation champion.** A person whose role is to get suppliers to work in an open innovation model. The concept of the innovation champion was introduced by Schon (1963). Subsequent researchers have addressed the champion's involvement in innovation activities (Chakrabarti, 1974; Frost, Egri, 1981; Howell et al., 2005; Kratzer et al., 2010; Mansfeld et al., 2010). Markham's (2013) study showed that the champion specifically supports early stage R&D projects for which there is no support from other parts of the organisation, and is therefore involved in the process of sourcing innovative solutions from suppliers. The innovation champion role has been introduced by Volkswagen into its structures.
- **Outsourcing the role of innovation champion.** Supplier relationship management should be learned and institutionalised internally or outsourced. The literature suggests that the management of relational activities can be moderated by external organisations (external purchasing execution companies, information brokers or cluster coordinators) because of the need to eliminate dominant organisational attitudes (Henneberg et al., 2010). An external company may be more effective in shaping the network (configuring the supplier portfolio). The external innovation champion delegates project management to the leader - the producer of the strategic good.
- **A computerised project vision for which talent is recruited.** The vision document defines the overall scope and purpose of the programme, product or project. Clearly articulating the problem, proposing a solution, helps to set expectations and reduce risk. Using IBM's Knowledge Center platform, for example, a product vision document can be presented and talent can be recruited for the automotive industry. The platform is used by Volkswagen.
- **Control of communication with and between suppliers.** Strategic integration with suppliers has been discussed by (Johnson, 1999), supplier development programmes (Wagner, 2006), and team control of supplier communication (Joshi, 2009). All these researchers are of the opinion that communication is very important for the development of a joint product (at each stage of this development). The researchers have developed tools to control communication at each stage of the collaboration. Volkswagen, PSA have specific communication interfaces for collaboration with suppliers to monitor and evaluate the contact of each party in the relationship.

- **Formal mechanisms for managing investment in an innovation project.** The main formal mechanisms are the estimation and valuation of the investment input and the regular updating of innovation processes, general agreements, non-disclosure agreements for engineering research. These formal mechanisms strengthen supplier relationships and have a positive impact on innovation performance (Lawson et al., 2015). In new product development, there are often unforeseen and additional inputs. Acquisition, transfer of assets, requires effective control, communication and reporting related to their funding (Eckerd, Hill, 2012). Smart Contract (blockchain technologies) in automotive is intended to be used by Toyota. The Toyota Research Institute (TRI) has officially stated that it will apply it to each of the following stages of the product lifecycle: concept development, design, product distribution, trade finance, retail sales and use of the product, product recycling and aftermarket and parts operations. Smart contracts and custom code support the security and compliance of multi-party contracts at any level of the supply chain, speeding up reconciliations, transactions, money and asset transfers between parties (<https://www.bloomberg.com/...>).
- **Building trust between employees of collaborating companies and educating in the area of relational competence.** Cheng and Huizingh (2014), Dyer and Hatcha (2006), and Ryciuk (2017) presented mechanisms for building inter-organisational trust in the automotive industry. They showed that manufacturers who provide more assistance in innovation projects reap more benefits from their supply chain relationships. Jean et al. (2014) demonstrate that, stimulating co-operators' procedural adaptations, an appropriate partnership approach to jointly develop new procedures through structured socialisation, translates into innovation performance of co-operating parties. By building strong ties within the supplier association, Toyota develops a strong network identity, and this overcomes the constraints of knowledge preservation bias.
- **Analysing purchasing practices,** auditing purchasing reports in the areas of: sourcing strategy, supplier management, material category management, inventory and procurement, ICT in purchasing, is routine in the automotive industry and generates many ideas for bringing suppliers together in R&D research groups (<https://www.apqc.org/...>).
- **Crowdsourcing is public brainstorming aimed at finding a solution to a specific problem.** The object of crowdsourcing can be knowledge. InnoCentive is an example of an online platform that gives entrepreneurs the opportunity to formulate tasks and seek their solution among ideas from a large number of originators. Associated with the solution of a task is, a monetary reward. Obtaining the solution is in line with intellectual property law. Among the companies using the platforms are Ford and Toyota. Ford's 'Your Idea' platform, has already received more than 3000 ideas from customers. Toyota has developed the Prius using the platform. An analysis of the various

implementations of crowdsourcing allows the following classification of their operating models to be proposed: exchange, competition, collaboration, exchange.

- **Innovation competitions are possible with tools for initiating, implementing and monitoring product development.** They are organised among an established project group (e.g. supply company engineers). Ferradasa et al. (2017) show that innovation competitions are an excellent tool to seek external knowledge, e.g. among next-tier suppliers. The authors advise on how to prepare and run a competition. In their research, they show that SME companies threatened by market and technological turbulence are keen to enter competitions organised by corporations. FCA, Volkswagen organise innovation competitions for students in Poland. A common practice in the automotive industry are competitions organised by first-tier suppliers for next-tier suppliers. Organisers of high-profile competitions are the companies: AC S.A., Kongsberg Automotive, Valeo Innovation Challenge. Competitions in the automotive industry are also organised by external companies e.g.: Microsoft Imagine Cup and state authorities (the Polish government is organising the InnoMoto competition for the second time).
- **Collaboration with research centres** (universities and research institutions, scientific government agencies) is carried out in accordance with standards for identifying resources (technological, human, financial) needed in the development of the spin-off organisation, and measured by spin-off performance indicators. Examples of cooperation between automotive concerns and universities come from Poland. FCA Group plants located in Poland and Opel Manufacturing Poland Sp. z o.o. cooperate with the Silesian University of Technology.
- **Recombinant models of knowledge management** Bessant and Trifilovwj (2017) and Aloini (2018) focus on 'recombinant' models of knowledge management, in which knowledge learned and successfully implemented in one domain can be transferred to another'. The authors highlight that managerial tools for knowledge transfer hold promise for IOs. The content of the article can be associated with the concept of TRIZU.
- **A set of tools to support creativity and imaginative thinking called Theory of Inventive Problem Solving TRIZ** (Russian: Теория Решения Изобретательских Задач), TIPS. Altshuller and Shapiro's (1956) theory initially presented as a conceptual design method in engineering boiled down to a process. Nowadays, TRIZ tools are also applied in 'soft' non-technical areas (Zlotin et al., 2000), especially in innovation management (Sheu, Lee, 2011), supply chain management (Stratton and Warburton, 2006), knowledge management (Qi, Shangguan, 2008; Vezzetti et al., 2011) management of innovations arising in an open model (Biedenbach, Müller, 2012). The TRIZ process starts by describing the problem to be solved with an abstract model (function model, contradiction model, substance field model, etc.). Then one or more standard model transformation techniques can be applied (pruning, contradiction elimination rules, substance field model transformation standards, etc.). The usefulness

of the models is checked by means of specific indices, such as the concept of ideality, trends in the evolution of engineering systems. The best model presents an abstract (theoretical) solution. The final step in this process is to find a 'real world' phenomenon that could enable the implementation of this theoretical solution. For this purpose, TRIZ recommends the analysis of databases or physical and chemical phenomena, based on database functions or function-oriented search. TRIZ, being a complex instrument, provides a broad set of tools for idea generation, analysis and problem solving. In addition, a TRIZ knowledge base for various knowledge management tools has been adopted to facilitate patent search and analysis (Cong, Tong, 2008; Marcandella et al., 2009); The second set of TRIZ tools relates to product potential analyses. They can be used at the idea generation and internal R&D planning stages, as well as to facilitate collaborative activities by analysing the potential of external technology. TRIZ tools are used by Korean automotive companies, i.e. Hyundai and Kia. Existing technology from other industries is applied in these corporations. The analysis of contradictions and their elimination (using the classic Altshuller matrix) contribute to the exponentially increasing number of patented solutions. Separation principles are applied to supply chain design. TRIZ stimulates creativity and shortens the costly iterative process. TRIZ experts have worked with Hyundai and Kia corporations and suppliers for the adoption of new tools. TRIZ tools have been integrated into the innovation management system for several years, but there is a lack of research dedicated to the adaptation of TRIZ tools to supplier systems. Existing case studies of TRIZ use (Moehrle, 2005), suggest that: TRIZ tools can be used separately (that is, not necessarily the entire TRIZ set); the most commonly used TRIZ tools are contradiction elimination instruments; TRIZ does not have sufficient integration with IT tools; the most common problem with TRIZ is subjectivity and dependence on user experience and qualifications. The study shows that TRIZ-based methods are viable tools for innovation management and are able to provide support at all three stages of the innovation process (creation, implementation and diffusion of innovations).

- **QFD (Quality Function Deployment).** It is a method used to design and improve the quality of products or services. This method enables a customer requirement to be translated into the technical parameters of the final product through the successive stages of its design and manufacture and, as a result, to achieve greater customer satisfaction. For each customer requirement and technical parameter, a performance index is calculated. This makes it possible to identify priorities for improving product quality. Shigeru Mizuno and Yoji Akao are considered the forerunners of the method under discussion. The method was first used in 1972 at the Mitsubishi shipyard in Kobe. In the 1980s, it found widespread use particularly in automotive companies (Toyota, Ford, General Motors) (Wolniak, 2015). The basic tool of the method is the so-called 'House of Quality'. It is a matrix which is a combination of a diagram of the

interdependence of customer needs and technical requirements. QFD shows good complementarity with TRIZ-based methodologies. It is used as a problem-solving tool, e.g. to determine the purpose of an innovation (Hua et al., 2006). The QFD tool has IT software dedicated to the automotive industry (e.g. Edraw MaX Pro - platform for diagramming).

- **FMEA** (Failure Modes and Effects Analysis) or FMECA (Failure Modes and Criticality Analysis), this method is based on the analytical determination of cause-and-effect relationships of potential product defects and the inclusion of a criticality (risk) factor in the analysis. Its objective is to consistently and systematically identify potential product/process defects and then eliminate them or minimise the risks associated with them. With the FMEA method, the product/process can be continuously improved by subjecting it to successive analyses and, on the basis of the results obtained, introducing new corrections and solutions, effectively eliminating the sources of defects and providing new ideas to improve the product properties. The objectives of the method are: to reduce the probability of defects, to increase the detectability of defects arising, and to increase customer satisfaction with the product/service being purchased (Myszewski, 1994). This method was used as early as the 1950s in the United States and Japan to ensure the reliability of high-risk products, mainly in aviation, aerospace and military applications. In the 1970s, it spread to Europe and was mainly used in the electronics and mechanical engineering industries. Since the 1980s, it has been successfully used in the automotive industry. In February 2018, a group of international automotive companies signed an agreement on the use of FMEA in the automotive industry. The document places requirements on suppliers to assess the types and consequences of failure of their components. A common set of FMEA requirements/expectations enables suppliers to run one business process and use one set of FMEA methods and tool, while satisfying the requirements of all their customers. In December 2018, the official AIAG-VDA FMEA industry manual was released. IT tools fully support the new harmonised AIAG VDA FMEA system, e.g. DataLyzer's FMEA software.
- **Self-assessment tool** - a scorecard, used to monitor whether the company is effectively and efficiently generating IO outputs. The charter shows the resources free and committed to projects. Lamberti et al. (2017) lists six indicators for self-assessment of innovation in the charter. Galankashia et al. (2014) more extensively described the application of the scorecard to multi-criteria supplier selection in the Iranian automotive industry.
- **Tools for imitation.** Some of the smaller Japanese car companies have a strategy of never introducing a new technology and commercialising new solutions first. They prefer to wait for other manufacturers, preferably Toyota, to establish the technology in the market, thereby reducing their own and their suppliers' risks. Keiretzu

does not expect high innovation performance from its group suppliers. Among these suppliers are many manufacturers of 'non-original' spare parts. General-purpose technology offers opportunities for imitation as well as the use of a variety of materials. Little is known about what business tools are used to copy technology in the automotive industry. There are publications that present a comprehensive proposal for developing a cost model for comparing diverse products from developed and emerging markets (Schleich, 2006). In the Western world, offensive, innovative manufacturers expect themselves and their suppliers to act independently and proactively and do not use the tools mentioned.

- **SGMM** - sub-system innovation management.

When analysing the above methods and accompanying managerial tools, SGMMs were looked at in particular, which should make up a future innovation management system. Rudkowski (2014) recommends a systematic assessment of supplier innovation using SGMM in eight management areas. The author follows the model developed at Carnegie Mellon University - the SGMM (Smart Grid Maturity Model). The SGMM provides a framework for transforming suppliers from the supply chain and network to their innovation maturity. The SGMM consists of eight domains and six levels of maturity assessment. The SGMM provides a common language for comparing and improving areas of innovation management. It gives suppliers and potential suppliers/network members, guidance on activities, investments and best practices for engaging in open integrator R&D activities. As an IT-based expert system, the SGMM, based on knowledge and collaboration with the innovation champion, can provide guidance on technological, regulatory and organisational issues. The model has eight main domains to monitor and these are:

1. Strategy, governance and regulatory oversight, planning, decision-making, strategy implementation, disciplines, regulation and investment.
2. Organisation and structure-communication, culture, knowledge management, training and education.
3. Technology-information, engineering, integration of information and operational technologies, standards and business analysis tools.
4. Social and environmental and ecological initiatives, sustainability, economics and ability to integrate grid operations.
5. Grid operations - advanced grid observability, control, quality and reliability.
6. Labour and asset management - optimised resources (e.g. people and equipment).
7. Customer management and experience - retail sales, customer service, pricing options and controls, advanced services, visibility into usage, quality and performance.
8. Value chain integration - enables demand and supply management, distributed generation and load management and exploitation of market opportunities.

The APQC organisation, in collaboration with Carnegie Mellon University's Software Engineering Institute, has developed software tools for SGMM (i.e.: tools for capturing and maintaining data collected from organisations in the energy industry). There is nothing to prevent SGMM from being modelled for use in automotive supply chain and network development. For the purpose of the research work, a tool was prepared to survey the innovation maturity of automotive suppliers (Appendix 3), and an Excel-based IT tool was prepared to collect and process the data obtained in the supplier surveys. The SGMM model can also be used to self-assess the innovation maturity of any organisation that is: at any level of the supply chain, a member of a formal or informal supply network or a non-networked enterprise. The SGMM can become an important element of an innovation management system. Its implementation in an organisation does not complete the work on the innovation management system.

2. Research methodology

The main objective of the literature study was to prepare tools to review the elements, with consist of the innovation management subsystems. The main objective of the own research was to compare the elements of innovation management used by the three automotive concerns that produce propulsion systems in Poland. Comparing the elements used allowed the defined a complex model of a network and supply chain innovation management system (especially the two subsystems and propose to retrofit them).

The proposed research tools (Appendix 1, Appendix 2) can too be used to assess the maturity for managing innovations arising in collaboration. The tools will also serve as an inspiration (for manager R&D) for supplementing a functioning system with missing elements.

Achieving the aims required applying research methodology which meant operating according to stages: analysis of the literature on the subject; determining the research gap; initial (praxeological) research; conceptualization of four podsystem; preparation of research tools and gathering of data - conducting relevant research; data analysis; formulation of practical recommendations for the researched enterprises; indication of limitations of the conducted research; indication of the rationale for further research.

Combination of various research methods, corresponding to subsequent research stages, have been applied. Grouping the methods according to the tested models was found significant. Details related to the research methodology are presented in table 1.

Table 1.
Research methodology

Innovation management system	Research methodology			Research Subject Matter	Sample size
	Critical analysis of the literature on the subject	Quality methods	Quantity methods		
Subsystem for managing their own innovative maturity	•	The SGMM expert method Individual in-depth interviews Survey <i>Appendix 1,2</i>	-	Corporations: VW, Toyota, FCA	3
Subsystem for managing the processes of obtaining product innovations from suppliers	•	Individual in-depth interviews Survey <i>The results of the study are not presented in this article</i>	-	Plants manufacturing engines that belong to the corporations VW, Toyota, FCA	3
Subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies	•	The SGMM expert method Individual in-depth interviews Survey <i>Appendix2</i>		Plants manufacturing engines that belong to the corporations VW, Toyota, FCA	3
Subsystem for innovation performance management	• Financial document analysis	Survey <i>The results of the study are not presented in this article</i>	Statistical analysis - correlation analysis - regression analysis		3
System management model	•	Interview	-	Implementer of IT solutions for business	-

Source: own study.

Tests of research tools preparation for subsystems analysis were conducted in three automotive corporations (producing drives in Poland).

3. Research findings

Tabela 2.

Tools used by the company (concern) in its relations with suppliers (case of Toyota, VW, FCA)

Management tools	Concern	Use of		
		T	V	F
Individual meetings with suppliers		✓	✓	✓
Participation in dedicated discussion forums		✓	✓	✓
Requests for information and technical dialogues		✓	✓	✓
Standard in communication with suppliers e.g., developed RFI process		✓	✓	✓
Dedicated teams to solve problems arising in cooperation with suppliers		✓	✓	✓
Conduct supplier assessments as part of development programmes and identify potential for improvement		✓	-	-
Secondment of staff to the supplier to exchange knowledge		✓	-	-
Adoption of seconded staff from the supplier to share knowledge		✓	-	-
Cyclical meetings of inter-organisational working groups		✓	-	-
Cooperation and exchange of experience not only with suppliers but also with subcontractors		-	-	-
Innovation days organised to communicate development and innovation needs to suppliers		✓	✓	✓
Learnig trip/ Learnig journeys		-	✓	-
Strengthening of inter-organisational personal links between R&D, Purchasing employees		✓	-	-
Finding commonalities between supplier companies and combining them for innovation development		✓	-	-
Continuous training or education and incentives for innovative suppliers		✓	-	-
Innovation audit as a routine activity/identifying specific resources and processes dedicated to the relationship/asking the supplier for a self-assessment		✓	-	-
Monitoring of relations dedicated to the development of innovative projects		✓	-	-
Supplier portfolio management and relationship termination mechanisms		-	-	-
Appointment of "Innovation Champions"		✓	✓	✓
Hiring an innovation champion		-	-	-
Computer vision of the project to which talent is recruited		-	-	-
Formal mechanisms for managing investment in open innovation		✓	✓	✓
Building trust between employees of cooperating companies and education in the area of relational competence		✓	-	-
Analysis of purchasing practices, audit of purchasing reports		✓	✓	✓
Innovative competitions		-	✓	✓
Use with suppliers of tools to support creativity and imaginative thinking developed by TRIZ (Theory of Inventive Problem Solving)		-	-	-
Use of QFD (Quality Function Deployment) tools with suppliers		-	-	-
Use of FMEA (Failure Mode and Effects Analysis) tools with suppliers		✓	✓	✓
Using "Procurement engineering" with suppliers to improve product performance to meet changing customer expectations		-	-	-
Use of "Reverse engineering" with suppliers to study the product to design a counterpart		✓	✓	✓
Use of "Reverse engineering" with suppliers to study the product in order to design an equivalent		✓	✓	-

Source: own study, base on Appendix 1 (in January 2021 FCA I PSA joined and created concern Stellantis. Data refer to the period 2020)

Using the Smart Grid Maturity Model, lider of supllly chain can assess the innovation maturity of cooperators and prepare measures to improve their competence for R&D cooperation.

The proposed comprehensive method, is a multidimensional set of precise instruments for measuring and assessing the maturity of activities carried out in cooperation. The SGMM model lists six levels of maturity assessment of activities carried out in 8 domains of the organization. An example matrix for assessing innovation maturity is shown in the table below.

Example of innovation maturity matrix to work in the OI open innovation model.

Table 3.
Research methodology in SGMM

5								
4								
3								
2	X	X		X	X		X	X
1			X					
0						X		
	SPZRP	OS	MDO	ZAKP	TTI	PKRK	ISW	POSS

Source: <http://www.sei.cmu.edu/library/assets/brochures/sgmm-1010.pdf>.

The eight enterprise domains rated on a six-point scale are¹:

1. Strategy, Management Processes and Regulation (SPZRP),
2. Organization and Structure (OS),
3. Matrix of Operational Activities (MDO),
4. Asset Management and Employee Competence (ZAKP),
5. Technology and Information Technology (TTI),
6. Customer Needs and Customer Relationships (PKRK),
7. Integration of Value Networks (ISW),
8. Processes in the Social and Environmental Area (POSS).

Based on the Smart Grid Maturity Model method, using the Analytic Hierarchy Process (AHP), the domains most relevant to cooperation in IO with first-tier and next-tier suppliers and idle suppliers were selected. Using the article by (Motyka, 2012), in which the author juxtaposes the AHP method with the Strategic Scorecard method, component weights are assigned to the eight domains of enterprises. The leader can build the innovation maturity of suppliers in different areas of operation. Assessing the level of innovation maturity and identifying the competency gap, if any, is necessary in the effort to improve supplier innovation. The competence gap of suppliers of the three concerns was examined and is shown in the following radar charts. Respondents/employees of the concerns were asked to give a rating for their suppliers (engine component suppliers). The ratings were averaged and shown in the figures below.

¹ Domain evaluation criteria and complete domain evaluation form see: (Stawiarska, 2019).

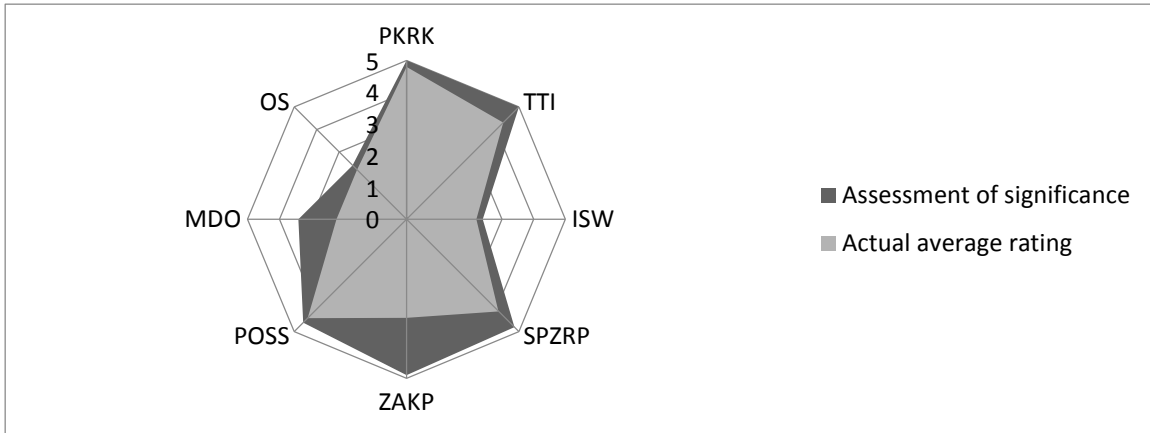


Figure 4. Competency gap analysis of Toyota suppliers' innovation maturity.

Source: own study, base on Appendix.

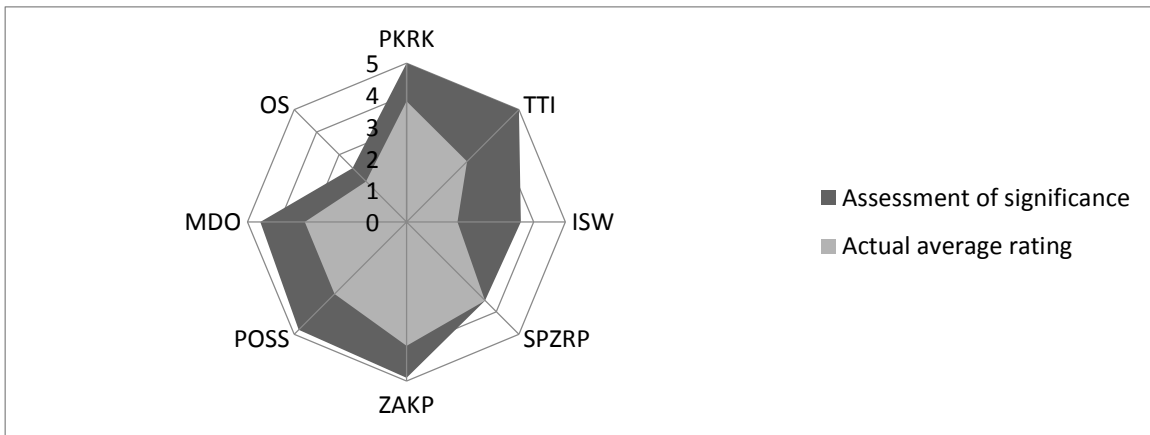


Figure 5. Competency gap analysis of Volkswagen suppliers' innovation maturity.

Source: own study, base on Appendix.

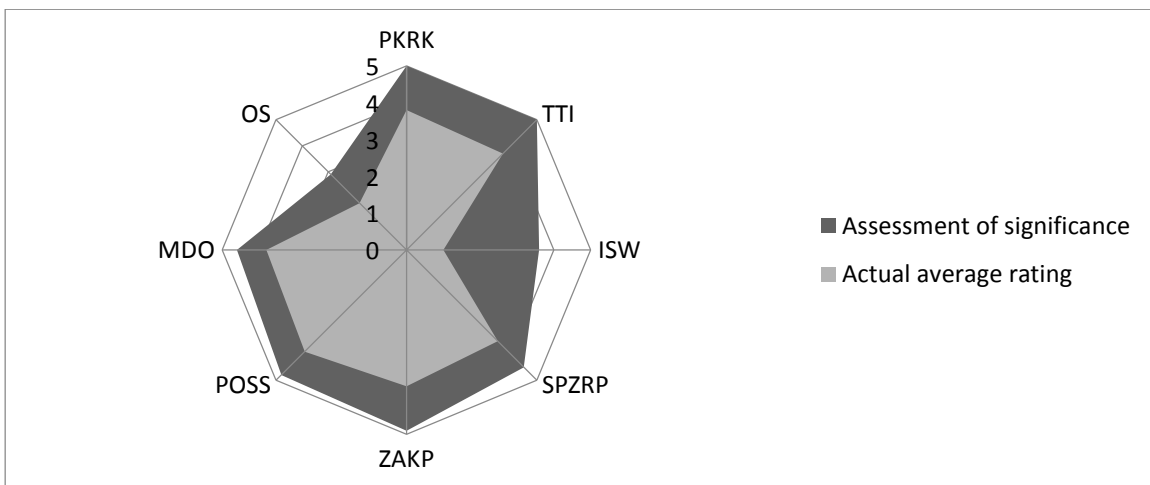


Figure 6. Competency gap analysis of FCA suppliers' innovation maturity.

Source: own study, base on Appendix.

The enterprise domains listed in the figures play a key role in developing organizations to work in an open innovation model OI. A high rating of the domains is a guarantee of the ability to collaborate on innovation in cooperation with the chain leader. The averaged assessment conducted by the respondents showed that suppliers have competence gaps in innovation maturity. Looking at the charts above, it can be concluded that Toyota suppliers show the smallest competence gap in maturity to work in an open innovation model. The figure shows that Volkswagen sees a larger supplier competency gap. Perhaps this is why it is still skeptical about the open innovation development model. The above graphical analysis proves hypothesis 3: Implementation of the supplier's innovative maturity assessment model / Managing the innovative maturity of suppliers results in an increase in the innovativeness of the supply chain leader (measured by the number of patents obtained).

Recognizing the domains of suppliers supporting and assessing them, results in an increase in the number of patents developed in cooperation (see Table 3), this relationship is particularly well demonstrated at Toyota.

4. Discussion

Researchers are building and testing innovation management systems (Cooper, 2004), (Forslund, 2007), (Ryan, 2010) that can be applied to supply chains and networks. The systems being implemented take into account inter-organisational R&D collaboration in the automotive industry (Afuach, 2014). Most of the innovation management systems in operation require digitisation (Stawiarska et al., 2001). Chapter one presents the author's model of a complex innovation management system. The proposed model consists of subsystems, and these subsystems consist of elements identified in the literature. The research work resulted in analyses of two innovation management subsystems operating in the three automotive concerns studied. The results of the subsystem studies are presented in Chapter Three. The presented results of the comparative empirical research suggest the following cognitive conclusions:

1. The conglomerates studied often lack the competences of their competitors, which are necessary for innovation activities in the IO model.
2. The studied corporations implement an innovation management system, but this system cannot be called complex. The closest sophisticated system to support the development of innovation in IO is that of Toyota. Toyota among keiretsu suppliers builds a specific organisational culture, applying the philosophy: challenge, kaizen, genchi genbittsu, mutual respect, teamwork, Toyota Production System, quality circles. The innovation management system among suppliers implemented by Toyota is a perfect exemplification of the Japanese approach to work. Product development decisions do not come suddenly, they are worked out over many meetings, discussions, collective

consultations in a group of managers of cooperating companies. Even if Toyota's activities are not explicitly referred to as an innovation management system - they de facto form an integrated set of principles, procedures and methods oriented towards the creation, dissemination and use of innovation knowledge.

3. Corporations do not build a culture of innovation among suppliers, they do not require creativity, they do not measure the innovation maturity of suppliers. They use supplier databases prepared for their use, where they store information about innovations developed by suppliers. Volkswagen has the most advanced tool for monitoring suppliers and their innovations. A supplier can log on to the VW portal, becoming an 'inactive' supplier, and submit information about a proposed innovation. Volkswagen declares that the knowledge deposited here contributes to the supplier relationship and is used to develop new technologies, products, services.
4. The case studies reveal clear difficulties related to the process of changing the supplier base and reconnecting the resources of new suppliers.

Chapter three also shows an assessment of the innovation maturity of suppliers. It is presented in radar charts as a competence gap in the eight domains of IO work. Toyota suppliers are the most mature for IO work. Only by having a complete picture of the competences of suppliers and potential suppliers can the conglomerate join forces with suppliers in developing new innovationsolutions. The results of the study provide evidence that there is still a lot of work to be done in the systemic innovation management of automotive suppliers. The development of four innovation management sub-systems by the supply chain leader creates an opportunity for their integration. It is therefore worth formulating practical conclusions precisely for purchasing and R&D managers in automotive corporations. The basic practical conclusions are:

1. An innovation management system among suppliers developed centrally and locally, i.e. in the countries of location of production plants, is desirable.
2. All the subsystems and elements of the innovation management subsystem architecture mentioned are equally important. However, there is one that should be singled out - this is a common culture of innovation among co-operators.
3. It is worth implementing innovation management tools and applications in an open innovation model. The supplier innovation management model could be implemented in an IT system and serve as a tool to support innovation development. The idea of implementation was discussed with a specialist from SAP (responsible for cooperation with automotive companies) and met with interest and confirmation of feasibility. An IT-based supplier innovation management system could be classified as an integration platform for innovation. This platform could integrate so-called 'active' and 'inactive' suppliers, concerns and cluster animators. The tool could support the innovation process and consist of different procedural elements. The first element would serve to self-assess innovation maturity. Equipped with artificial intelligence,

the platform would analyse the supplier's declared innovation maturity in the self-assessment, identify competence gaps in the domains subject to self-assessment. At the end of the research periods, the platform would be able to display the average ratings of suppliers by group (by row or segment related to a specific technology). The platform, by detecting competency gaps in specific domains of the surveyed company, could generate action plans for their improvement, identify incentives that will result in closing the gap/resolving the problems. Big data technology will collect and analyse data on supplier assets and pinpoint their location in a timely manner. It seems that corporations still have an indifferent attitude towards new ICT used in supplier relations for innovation development, so they do not invest in modern ICT systems, and this delays organisational change in innovation development processes in open models. Education and promotion of the platform will therefore be necessary. However, looking at what is happening in the automotive software supplier market, it is becoming clear that in the future all automotive suppliers will develop innovations based on open source software. There will come a time when all automotive innovations will be the result of collaboration on open source platforms.

Research on building an innovation management system will continue. The goal of the research will be achieved after testing further tools to identify elements of the next two subsystems, i.e.

- Subsystem for managing their own innovative maturity.
- Subsystem for innovative maturity management of suppliers from the supply chain and networks of cooperating companies.

Although there are problems in the automotive industry in obtaining and analysing data for research, it must be said that a new look at the area of open innovation is needed. The aim of future projects is to develop software, processing data on supplier potential. Artificial intelligence algorithms will be used to find the best suppliers, identify their resources and simulate efficient and effective innovation processes. The undertaking is important for the sustainability of suppliers and the growth of innovation for all companies in the supply chain. The fact that there is a growing demand for eco-innovation, as well as the projected possible crisis in the automotive market, remains an important context for future research.

References

1. Afuah, A. (2014). *Business Model Innovation. Concepts, Analysis, and Cases*. New York-London: Routledge, p. 4.
2. Afuah, A. (2009). *Strategic innovation: New game strategies for competitive advantage*. New York: Routledge.
3. Agarwal, R., Brown, P.J., Green, R., Randhawa, K., Tan, H. (2014). Management practices of Australian manufacturing firms: why are some firms more innovative? *International Journal of Production Research*, 52(21). pp. 6496-64517.
5. Aloini, D. (2018). Implementing open innovation: technological, organizational and managerial tools. *Business process management journal*, Vol. 23, Iss. 6, p. 17.
4. Aloini, D., Lazzarotti, V., Manzini, R., Pellegrini, L. (2017). Implementing open innovation: technological, organizational and managerial tools. *Business Process Management Journal*, 23, 6, p. 1086.
6. Altshuller, G.S., Shapiro, R.B. (1956). On the Psychology of Inventive Creativity (in Russian). *Voprosy Psychologii*, No. 6, pp. 37-49.
7. Beltz, L. (2011). *Organizational structures for open innovation*, <http://www.15inno.com/2011/09/02/organizationalstructures/>.
8. Bendkowski, J. (2016). Korzyści organizacyjne związane z funkcjonowaniem nieformalnych sieci wiedzy. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, z. 93, pp. 19-30.
9. Bessant, J., Trifilova, A. (2017). Developing absorptive capacity for recombinant innovation. *Business Process Management Journal*, Vol. 23, No. 6, pp. 1094-1107.
10. Biedenbach, T., Müller, R. (2012). Absorptive, innovative and adaptive capabilities and their impact on project and project portfolio performance. *International Journal of Project Management*, 30(5). pp. 621-635.
11. Bratianu, C., Stănescu, D.F., Mocanu, R. (2022). The mediating role of customer knowledge management on the innovative work behavior and product innovation relationship. *Kybernetes*.
12. Chakrabarti, A.K. (1974). The role of champion in product innovation. *California Management Review*, 17/2, pp. 58-62.
13. *Checklist for your Innovation Management System*, Finn Kollerup, <http://finnkollerup.com/methods-and-tools/innovation-managementsystem-checklist/>.
14. Cheng, C.C.J., Huizingh, E.K.R.E. (2014). When is open innovation beneficial? The role of strategic orientation. *Journal of Product Innovation Management*, Vol. 31, No. 6, pp. 1235-1253.
15. Chesbrough, H., Brunswicker, S. (2013). *Managing Open Innovation in Large Firms*. The University of California, p. 10.

16. Chesbrough, H.W. (2003). The logic of open innovation: Managing intellectual property. *California Management Review*, 45(3). pp. 33-58.
17. Chesbrough, H.W. (2006). *Open innovation: the new imperative for creating and profiting from technology*. EUA: Harvard Business School Publishing Corporation.
18. Cong, H., Tong, L.H. (2008). Grouping of TRIZ Inventive Principles to facilitate automatic patent classification. *Expert Systems with Applications*, 34(1). pp. 788-795.
19. Cousins, P.D., Lawson, B., Squire, B., Cousins, P.D., Lawson, B., Squire, B. (2006). An empirical taxonomy of purchasing functions. *International Journal of Operations & Production Management*, 26(7). pp. 775-794.
20. Dahlander, L., Gann, D. (2010). How open is innovation? *Research Policy*, 39(6), pp. 699-709.
21. Dahlander, L., Wallin, M.W. (2006). A man on the inside: Unlocking communities as complementary assets. *Research Policy*, 35(8), pp. 1243-1259.
22. Deal, T.E., Kenedy, A.A. (1982). *Corporate Cultures: The Rites and Rituals of Corporate Life*. Harmondsworth: Penguin Books.
23. Dyer, J., Hatch, N. (2004). Using Suppliers Networks to Learn Faster. *MIT Sloan Management Review*, vol. 45, nr 3, pp. 57-63.
24. Eckerd, S., Hill, J.A. (2012). The buyer-supplier social contract: information sharing as a deterrent to unethical behaviors. *International Journal of Operations & Production Management*, Vol. 32, No. 2, pp. 238-255.
25. Ferradas, R., Mi, A., Tanco, J.A., Sandulli, F. (2017). Important factors for innovative competitions for SMEs. *Business Process Management Journal*, Vol. 23, No. 6, pp. 1196-1215.
26. Flint, J.D., Larsson, E., Gammelgard, B. (2005). Logistics innovation, A customer value-oriented social process. *Journal of Business Logistics*, Vol. 26(1), pp. 113-147.
27. Forslund, H., Jonsson, P. (2008). Order-to-delivery process performance in delivery scheduling environments. *International Journal of Productivity and Performance Management*, pp. 41-53.
28. Foster, R., Kaplan, S. (2001). *Twórcza destrukcja*. Łódź: Galaktyka, p. 235.
29. Frost, P.J., Egri, C.P. (1981). *The political process of innovation*. *Research in Organizational Behaviour*. B.M. Staw, L.L. Cummings (eds.). Greenwich, CT: JAI Press, pp. 229-295.
30. Galankashia, S.A., Helmi, P. (2014). Supplier selection in automobile industry: A mixed balanced scorecard–fuzzy AHP approach. *Alexandria Engineering Journal*, Vol. 55, Iss. 1, pp. 93-100.
31. Giannopoulou, E., Yström, A., Ollila, S. (2011). Turning open innovation into practice: Open innovation research through the lens of managers. *International Journal of Innovation Management*, Vol. 15, No. 3, pp. 505-524.
32. Griffin, R.W. (2012). *Podstawy zarządzania organizacjami*. Warszawa: PWN, p. 17.

33. Guan, J., Zhang, J., Yan, Y. (2015). The Impact of Multilevel Networks on Innovation. *Research Policy*, 44(3), pp. 545-559.
34. Gutiérrez, E. (2012). Evaluation and selection of ideas and projects in product development. *KTH Industrial Engineering and Management*, pp. 47-57.
35. Henneberg, S.C., Naudé, P., Mouzas, S. (2010). Sense-making and management in business networks – some observations, considerations, and a research agenda. *Industrial Marketing Management*, Vol. 39, No. 3, pp. 355-360.
36. Howell, J.M., Shea, C.M. (2001). Individual differences, environmental scanning, innovation framing, and champion behavior: Key predictors of project performance. *Journal of Product Innovation Management*, 18, 1, pp. 15-27.
37. <https://www.bloomberg.com/news/articles/2017-05-22/toyota-merck-join-ethereum-group-to-build-blockchain-network>.
38. <http://www.cedr.eu/strategic-plan-tasks/769-2/>.
39. <http://www.fiatsrbija.rs/i-am-fca/fca.pdf>.
40. <https://book.onepdf.us/read/potential-failure-mode-effects-analysis-fmea-reference-manual-4th-edition-potential-failure-mode-effects-analysis-fmea-reference-manual-4th-edition-by-aiag-2008-05-04.pdf>.
41. <https://www.apqc.org/knowledge-base/documents/procurement-industry-spotlight-automotive-industry>.
42. <https://www.ibm.com/support/knowledgecenter/pl/search/automotive>.
43. Hua, Z., Yang, J., Coulibaly, S., Zhang, B. (2006). Integration TRIZ wit problem-solving tools: a literature review from 1996 to 2006. *International Journal of Business Innovation and Research*, vol. 1, No. 1/2, pp. 111-128.
44. Husanudin, A.I. (2018). Four possible rewards (or punishments) for innovation - Their effect on the employee. *Problems and Perspectives in Management*, 16(2), pp. 232-240.
45. Ihl, C., Piller, F.T., Wagner, P. (2012). *Organizing for Open Innovation: Aligning Internal Structure with External Knowledge Search*, <http://ssrn.com/abstract=2164766>, <http://dx.doi.org/10.2139/ssrn.2164766>.
46. Jean, R.J., Sinkovics, R.R., Hiebaum, T.P. (2014). The effect of supplier involvement and knowledge protection on product innovation in customer-supplier relationships: a study of global automotive supplier in China. *Journal of Product Innovation Management*, Vol. 31, No. 1, pp. 98-113.
47. Johnson, J.L. (1999). Strategic integration in industrial distribution channels: managing the interfirm relationship as a strategic asset. *Journal of the Academy of Marketing Science*, Vol. 27, No. 1, pp. 4-18.
48. Joshi, A.W. (2009). Continuous supplier performance improvement: effects of collaborative communication and control. *Journal of Marketing*, Vol. 73, No. 1, pp. 133-150.

49. Kastensson, A. (2014). Developing lightweight concepts in the automotive industry: taking on the environmental challenge with the Sånätt project. *Journal of Cleaner Production*, 66, pp. 337-346.
50. Katz, R., Allen, T. (1985) Organizational issues in the introduction of new technologies. In: P. Kleindorfer, *The Management of Productivity and Technology in Manufacturing*. New York, NY: Plenum Press.
51. Kratzer, J., Hoolzle, K., Gemünden, H.G. (2010). How the network position of R&D team managers and members affects their evaluations of creative performance. *Creativity and Innovation Management*, 19, 2, pp.107-118.
52. Lamberti, E., Michelino, F., Cammarano, A., Caputo, M. (2017). Open innovation results sheet: a managerial tool. *Business Process Management Journal*, vol. 23, no. 6, pp. 1126-1244.
53. Lamberti, L., Noci, G. (2010). Marketing strategy and marketing performance measurement system: Exploring the relationship. *European Management Journal*, vol. 28.
54. Lawson, B., Tyler, B.B., Potter, A. (2015). Strategic suppliers' technical contribution to new product advantage: substitution and configuration options. *Journal of Product Innovation Management*, Vol. 32, No. 5, pp. 760-776.
55. Lee, S.M., Hwang, T., Choi, D. (2012). Open innovation in the public sector of leading countries. *Management Decision*, 50(1), pp.147-62.
56. Lee, Y., Cavusgil, S.T. (2006). Enhancing alliance performance: The effects of contractual-based versus relational-based governance. *Journal of Business Research*, 59(8), pp. 896-905.
57. Mansfeld, M.N., Hoolzle, K., Gemünden, H.G. (2010). Personal characteristics of innovators: An empirical study of roles in innovation management. *International Journal of Innovation Management*, 14, 6, pp. 1129-1147.
58. Marcandella, E., Durand, M-G., Renaud, J., Boly, V. (2009). Past Projects Memory: Knowledge Capitalization from the Early Phases of Innovative Projects. *Concurrent Engineering: Research and Applications*, vol. 17, No. 3, pp. 213-224.
59. Markham, S.K. (2013). The impact of front-end innovation activities on product performance. *Journal of Product Innovation Management*, 30, S1, pp. 77-92.
60. Michailova, S., Worm, V. (2003). Personal networking in Russia and China: Blat and Guanxi. *European Management Journal*, Vol. 21, No. 4, pp. 509-519.
61. Mitreğa, M. (2016). Networking capability in supplier relationships and its impact on product innovation and firm performance. *International Journal Of Operations & Production Management*, Vol. 37, Iss. 5.
62. Mitreğa, M., Forkmann, S., Zaefarian, C.G., Henneberg, S.C. (2016). Networking capability in supplier relationships and its impact on product innovation and firm performance. *International Journal of Operations & Production Management*, Vol. 37, No. 3, pp. 145-167.

63. Moehrle, M.G. (2005). How combinations of TRIZ tools are used in companies-results of a cluster analysis. *R&D Management*, 35, p. 3.
64. Moeller, S., Fassnacht, M., Klose, S. (2006). A framework for supplier relationship management (SRM). *Journal of Business-to-Business Marketing*, Vol. 13, No. 4, pp. 69-94.
65. Motyka, S. (2012). *Innowacyjność przedsiębiorstwa - wskaźniki – efekty*. Kraków: Uniwersytet Ekonomiczny, pp. 160-167.
66. Myszewski, J.M. (1996). *Warsztaty zespołu FMEA*. Prace uczestników warsztatów szkolenia podstawowego FMEA. Warszawa: BJW ZETOM, pp. 45-76.
67. Norm CEN/TS 16555-1:2014 — Part 1: Innovation Management System.
68. Ollila, S., Elmquist, M. (2011). Managing Open Innovation: Exploring Challenges at the Interfaces of an Open Innovation Arena. *Creativity and Innovation Management*, Vol. 20, no. 4, pp. 273-283.
69. Piller, F., West, J. (2006). Toolkits for idea competitions: a novel method to integrate users in new product development. *R&D Management*, 36(3), pp. 307-318.
70. Qi, M., Shangguan, B. (2008). *Design of the Knowledge Management Integrated System Based on TRIZ*. *Electronic Commerce and Security*. Conference paper. International Symposium on 3-5 Aug. 2008.
71. Quinn, J.B. (1992). *Intelligence Enterprise*. New York: Free Press.
72. Rutkowski, K. (1998). *Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie*. Warszawa: SGH, pp. 13-14.
73. Ryan, A. (2010). *Innovation Performance*, <http://www.managedinnovation.com/articles>.
74. Ryciuk, U. (2017). Wpływ zaufania międzyorganizacyjnego na funkcjonowanie łańcucha dostaw. *Zeszyty Uniwersytetu Ekonomicznego w Katowicach*, Nr 315.
75. Schleich, H., Schaffer, J., Scavarda, L.F. (2006). *Managing complexity in automotive production*. 19th International Conference on Production Research.
76. Schon, D.A. (1963). Champions for radical new inventions. *Harvard Business Review*, 41, 2, pp. 77-86.
77. Schuman, H. (2013). *Metoda i znaczenie w badaniach sondażowych*. Warszawa: Oficyna Naukowa, p. 13.
78. Sheu, D.D., Lee, H.-K. (2011). A proposed process for systematic innovation. *International Journal of Production Research*, Vol. 49, No. 3, pp. 847-868.
79. Sopińska, A., Mierzejewska, W. (2017). *Otwarte innowacje produktowe realizowane przez przedsiębiorstwa działające w Polsce. Podejście zasobowe*. Warszawa: Oficyna wydawnicza SGH, pp. 76-84.
80. Stawiarska, E. (2014). *Ryzyko w systemach zaopatrzeniowych sektora automotive w aspekcie społecznej odpowiedzialności dostawców. Natura i uwarunkowania ryzyka*. I. Staniec (ed.). Łódź: Wyd. Politechniki Łódzkiej, pp. 196-209.

81. Stawiarska, E. (2016). Nowe rozwiązania organizacyjne, produktowe i procesowe w kulturze japońskiej i europejskiej. In: S. Borkowski (ed.), *Toyotaryzm Analiza Strumieni Wartości Produkcyjnych* (p. 34). Polski Instytut Jakości.
82. Stawiarska, E. (2019). *Modele zarządzania innowacjami w łańcuchach i sieciach dostaw międzynarodowych koncernów motoryzacyjnych*. Warszawa: CeDeWu.
83. Stawiarska, E., Szwajca, D., Matuszek, M., Wolniak, R. (2021). *Wdrażanie rozwiązań Przemysłu 4.0 w wybranych obszarach zarządzania przedsiębiorstw branży motoryzacyjnej*. Warszawa: CeDeWu, pp. 45-78.
84. Stratton, R., Warburton, R.D.H. (2006). Managing the trade-off implications of global supply. *International Journal Production Economics*, 103, pp. 667-679.
85. Tähtinen, J., Halinen, A. (2002). Research on ending exchange relationships: a categorization, assessment and outlook. *Marketing Theory*, Vol. 2, No. 2, pp. 165-188.
86. Torre, A. (2008). On the role played by temporary geographical proximity in knowledge transfer. *Regional Studies*, vol. 42, no. 6, pp. 869-889.
87. Torre, A., Rallet, A. (2005). Proximity and localization. *Regional Studies*, vol. 39, no. 1, pp. 47-60.
88. Vezzetti, E., Moos, S., Kretli, S. (2011). A product lifecycle management methodology for supporting knowledge reuse in the consumer-packaged goods domain. *Computer-Aided Design*, 43, pp. 1902-1911.
89. Wagner, S.M. (2006). A firm's responses to deficient suppliers and competitive advantage. *Journal of Business Research*, Vol. 59, No. 6, pp. 686-695.
90. Wagner, S.M., Hoegl, M. (2006). Involving suppliers in product development: insights from R&D directors and project managers. *Industrial Marketing Management*, Vol. 35, No. 8, pp. 936-943.
91. Wincewicz-Bosy, M., Stawiarska, E., Łupicka, A. (2017). *Współczesne wyzwania łańcuchów dostaw*. Warszawa: Texter, pp. 79-115.
92. Wolniak, R. (2012). Kryterium wzajemnie korzystnych powiązań z dostawcami w samoocenie systemów zarządzania jakością. *Logistyka*, 5, p. 229.
93. Wong, A., Tjosvold, D., Zhang, P. (2005). Developing relationship in strategic alliances: Commitment to quality and cooperative interdependence. *Industrial Marketing Management*, Vol. 34(7), pp. 722-731.
94. Yam, R.C. Chan, C. (2015). Knowledge sharing, commitment and opportunism in new product development. *International Journal of Operations & Production Management*, Vol. 35, No. 7, pp. 1056-1074.

Appendix 1

Survey of international automotive companies

Dear all, I would like to request an interview questionnaire on innovation capacity building and cooperation among companies in the automotive industry. The research is being carried out for an academic thesis.

The research aims to identify supplier innovation management methods in the context of the effectiveness of new product implementation in your company.

Innovation is key to the success of companies. Despite the announcement of multi-million-pound innovation implementation programmes in the economy, a significant challenge remains in how to source innovation. The R&D function and the Purchasing function have an important role in developing innovation. The work of those employed in these departments involves co-creating and sharing knowledge with strategic suppliers, as well as purchasing innovative solutions, including early-stage development. Given the existing challenges, it was decided to carry out a diagnosis of innovation in the purchasing of innovative solutions. The research was conducted in both the R&D and Purchasing departments of car manufacturing companies and suppliers. The questions concern stimulators and barriers to innovation procurement, solutions to support the development of innovations in an open model, ICT tools used in the innovation procurement process.

I ask for truthful information and honest answers.

Part 1

Interview questionnaire

Supplier innovation management

Kindly answer the following questions to understand your supplier innovation management model.

1. Does your company (concern) have an innovation strategy? yes no
 If yes, does this strategy have a separate strategy for the area of Purchasing? yes no
 Is there a policy for managing the innovation of 1st tier suppliers? yes no
 Is there a policy for managing the innovation of 2nd tier suppliers? yes no

2. What percentage of innovation (concern)

develops in-house R&D and then subcontracts to suppliers (process I)%
sources to suppliers by purchasing/licensing the finished solution (process II)%
sources externally through coupled project collaboration with suppliers (process III)%
other what.....%
	100%

3. Does this percentage pattern hold in relation to previous years
 - increases in favour (I) yes no
 - increases in favour (II) yes no
 - increases in favour (III) yes no
 - Does the change affect the efficiency of innovative solutions? yes no
4. Does the company purchase all components also innovative? yes no
 If yes then:

Does the company strive to increase the number of first-tier suppliers tier suppliers cooperating in R&D? yes no

Does the company strive to increase the number of second-tier suppliers cooperating in the R&D area? yes no

5. Does the company (concern) manage R&D contracts with second-tier suppliers? yes no
Does the company (concern), in the execution of R&D contracts with suppliers, use the processes developed? yes no

Does the company (concern) manage the risk of purchasing innovative solutions? yes no

6. On the basis of which criteria does the company (concern) segment (group) active suppliers with whom it develops R&D projects?
with whom it develops R&D projects?

7. On the basis of which criteria does the company (concern) segment (group) inactive suppliers, with which it wants to develop R&D projects?
.....

8. Is controlling implemented for the distinguished categories of suppliers with whom the company (concern) develops R&D projects? (insert "x" in the table below)

Organisation of purchases							Controlling	Strategic Operational Tactical
Active suppliers				No-active suppliers			Area strategy	
Category	Category	Category	Category	Category	Category	Category		
.....		
.....		
							Market analysis	
							Category strategy	
							Category innovation strategy	
							Supplier and contract management	
							Process preferences (I), (II), (III)	
							Risk management in processes	
							Negotiations	
							Order processing/verification	

9. Does the company (concern) use an ICT tool, Business Intelligence? e.g. K-Monitor to:

- supplier grouping, yes no
- strategic controlling of suppliers, yes no
- operational controlling of suppliers, yes no

10. What are the specific criteria for evaluating a supplier with whom the company (group) is developing/intends to develop innovative component projects?
.....

Are these criteria:

- formulated/written down yes no
- measurable yes no
- communicated to suppliers yes no

11. Are the following managerial tools used in the company (concern) in relations with suppliers (insert "x" in the column on use)

Management tools	use of
Individual meetings with suppliers	
Participation in dedicated discussion forums	
Requests for information and technical dialogues	
Standard in communication with suppliers e.g., developed RFI process	
Dedicated teams to solve problems arising in cooperation with suppliers	
Conduct supplier assessments as part of development programmes and identify potential for improvement	
Secondment of staff to the supplier to exchange knowledge	
Adoption of seconded staff from the supplier to share knowledge	
Cyclical meetings of inter-organisational working groups	

Cooperation and exchange of experience not only with suppliers but also with subcontractors	
Innovation days organised to communicate development and innovation needs to suppliers	
Learnig trip/ Learnig journeys	
Strengthening of inter-organisational personal links between R&D, Purchasing employees	
Finding commonalities between supplier companies and combining them for innovation development	
Continuous training or education and incentives for innovative suppliers	
Innovation audit as a routine activity/identifying specific resources and processes dedicated to the relationship/ asking the supplier for a self-assessment	
Monitoring relacji poświęconych rozwojowi projektów innowacyjnych	
Supplier portfolio management and relationship termination mechanisms	
Appointment of "Innovation Champions"	
Outsourcing the innovation champion	
Computer vision of the project to which talent is recruited	
Formal mechanisms for managing investment in open innovation	
Building trust between employees of cooperating companies and education in the area of relational competence	
Analysis of purchasing practices, audit of purchasing reports	
Innovative competitions	
Use of creativity and inventive thinking tools developed by TRIZ (Theory of Inventive Problem Solving) with suppliers	
Use of QFD (Quality Function Deployment) tools with suppliers	
Use of FMEA (Failure Mode and Effects Analysis) tools with suppliers	
Using Procurement engineering with suppliers to improve product performance to meet changing customer expectations	
Using Reverse engineering with suppliers to study the product to design an equivalent	
Crowdsourcing of innovations (ideas from "ordinary" people)	

12. What barriers (including communication) and risks does your company (Polish branch) face in developing innovation with suppliers?

.....

13. What kind of stimulators (including communication) for the development of innovations with Polish suppliers are distinguished by the company?

.....

Part 2
Questionnaire survey
Supplier innovation management - self-assessment of activities

1. are the following sentences about the company (concern) close to the truth:
(1 - completely disagree 5 - fully agree) (insert "x" in the chosen column 1 - 5)

Supplier innovation management	1				5
We periodically monitor the internal causes of potential inefficiencies in purchasing processes					
We periodically monitor external causes of potential inefficiencies in purchasing processes					
We measure the value generated by purchases, e.g., impact of purchases on sales performance, operating costs by purchasing category					
We cyclically observe the trends evident in the market among purchasing organisations and consider their relevance to our organisation					
We periodically monitor external suppliers (not currently affiliated with our organisation) in order to acquire their innovative solutions through purchase/licensing					
We periodically monitor external suppliers (not currently associated with our organisation) in order to develop innovative projects with them					
We fear the complexity of buying innovation, preferring to co-create it in the development process with the supplier					
Our structures allow us to be fast and agile in our new solution development projects with suppliers, we have an open book policy in place)					
We audit our own company, analysing: Strategy, Management Processes and Regulations (SPZRP) in order to be more open to innovative solutions from outside					
We audit our own company, analysing: Organisation and Structure (OS) in order to be more open to innovative solutions from outside					
We audit our own company, analyse: Measures of Operations (MDOs) to be more open to innovative solutions from outside					
We audit our own company, analyse: Technology and Information Technology (TTI) in order to be more open to innovative solutions from outside					
We audit our own company, analysing: Level of Customer Service and Customer Relationships (PKRK) in order to be more open to innovative solutions from outside					
We audit our own company, analyse: Value Network Integration (ISW) opportunities, in order to be more open to innovative solutions from outside					
We audit our own company, analysing: Social and Environmental Area Processes (POSS) in order to be more open to innovative solutions					
We apply risk management to innovative projects with suppliers					

2. Does developing R&D cooperation in an open model with suppliers increase the number of innovative solutions implemented? yes no

Appendix 2

Survey of international automotive companies Interview questionnaire Managing the innovation competence of suppliers

Please use the tool prepared below to provide an expectation and rating towards the innovation maturity of the suppliers (1st tier, 2nd tier and 'idle/networked) with whom you are collaborating in the development of the engine. Please give an importance rating to each domain (5 - domain important/desirable, 0 - domain not important/not required). Please average the rating of the engine's parts/software suppliers (5 - very high rating of suppliers' cooperation in engine development, 0 - critical rating of suppliers). Please use the form below.

Supplier innovation maturity analysis form

Analysis of supplier innovation maturity - questionnaire		Group suppliers Tier I		Group Tier II suppliers and subsequent		Group suppliers idle networked	
		Assessment of importance	Assessment	Assessment of importance	Assessment	Assessment of importance	Assessment
		Scale 0-5	Scale 0-5	Scale 0-5	Scale 0-5	Scale 0-5	Scale 0-5
1	Strategy, Management Processes and Regulations (SPZRP) - vision and mission, governance , stakeholder cooperation	Sum of products		Sum of products		Sum of products	
	Skills in strategic market analysis/technology monitoring						
	Organisation/membership in a network, exploiting opportunities from the network						
	Presentation, vision, strategy, development directions to next level suppliers						
	Cooperation with suppliers of innovative solutions is regulated by law						
	Ability to create relationships with innovation suppliers, speed of execution of purchase transactions						
	Patent activity for self-created and networked innovations						
	Defined policy of innovation and support for investment decisions in new solutions						
	Innovation strategy integrates all five areas of innovation management (ideas, priorities, implementation, people and strategies)						
	Diversified portfolio of innovation processes (I, II, III)						
	Working with stakeholders ensures investments that sustain growth						

2	Organisation and Structure (OS)	Sum of products		Sum of products		Sum of products	
	The organisational structure enables collaboration with other network stakeholders to optimise network performance and security						
	Ability of the structure to adapt to market changes						
	The organisation is able to adapt easily to support new ventures, products and services that emerge as a result of collaborative networking of relationships						
	Using structured methods to create innovation: morphological method, focal object method, design thinking, brainstorming, synectics						
	Using complex systems (as opposed to ad-hoc solutions) to generate, test and evaluate innovation ideas						
	Stosowanie procesu priorytetyzacji w celu wyboru projektów zgodnie ze strategią innowacji						
	Products and services are more competitive thanks to innovative processes						
	Effective internal and external information flow						
	Speed and efficiency of decision-making						
	The organisation supports the collection of ideas e.g. (from network links)						
	A clear, common and comprehensible system of risk assessment for the development of innovations - which allows projects to be analysed objectively						
	Project management skills						
	Possession of management certification (e.g. ISO 9001)						
3	Operational Measurement Matrix (MDO)	Sum of products		Sum of products		Sum of products	
	Decisions are made quickly in the company based on analysis and are often automated						
	Operational management is based on real-time data extracted from the relationship network						
	Preparation time for innovative components is competitive/design time						
	The R&D/purchasing and production cell is involved in coordinating the development and testing of prototypes between downstream suppliers						
	There is an automated innovation development process						
4	Asset and Employee Competence Management (ZAKP)	Sum of products		Sum of products		Sum of products	
	Management of staff development						
	Effective incentive system						
	Kompetencje pracowników						
	Use/exchange of staff resources/knowledge within the organisation and between companies in the network (key staff from R&D, purchasing and production)						
	Employee autonomy in problem solving						
	An organisational culture that supports innovative company and network activities						
	The company has a complete picture of cooperators' assets based on information, databases and connectivity						
	General climate of the organisation supporting the idea generation process						
	Promoting opportunities to learn and share experiences with other organisations						
	Audit of operations, performance and trend analyses are available to collaborating organisations						

5	Technology and Information Technology (TTI)	Sum of products	Sum of products	Sum of products
	The quality of the IT infrastructure (hardware, network) supports innovative activities IT compatibility allows for the implementation of joint projects			
	Purchasing systems support the development of innovation			
	Design systems support the development of innovation			
6	Customer Needs and Customer Relationships (PKRK)	Sum of products	Sum of products	Sum of products
	Mutual relationship management			
	Mutual understanding of business needs			
	Building lasting business relationships			
	Relationship enhancement applications are plug-and-play			
7	Integration of Value Networks (ISW)	Sum of products	Sum of products	Sum of products
	Level of joint investment in research and development activities			
	Number of new joint products and services launched annually			
	Number of patents filed as a result of cooperation			
	Optimisation of assets throughout the value chain, assets are automatically adapted to the needs of the innovation process			
8	Processes in the Social and Environmental Area (POSS)	Sum of products	Sum of products	Sum of products
	A trustworthy corporate image			
	Network cells control their activities in the context of environmental burdens			
	Strategic, tactical and operational objectives are aligned with local, regional, national and international development goals			
	The organisation cooperates with external actors on environmental and social issues			
	Innovation maturity score (sum of products from eight domains)	total	total	total

Source: own elaboration.

OUTSOURCING OF LOGISTIC SERVICES IN POLISH E-COMMERCE STORES

Dagmara SURPEL

University of Lodz, Faculty of Economics and Sociology; dagmara.skurpel@uni.lodz.pl,
ORCID: 0000-0002-9631-0147

Purpose: The aim of the article is to present the issues of outsourcing logistic services in Internet commerce companies.

Design/methodology/approach: The article is based on an analysis of the literature on the subject and reports, as well as the presentation of the author's own questionnaire research.

Findings: Own research has shown that the outsourcing of logistics activities in Polish online stores is still not very popular. For several years, the percentage of companies using the services of external companies as part of logistics has been at the level of 10%.

Research limitations/implications: The issues require further research, mainly in order to define the reasons why companies decide to carry out activities in the area of logistics on their own. It would be advisable to analyze and compare the costs of logistics activities in detail in the case of outsourcing and in the case of carrying out these activities on their own.

Practical implications: From the practical point of view, the presented analyzes can be used by companies offering their services as part of logistics for electronic stores, so that their offer is better suited to the specificity of e-stores.

Originality/value: The article is addressed to academics and students, but also to entities operating in the logistics industry - mainly companies offering fulfillment. The work presents the current results of original research and compares them with data from previous years, which allowed to indicate the trend in the development of logistics services outsourcing in the e-commerce industry.

Keywords: logistics outsourcing, fulfillment, logistics services, e-commerce.

Category of the paper: Research paper.

1. Introduction

In the era of globalization, many companies face challenges. To stay in business and be competitive, companies are forced to adapt to the changes taking place on the market, as well as to the requirements of new generation customers. In response to these challenges, many companies are beginning to outsource more of their business functions, including logistics.

Logistics outsourcing has become a common practice of many companies in various industries, operating both on local and international markets, both small and large.

The aim of the article is to analyze and assess the impact of logistics outsourcing on the functioning of stores in electric trade on the example of Polish companies. The article is theoretical and empirical in nature. The first part describes the development and forecasts for the e-commerce market as well as the theoretical aspects of logistics outsourcing.

In the second part, an attempt was made to analyze and assess the impact of logistics outsourcing on the process of improving the efficiency of e-shops.

The study used secondary data, but most of all information collected during own research conducted in 2017, 2019 and 2021 on a group of 121, 139 and 141 e-commerce companies. The survey was conducted using CAWI (Computer-Assisted Web Interview) surveys on the web panel, and survey invitations were sent out via e-mail. Due to the possibility of sending a certain number of messages by e-mail, a quota selection was decided according to the provincial criterion, and the sample size was set at 25% of the population.

2. The essence and development of outsourcing logistics services

“If there is something we cannot do more efficiently, cheaper and better than our competitors, it makes no sense for us to do it. We should hire someone to do the job better.” These words of H. Ford, spoken at the beginning of the twentieth century, gained meaning much later, when enterprises more and more often only perform their most important (income-generating) activities, delegating more and more other tasks to external companies. The term "outsourcing" is an acronym for outside-resource-using, which is simply the use of external resources. It is a management strategy of separating from organizational structure of specific auxiliary functions (non-core) and entrusting their implementation to specialized, external organizations in order to increase your efficiency activities (Gonzalez et al., 2015, p. 1067). Enterprises should not only strive to ensure proper customer service and the lowest possible cost, but also to reduce the impact of disruptions in logistics processes (König, Spinler, 2016, pp. 122-134).

Today there is a renewed interest for the Logistics services field. The main reasons for this situation are the steady growth of the logistics services market and the vital importance of Logistics services providers in the supply chain. But before detailing this concept, it proves important to start, first, with a brief overview of the notion of “service”. A service, in general, can be defined as an action performed to satisfy a requirement or to fulfill a demand. It is about incorporeal products such as accounting, insurance, consultancy, expertise or transportation. And as reported by Parasuraman et al. (1985, p. 41), a service is different from a good from the fact that it is: intangible (because it is a performance rather than an object and no transfer of

possession or ownership takes place when it is sold), inseparable (because its production and its consumption take place simultaneously. In other words, a service is consumed during its production and that's what we call the "servuction"), heterogeneous (because its performance often varies from supplier to supplier, from customer to customer and from day to day) and perishable (because it cannot be stored). All these characteristics remain valid for logistics services which are numerous and which cover all the supply chain's links. Therewith, it is important to classify logistics services for outsourcing research. In fact, in recent years, logistics services have attracted much attention from research teams and various classifications have been presented in the literature (Fadile et al., 2018, p. 59).

Hsiao et al. (2011, pp. 550-576) for example, have classified logistics services into four levels, making the distinction between execution and planning and control services in operations management:

- Level 1: it refers to transportation and warehousing services.
- Level 2: it refers to value-added services like packaging and labeling.
- Level 3: it refers to planning and control services, such as inventory management and transportation management.
- Level 4: it refers to distribution network management services.

According to the authors the most common logistics services that can be outsourced are transportation, packaging, transportation management, inventory management, and physical distribution.

Outsourcing is becoming more and more popular all over the world, most of the work is still outsourced. Research conducted by Deloitte in 2016 found that 56% of respondents said the reason they outsourced is to reduce or control costs. And it is not surprising. An hour of work on software development in Poland can be up to five times cheaper than the same work done in the USA (Kamiński, 2020).

As can be seen in the Figure 1. the global outsourcing market in 2019 was worth USD 92.5 billion, USD 6.9 billion more than in 2018. The highest value of the global outsourcing market was observed in 2014. It reached an astonishing 104.6 billion USD.

This massive use of logistics services outsourcing has led to the emergence of a new actor, the logistics services provider which now occupies a central place in the supply chain and has begun to diversify his offers, ranging from conducting operations to piloting the whole supply chain. The term logistics services provider is applied as a synonym for similar terms such as outsourcer, carrier, forwarding firm, transport firm, Logistics services firm and third-party logistics provider (Forslund, 2012, pp. 296-311). In fact, the logistics services provider should not be considered as an additional intermediary but he needs to be treated as a separate industry (Berglung et al., 1999, pp. 59-70).

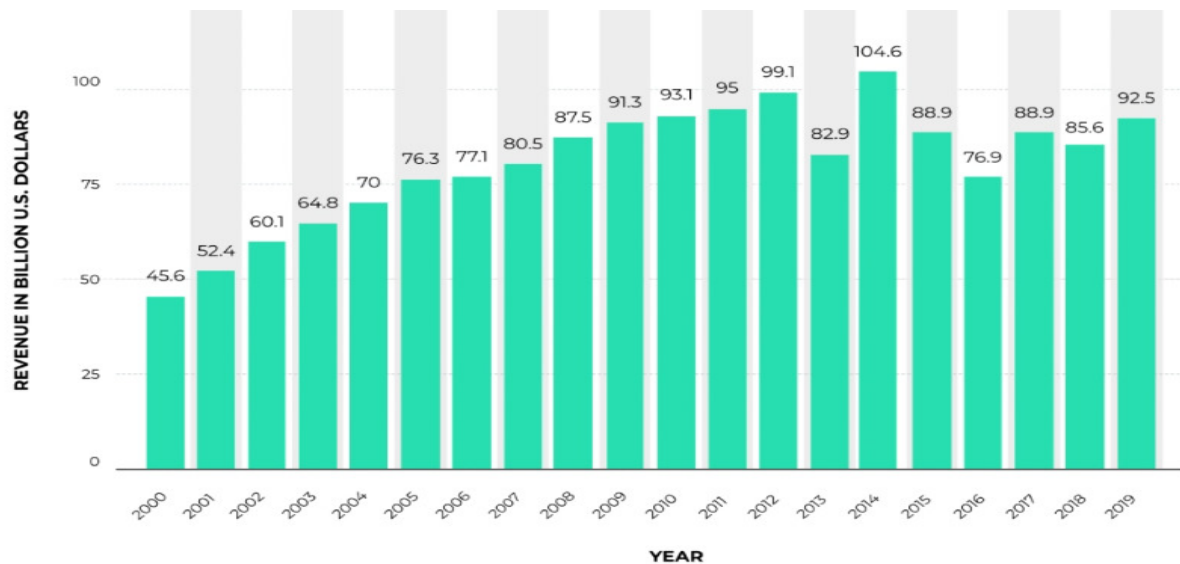


Figure 1. The value of global outsourcing in 2000-2019.

Source: Applover.

Although a number of specialist companies present on the market give us a chance to delegate almost every activity of the company, each entrepreneur should exercise moderation and define key activities that will remain fully dependent on him. And so - a company dealing in creating websites should not outsource the creation of its own website to someone else, and a store whose unique selling proposition are handmade products - should decide to mass production in one of the friendly plants.

Choosing a proven outsourcing company that has good opinions will allow the company to maintain a high level of customer service at every stage of the contract. At the same time, the costs of activities carried out by the company and their quality should be constantly monitored. In some cases, it may turn out that outsourcing will cease to pay off and, for example, instead of fulfilling fulfillment, it will be more advantageous to store goods on your own.

3. Development of e-commerce

According to eMarketer data, e-commerce turnover in the world from year to year they increase by about 20%. In 2019 their the value exceeded \$ 3.5 trillion. It accounted for it is around 14.1% of total retail sales. In 2020 a year is expected to reach 4.2 trillion (an increase of 19%), and in 2023 year is expected to reach \$ 6.4 trillion, which will be 22% of total trade (Lipsman, 2019) (see Figure 2). This share will be possibly bigger due to violent interest in online shopping by newcomers customers caused by the coronavirus pandemic.

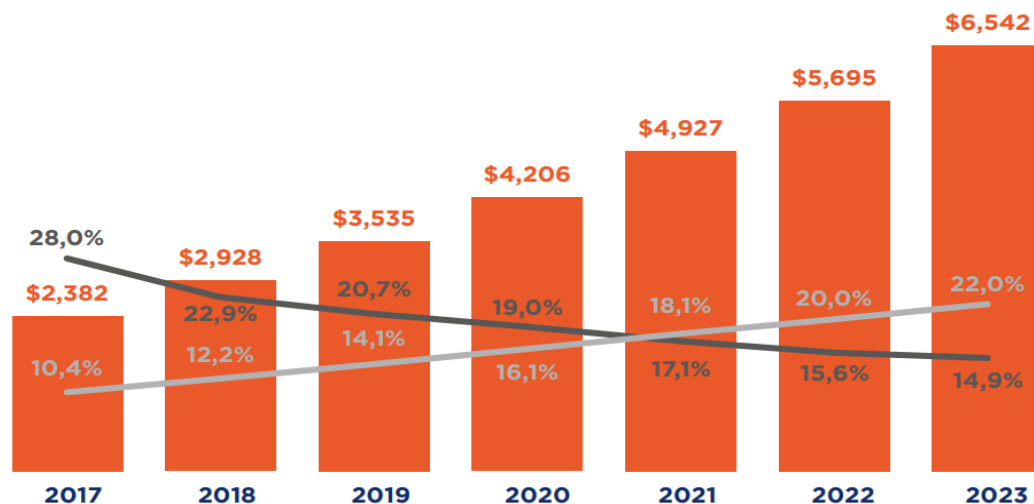


Figure 2. E-commerce in the world in 2017-2023 (million USD).

Source: Kawa, 2017. Fulfillment service in e-commerce logistics. *LogForum*, 13(4), 429-438.

Electronic commerce in Poland is treated as one of the most dynamic and important sectors economy as well as one of the major factors leading to greater competitiveness. His development is stimulated by rapidly increasing access to the Internet, but also by mobility and popularity mobile devices through which customers order goods and services in a convenient place and time. With their help, they buy not only larger things values, but more and more everyday products, they want to have very quick access to.

In 2018-2021, the increase was mainly due to customers switching between sales channels. The pace of this change significantly accelerated in the years 2020 - 2021. This was mainly due to the closure of brick-and-mortar stores. In the years 2022-2023, the role of the main engine of market growth is taken over by the increase in product prices with the weakening consumer demand. It is mitigated to some extent by the influx of more than 2 million refugees from Ukraine. From 2024, a return to the long-term growth trajectory and stabilization of macroeconomic conditions is assumed. By 2027 (figure 3), the value of the e-commerce market in Poland will increase by over PLN 94 billion to PLN 187 billion (Perspektywy rozwoju rynku e-commerce w Polsce 2018-2027, 2022).

Experts point out four extremely important aspects for companies that are already selling or intend to sell online. The first is omnichannel, i.e. ensuring consistency between various sales channels. The second is customer experience - building positive customer experiences. As many as 42% of Polish consumers are able to give up a given brand after just one bad experience. The third aspect is the activation and loyalty of customers, incl. by selecting the appropriate pricing strategies or loyalty programs. The fourth is logistics and ensuring the continuity of supply chains - especially important in the not fully predictable reality, as demonstrated by the ongoing pandemic in recent months.

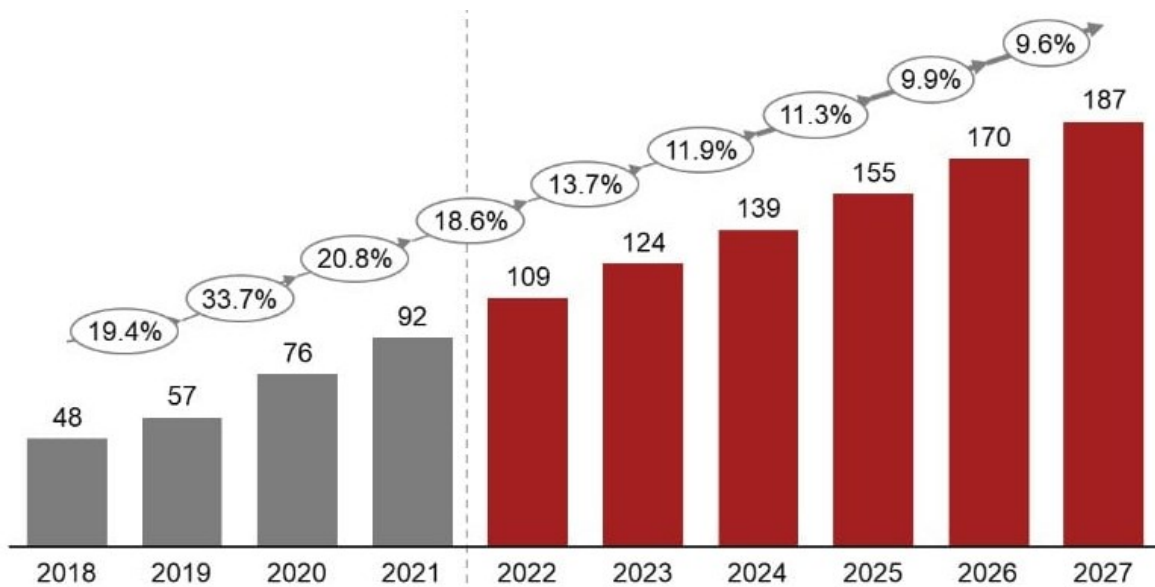


Figure 3. Value of the Polish e-commerce market in 2018-2021 and forecast until 2027 (billlion PLN).

Source: <https://www.strategyand.pwc.com/pl/pl/publikacje/2022/perspektywy-rozwoju-rynku-e-commerce-w-polsce-2018-2027.html>, 15.09.2022.

New ones are created along with the dynamic development the needs of companies trading via the Internet. One of them is the separation of logistics processes outside and transferring them to external operators. E-commerce companies increasingly prefer to focus on their key competences, i.e. marketing, sales, procurement.

4. Outsourcing of logistics functions in e-commerce

4.1. Logistics organization forms in e-commerce

There are three basic forms in e-commerce logistics organizations that indicate the scope of the processes carried out by an online retailer: own logistics, dropshipping and fulfillment.

Own logistics (independent execution of processes logistics) is the most popular among micro and small businesses, the scale of which is still too small for the use of external companies logistics was profitable. Some also use it the largest companies that use the effect scale or prefer to have everything under control.

Dropshipping, on the other hand, is about shipping goods directly from the warehouse of an external entity (e.g. manufacturer, distributor) to the customer, no need using the seller's warehouse. Thanks to this e-sellers don't have to take risks freeze your assets in the warehouse. Finally - fulfillment comes down to handover logistics processes to an external supplier.

Dropshipping is a method of selling products in which the seller does not physically store them. This method usually generates more profit per unit sold due to the cost savings that occur when retailers out-source the warehousing and distribution process. In a regular supply chain,

the retailer buys the products from the wholesaler and stores them in their warehouse, then ships them to the buyer. When dropshipping is used, the products are stored in the supplier's (dropshipper) warehouse, which reduces the cost of shipping and cost of storage. And when the retailer gets an order on his online store, he then pays his supplier and the supplier ships the product directly from his warehouse to the buyer's address. This way, the product is not sent and stored at the retailer, which saves money and allows a decrease in product price and a higher profit to be made (Froyk, 2012).

In fact, where dropshipping is concerned, you are actually acting as the middleman for the product that your customer receives and the manufacturer who produces it. This particular type of system is extremely beneficial to both small retail shops, as well as internet based stores, or those people who use mailing catalogs in order to generate sales for their companies. In fact, many customers who purchase their products in this way seem not to be too bothered that there is a delay between the time when the products are ordered and when they actually have them arrived (James, 2011). The biggest problem that is addressed by dropshipping is that retailers no longer have to worry about controlling their inventory, as this is done for them by the wholesaler instead.

Even though there are more and more companies providing services logistics for e-commerce and logistics operators complement their offer for this customer segment, it is still quite a niche service in Poland. Not however, this means that there is no significant potential. Looking at Western markets (e.g. Germany, France, Benelux countries), Poland is currently at the beginning of a very dynamic development fulfillment services.

4.2. Fulfillment models in e-commerce

The business services outsourcing market is growing rapidly all over the world. Its development is the result of economic entities building the most effective business models that allow them to use external resources. It is the concept of outsourcing and then offshoring that has brought companies a reduction in costs and an increase in efficiency. The effectiveness of the new solutions, confirmed by positive effects, influenced the development of the market of outsourcing and offshoring service providers.

The fact that outsourcing in e-commerce is doing well is demonstrated by the increasing number of duties entrusted to external companies. Not only large enterprises, but also small online stores have convinced themselves to delegate some tasks to specialists, which, thanks to the delegation of responsibilities, can quickly enter the demanding market. Thanks to this, small stores using outsourcing can offer customers the highest quality of services in many areas, despite the fact that they do not have their own departments dealing with this area of the company's operation, and large stores can fully focus on key areas of activity and not bother with e.g. advanced accounting that would consume a significant amount of company resources.

The logistics of the online store is one of the most important issues, because the availability of individual goods and the time in which the order will reach the customer will depend on it. The solution that is more and more appreciated by online stores is fulfillment.

The first research towards defining order fulfillment strategies was published by Hans Wortmann (1983) and was continued by Hal Mather (1988). The principle of operation of the service is simple and, in the narrow sense of logistics, it is based on entrusting warehouse management to an external company. In a broader sense fulfillment is in the most general sense the complete process from point of sales inquiry to delivery of a product to the customer (Croxtan, 2003, pp. 19-32). These processes most often include taking, storing, picking, packing and shipping products and handling their returns. Exists yet the concept of One Stop E-commerce that is fulfillment extension with additional services. Assumes it supports not only in the field of logistics (such as fulfillment), but also end customer service, marketing activities, IT solutions and finance and accounting by one company. For example, it can be run on behalf of a client multi-lingual call center where it is performer handling inquiries, complaints, etc.

Goods ordered by the online shop from suppliers are sent to such an operator's warehouse, and are then unloaded, inspected, stored, picked and shipped (Isac, 2014). On behalf of the client, the operators manage the warehouse, check the inventory, take orders from final customers, package shipments, prepare sales documents (e.g. invoices, receipts) and shipping ones (e.g. waybills), attach manuals, help in customs clearance, handle returned goods, co-operate with transport companies. This solution is very flexible because a specialist fulfillment operator is able to adapt to the variability of the demand of their client depending on his/her needs, e.g. by increasing or decreasing the storage area or the number of employees. The operator prepares reports on their activities for the client regarding the sales volume, number of returns, complaints. Some companies even undertake repairs, refreshing and disposal of returned products (Kawa, 2017). The needs in e-commerce and the specifics of individual stores vary significantly.

The business models of fulfillment are shaped by two factors: customer preferences (home delivery, store pick up), and supply sources (warehouse, stores, 3rd party, consolidators). As shown in table 1, home delivery can be fulfilled from all the four sources of supply, whereas, store pick up would rule out the warehouse and the 3rd party service provider. The supplier structures the fulfillment system by creating a new logistics infrastructure, or by adapting the existing processes.

Table 1.
E- Fulfillment models

		Customer	
		Home Delivery	Pick up at the Store
Supplier	Warehouse	X	
	Store	X	X
	Use 3 rd Party	X	
	Consolidate from Multiple Sources	X	X

Source: Chakravarty Amiya K., Supply Chain Transformation: Evolving with Emerging Business Paradigms (PDF), 2014, p. 159.

The trend for order fulfillment among most online e-grocers is to establish large, automated distribution centers for home delivery in each major market they serve, while some brick-and-mortar chains have employed only in-store order fulfillment (Chakravarty, 2014, p. 159).

Direct home delivery can be completed by the supplier, a 3rd party service provider, or a consolidator (Lang, 2010, pp. 1-25). Before initiating the fulfillment, products have to be picked, packed, and labeled, which can be done either in a central warehouse, a distribution center, or in a store, or in some combination thereof.

Direct Delivery from a Store- picking and packing of orders can be done inside a physical store out of the shelves. In this case, operators pick the products into a specific order preparation cart from the shelves and then pack and send the completed order to the customer (Chakravarty, 2014, p. 159).

In the next model, the ordered products are not available in one facility, they must be picked up from another location. They are then consolidated into one place where they are packed into the system.

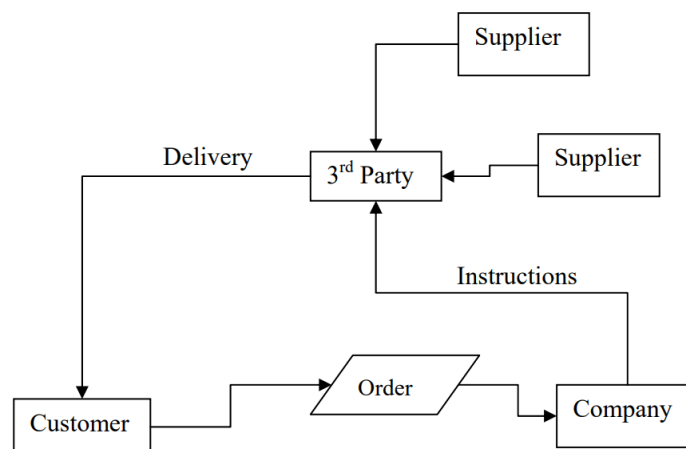


Figure 4. Fulfillment Through a 3rd Party.

Source: Chakravarty Amiya K., Supply Chain Transformation: Evolving with Emerging Business Paradigms (PDF), 2014, p. 161.

With increased demand uncertainty, companies are increasingly using 3rd party fulfillment centers, which can be thought of as virtual warehouses (not owned by the company). There are multiple ways a 3rd party service can be utilized, as shown in Figure 4. For example, they can be logistics companies, who pick up the products from different suppliers, provide finishing operations (packing, labeling etc), and ship them to customers. They could also be assemblers who procure components from suppliers, assemble the products, and ship them. Third party fulfillment facilitates inventory reduction at the company's warehouses, but it may also lead to ceding direct control of fulfillment operations.

Customers ordering online may choose to pick up the products in one of the retailer's stores. In such a case, products must be picked, packed, and kept ready for pick-up in the store. **Direct in-store Order Preparation** If all the products of the customer's order are available in the store chosen by the customer to pick-up, the picking, preparation and packing of the order can be done immediately in the store. If some of the products of the customer's order are not available in the store chosen by the customer, the unavailable items must be ordered from different locations to complete the order. The preparation and packing of the order can be done only after consolidation of all items in the store.

Fulfillment services should be constantly developed according to the needs of the market. A decisive factor building a competitive advantage in the near future will be value-added services such as the delivery of parcels on the same day, cheap and fast shipping to foreign countries etc (Kawa, 2017).

5. Outsourcing in polish online stores- own research results

One of the biggest challenges for online stores is logistics. Online shopping, unlike traditional trade, are inextricably linked with delivery to the final customer, that is, with the process that is the most complex and costly along the entire supply chain. In addition, warehousing of goods is a problem. The vast majority online stores in Poland, it organizes its own logistics processes range- according to our own research, fulfillment in recent years has been used by approximately 7% of Polish e-stores on average, and this trend is constant (figure 5). Since 2017, the interest in dropshipping has been declining - in 2021, only 2% of respondents declared that they use such a solution. This may be mainly due to the covid-19 pandemic, which has limited imports of goods from China.

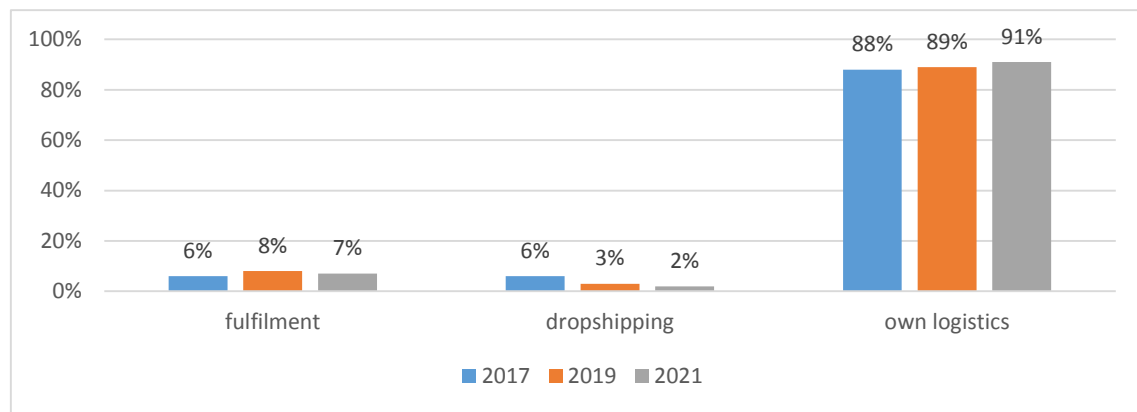


Figure 5. Forms of logistics in Polish e-stores in 2017, 2019 and 2021.

Source: own research.

Importantly, Polish online stores are increasingly resigning from having their own warehouse space - in 2017 it was 13% of respondents, in 2019 - 26%, and in 2021 - 27% of the respondents. Most often, stores that handle more than 100 orders per month decide to resign from their own warehouse (figure 6).

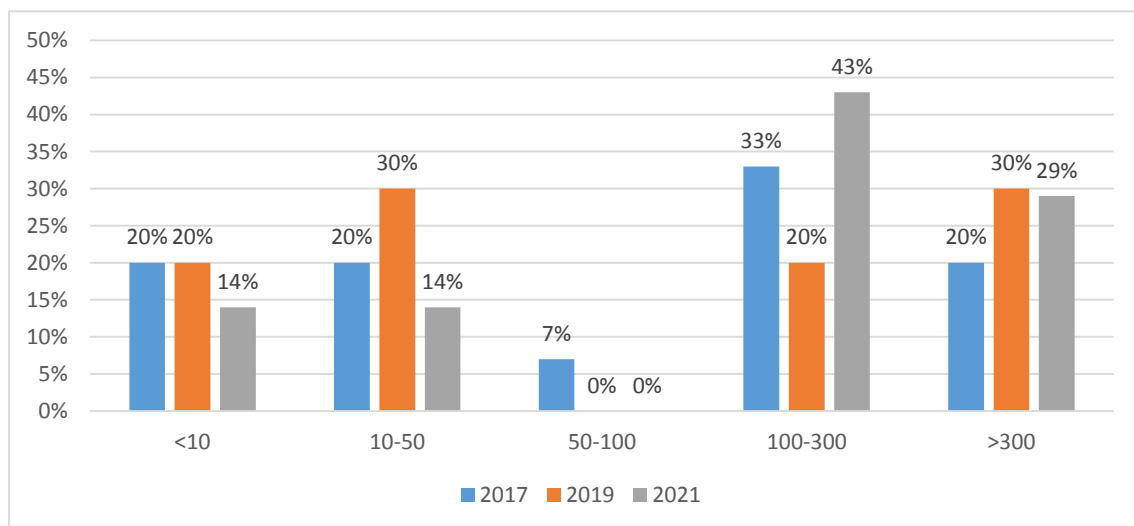


Figure 6. The percentage of e-stores resigning from their own warehouse space depending on the sales volume.

Source: own research.

As can be seen, there is a discrepancy between the number of stores without a warehouse and those using dropshipping or fulfilment, respectively: 1% in 2017, 15% in 2019 and 18% in 2021. In this case, the store collects orders from customers and then purchases the goods from the manufacturer/distributor and sends it itself. From the point of view of the store, it is an ideal solution, as it does not generate the costs of storing inventory, but from the customer's point of view, such a solution may result in a long waiting time for the purchased product.

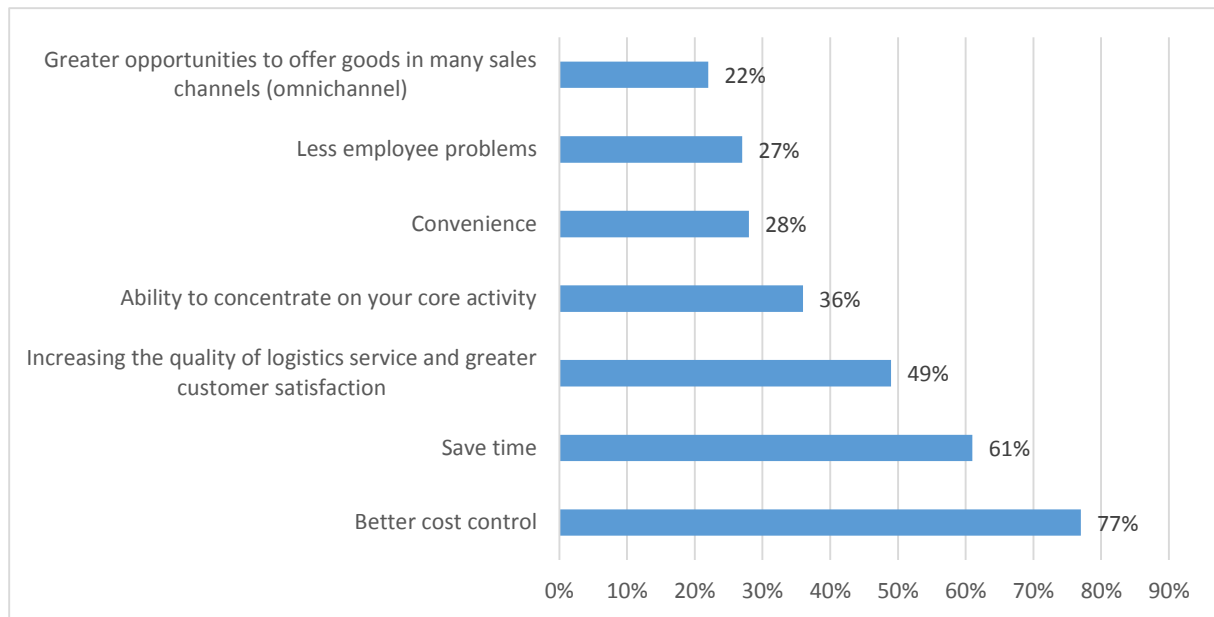


Figure 7. Benefits of using fulfillment.

Source: own research.

Among the advantages of fulfillment and outsourcing warehouse services, the most frequently mentioned were: Better cost control, Time saving and Increasing the quality of logistics services, which translates into greater customer satisfaction (figure 7).

On the opposite side, the arguments of stores that do not benefit from fulfillment were: Fear of losing control over processes and inventory (78%), low level of logistics services (59%), e.g. damaged parcels and too high costs of outsourcing services to an external company (52%).

Despite the high potential of process automation warehouses are still a large part of companies (even those largest) does most of the work with the use of human labor. It happened slowly though changes because the fulfillment operators more and more are considering investing in automation. Caused this is mainly rising labor costs and quite high warehouse lease costs. An additional the stimulus now will certainly be instability processes using human labor, caused coronavirus pandemic or similar challenges.

A certain direction of development for fulfillment operators is extending services for its customers, e.g. repair or renewal of returned products, financial and accounting services, contact center, program support loyalty cards, discount coupons, and so moving to the one stop strategy described earlier -commerce. An additional scope of activities may also be matching the offered products to preferences of specific customers in local markets - an example is attaching operating instructions, leaflets in the selected language.

Industry experts also pay attention to advice on choosing the right model business, in particular indicating areas activities that can be optimized. Is it possible thanks to the extensive experience of the operators fulfillment, their respective resources and know-how supported by many years of activity in shaping e-commerce trends.

6. Summary

The major drivers of a logistics system include products, customer preferences, technology innovation, globalization, sustainability, infrastructure, and cost. A logistics service, whether internal or outsourced, can carve out a competitive niche in terms of how it responds to these key drivers.

The Polish market is very similar to the western one - perhaps less technologically advanced, more fragmented and operating on a smaller scale, but the direction of development is consistent. The growing awareness of customers of the existence of such services and the cost pressure in Western Europe is an additional fuel for the e-commerce industry, which will catch up with or overtake its Western counterparts in the next few years.

It is said that the fulfillment services market in Poland is adjusted it is specific to our e-commerce, because it is characteristic is its considerable fragmentation. The fact that the majority of Polish online stores are micro or small stores means that these enterprises, due to the small number of customers served, carry out logistics activities on their own.

Logistics operators take a special place in the supply chain electronic commerce. They are an entity that integrates processes logistics between the seller and the buyer and shipping suppliers. Apart from process coordination can act as a wizard new solutions in the field of logistic service customer, e.g. by offering new services or an improved process customer service. Due to their close relationship with various entities need standardization of work, procedures, flow of goods and information.

References

1. Berglung, M., Van Laarhoven, P., Sharman, G., Wandel, S. (1999). Third Party Logistics: is there a future? *Int. J. Logist. Manag.*, vol. 10, no. 1, pp. 59-70.
2. Chakravarty, A.K. (2014). *Supply Chain Transformation: Evolving with Emerging Business Paradigms*. Retrieved from: <https://link.springer.com/book/10.1007/978-3-642-41911-9>, 3.02.2021.
3. Croxton, K.L. (2003). The Order Fulfillment Process. *International Journal of Logistics Management, The, Vol. 14 Iss. 1*, pp.19-32.
4. Fadile, L., El oumami, M., Beidouri, Z. (2018). Logistics Outsourcing: A Review of Basic Concepts. *Int. J. Sup. Chain. Mgt.*, Vol. 7, No. 3, p. 59.
5. Forslund, H. (2012). Performance management in supply chains: logistics service providers' perspective. *Int. J. Phys. Distrib. Logist. Manag.*, vol. 42, no. 3, pp. 296-311.

6. Froyk, R. (2012). *The ABCs of Ecommerce and Dropshipping Success: Practical guide how to start and run a successful online store and ecommerce business*. Robert Froyk.
7. Hsiao, H., Kemp, R.G.M., van der Vorst, J.G.A.J., (Onno) Omta, S.W.F. (2011). Logistics outsourcing by Taiwanese and Dutch food processing industries. *Br. Food J.*, vol. 113, no. 4, pp. 550-576.
8. James, E.D.St. (2011). *Running A Profitable Dropshipping Business*. KMSPublishing.
9. Kamiński, J. (2020). *The state of outsourcing services in the post-pandemic landscape*. Retrieved from: <https://applover.pl/blog/the-state-of-outsourcing>, 10.09.2022.
10. Kawa, A. (2017). Fulfillment service in e-commerce logistics. *LogForum*, 13(4), 429-438.
11. Lang, G. (2010). *Fulfillment systems in Multi-Channel Retailing – Customer Expectations and Economic Performance*. 8th International Research Conference in Logistics and Supply Chain Management (RIRL). Bordeaux, France, pp. 1-25.
12. Lipsman, A. *Global Ecommerce 2019*. Retrieved from: <http://www.emarketer.com/content/global-ecommerce-2019>, 12.02.2021.
13. Mather, H. (1988). *Competitive manufacturing*. Prentice Hall.
14. Parasuraman, A., Zeithaml, V.A., Berry, L.L. (1985). A Conceptual Model of Service Quality and Its Implications for Future Research. *J. Mark.*, vol. 49, no. 4, p. 41.
15. *Perspektywy rozwoju rynku e-commerce w Polsce 2018-2017*. Retrieved from: <https://www.strategyand.pwc.com/pl/pl/publikacje/2022/perspektywy-rozwoju-rynku-e-commerce-w-polsce-2018-2027.html>, 10.09.2022.
16. Wortmann, J.C., Chapter, A. (1983). A classification scheme for master production schedule. In: C. Berg, D. French, B. Wilson, *Efficiency of Manufacturing Systems*. New York: Plenum Press.

PRODUCT PHOTOGRAPHY IN PRODUCT ATTRACTIVENESS PERCEPTION AND E-COMMERCE CUSTOMER PURCHASE DECISIONS

Radosław SZULC^{1*}, Katarzyna MUSIELAK²

¹UWM in Olsztyn; radasz@uwm.edu.pl, ORCID: 0000-0002-0521-5073

²UWM in Olsztyn; knachurska@gmail.com

* Correspondence author

Purpose: This paper discusses the importance of product photography in influencing both consumer behaviour and the process of competitiveness among retailers in the e-commerce sector. The aim of the paper is to present the significance of product photography as regards its influence on purchase decisions, further illustrated by the author's own empirical results.

Design/methodology/approach: The authors verified the assumption that employing different techniques to produce a product photograph (e.g. lighting, setting) influences purchase decisions in terms of the change in attitude towards an offer under the influence of the photograph taken, the degree of this change and the likelihood of an increase in the conversion rate. The principal research concept is to use three factors that determine, in effect, the significance of product photography presented in different settings. Various combinations of these factors enhance the informational and persuasive function of photography, which rationalises consumer choice in e-commerce. The study was carried out using an online survey method. The authors used purposive sampling.

Findings: The main conclusion drawn from the study is that, in the opinion of the respondents, the way in which a product is photographed is of importance when making purchase decisions. The consumer pays attention to the way the product is presented in e-commerce offers and reacts differently depending on the lighting techniques used. The results also indicate that the price of the product plays an important role as a decisive factor in the purchase of the evaluated products by consumers. The findings further indicate that the price of the product is also of great importance to consumers as a factor determining the purchase of the evaluated products. Disclosing additional information about the price of a given product presented during the survey resulted in a change in the respondents' perception of an offer, regardless of the combination of factors. According to the research assumption made, lighting played a key role in the perception of photographs by potential customers. In the opinion of the respondents, the illumination method had a noticeable effect on accentuating the product details seen in the photographs.

Originality/value: This paper discusses the issue of product photography used in different ways in various e-stores' offers. The impact of selected photographic techniques influencing both consumer behaviour and the process of competitiveness among retailers in the e-commerce sector is shown. It was indirectly confirmed that the price and background used when photographing a product significantly influence the perception of the attractiveness of the

purchase under consideration, even in a situation when the presentation of the product is optimal, as it provides full, visualised information about it under the circumstances most conducive for a purchase made remotely.

Keywords: product photography, e-commerce purchase decisions, cyber market.

Category of the paper: Research paper.

Introduction

E-commerce refers to the process of exchanging goods over the Internet, and online shopping has been growing in popularity and reach globally since the turn of the 20th century. The number of people who use the Internet on a daily basis is increasing exponentially, contributing to the greater number and value of online transactions. This is reflected by an increase in the size of the cyber market itself as well as its competitiveness, with emerging entrepreneurial attitudes and lower entry and exit thresholds, chiefly due to the minimisation of sunken costs. Market democratisation perceived in this way is a consequence of technological progress. This, in turn, accelerates social and behavioural changes in the 21st-century society, but it also results from qualitative and structural changes taking place in the e-commerce sector. So far, numerous factors influencing the mentioned trend have been discussed and confirmed in the literature. These are diverse, yet no unequivocally dominant factors have been identified to confirm their close relationship with decisions regarding purchase (Li, Wang, Chen, 2014). Digitalization of business has been determining a change in the competitive potential of entities operating online, which has led to the formation of the cyber market, regarded as a virtual business space (e-business, e-market). The online and offline worlds are becoming increasingly intertwined. Both the structure of cyberspace, which increases its competitiveness, and the process of competition itself, which is intensified by the growing number of companies with increasing digital skills, offering an increasing number of individualised offers, are being strengthened. The development trend of the cyber market is illustrated best by the issue of NetReadiness (Hartman et al., 1999, p. 21) and the values of the NRI (Network Readiness Index). Owing to the relatively straightforward establishment of many different business models based on online platforms and retail transactions, the cyber market is becoming highly atomised, both on the demand and the supply side, thus increasing the level of competition. This growth and development affect the conditions under which transactions take place and ultimately alter the behaviour of the consumers themselves. The value and volume of online shopping are also on the rise due to a change in the shopping model itself and the consumers migrating to the online environment, encouraged by the level of maturity of the e-commerce markets. The translocation of shopping channels is also influenced by cultural differences (Kowlaczuk, 2018), as well as the elimination of direct interpersonal contacts due to the Covid-19 situation between 2019 and 2022. Against this background, one interesting case

comes from the contrasting findings of another team of researchers (Yang et al., 2020). A pure e-commerce business transaction is based on impersonal communication on the part of the customer, which is essentially a disadvantage in terms of the relevance of trust towards the seller and an obstacle to the transaction. This situation generates the need for a better evaluation of the offer. The missing dimension of face-to-face communication in a virtual environment can be substituted by a comprehensive presentation of the offer and other social activities, such as feedback from past customers or greater flexibility in terms of after-sales service (complaints, explanations, returns). One of the more objective methods of stimulating sales is product photography, which focuses on the presentation of the product itself from a number of angles and in different settings. In an attempt to persuade the customer to make a purchase in their e-store, producers focus on the presentation of goods in photos and descriptions. This follows from the implication of the influence of images on purchase decisions, which is known under the colloquial term: "the customers buy with their eyes". A clearly articulated rationale for the influence of image on these decisions has emerged from a handful of studies (Li, Wang, Chen, 2014). Based on the authors' own literature review, it can be assumed that little has changed concerning the above issue since the papers were published. The considerations presented in the paper by Li, Wang and Chen (2014) constitute an important supplemental source, relying on the results of an experiment which not only presents the technical aspects of product photography but also provides simultaneous empirical verification. Similarly, a small number of more recent studies lead to the conclusion that product photography significantly influences consumers' purchase decisions and market behaviour. Four types of visual stimuli that form the content of each photograph undoubtedly contribute to this, and the authors classify them as information, emotion, aesthetics and a social element. Product photography is being used on all social networking sites. Its popularity is consistently high, which is probably a reflection of the weight of its impact, universality and conciseness of the form in relation to the content. At the same time, there are few publications which distinguish and discuss the issue of presenting a product offer in the form of a photograph as a factor contributing to the perception of the product, assessment of its attractiveness, interest in it, and ultimately the decision to purchase it.

The aim of this study is to provide an insight into the role of product photography in the context of its influence on purchase decisions, illustrated by the author's own empirical results. The central element of the research concept pursued is the application of three factors determining the significance of photographs of products presented in various settings. Combinations of these factors determine the informational and persuasive function of photography, which rationalises consumer purchase decisions in e-commerce.

1. Product photography and its impact on customer purchase decisions

In a world saturated with information and visual content and easy access to it all, photography plays a vital role in communication and in shaping social behaviour. Thanks to this evolution, society is witnessing a shift from the use of verbal and text-based messages toward images, as the saying goes, "a picture is worth more than a thousand words". The popularity of the Internet has intensified the development of ICTs and the emergence of multiple new communication media that are used as new channels of communication, including marketing communication (Neslin, Shankar, 2009). The high value of marketing communication relies on fully exploiting its two essential elements, i.e. promotion and study thereof (Kaczmarczyk, 2015). Promotion is invariably based on visuality complemented by contemporary social technology exploited in social media. It is commonly believed that the majority of society relies entirely on visual sensations, through which it largely satisfies the need for cognition as such. It is also carried over into customer behaviour in the area of purchase decisions, product evaluation in terms of attractiveness and quality, and the final decision. Eyesight allows a human being to perceive differences between compared objects regarding their physical properties, particularly their colour, shape and size. The importance of sight grows even more when viewed in the context of the cyber market and the activities taking place there. Therefore, product photography has become a tool that provides a full visual presentation of the product in cyberspace, with various spatial techniques, including HDR or 3D. As part of online merchandising activities, attention to proper website architecture and easy-to-read and coherent content, both at the textual and visual level, is apparent. The quality of the website, including perceived visual appeal, has been found to influence the perception of product quality and purchase intentions noted in Wells' study (Wells et al., 2011). The Shopper Experience Index study (Bazaarvoice, 2017) revealed that product photos are able to create a 111% increase in conversion and a 180% increase in revenue per visitor for top retailers and brands. In turn, according to the Gemius-2019 study, the presentation of the offer itself, especially accompanied by better photos, motivates people to shop online more frequently. The term "better photos" used in this study meant higher resolution and accurate reproduction of details in the image. Women are motivated to shop by better quality photos more often than men, although the motivation to shop as a result of better photos decreases with age, although no statistically significant differences were found between the separate age groups (Report, pp. 112-117). The significance of product photography will also become apparent in relation to different types of goods.

The research proves that products in the clothing and cosmetics sectors, including accessories and footwear, are among those bought online most often. This is followed by books, records and movies. Therefore, the category of the product itself should also be carefully considered when discussing the relationship between product photography and customer

behaviour. It seems that a photograph can play important descriptive, informative and explanatory roles, as well as serve a marketing function related to product placement and advertising, especially in the case of selective goods, such as clothing, cars or luxury goods (jewellery). A wide range of marketing content can be communicated through the image, leaving freedom of interpretation to the creative buyer. It can therefore be concluded that product photography has a positive and stimulating impact on e-commerce. Generally speaking, whenever product sampling is not possible remotely, the image and the shot, background, lighting or context and backdrop used will play an important role in highlighting the product featured. This is because the purpose of product photography is closely linked to attracting the potential customer's attention to the product being presented and to communicating the carefully selected content and value on offer as fully as possible. The extent to which product photography influences the purchase behaviour on the part of the customers using the e-commerce channel and the purchase decision itself seems to be difficult to underestimate. At the same time, given the paucity of literature on the subject, it remains of great interest to study it. The dynamic evolution of platforms such as Instagram and Pinterest and other e-commerce intermediary models gaining popularity or already well-known (Vintage, Allegro, Alibaba, e-Bay) increases the possible extent of showcasing a potential synergistic effect, whereas disregarding them indicates e-business ignorance.

Scientific findings demonstrate that eyesight provides people with approximately 80% of the information about their surroundings. Nearly 80% of what we remember is what we have seen earlier. This is why designers, marketers, retailers and producers of goods and services are keen to use images when advertising and promoting goods. Commercial photography is intended to focus the consumers' attention and interest them in the presented object, encouraging them to make a purchase. One of many disciplines of photography is product photography, which is used for commercial purposes to promote products, services and ideas. Product photography is an important factor influencing customers' perception of a given product. When presenting an item, the quality of published photographs can substantially contribute to the success of the advertised product on the market. An essential sales activity is to evoke the expected reaction in a potential buyer, consistent with the marketing objectives pursued. This is what makes the depiction of a product in a photograph so important, and in order to achieve such an effect, it is necessary to synchronise a number of factors, such as the styling of the product (to make it look as good as possible), the composition of the photograph and the backdrop. Another important factor in creating a good photo is lighting, which allows one to highlight all the details of the photographed product properly, exposing those desired by the consumer while skilfully hiding others. The most basic type of images in product photography are images against a white background, i.e. packshots and shadow-free images. Good packshots show the viewer the nature of the product and its qualities. Therefore, they should be characterised by appropriate lighting, accurate sharpness and colour fidelity.

Such photography is a platform for relevant marketing content and engages a potential customer, something which is a competitive advantage in e-commerce.

Understanding consumer reactions to product photography falls within the issue of identifying preferences and needs. From the time preference theory of interest (law of tendency), which according to L. von Mises, is an axiom of human action, it is clear that not every product presents the same value to the buyer in a given time and situation (von Mises, 2011, p. 411; Huerta de Soto, 2010, p. 71). The propensity to make a purchase may therefore change under the influence of a reassessment of its value, and this depends on a number of factors, basically, on the buyer's particular situation. The intensity of competition, which is associated with the number of offers, and the photograph, which has a presentational, informational or persuasive function, serve as good examples of these factors. The change in reaction and attitude prior to and after the purchase under the influence of the product photograph frees the experiment from the influence of other factors on the purchase decision. In other words, a photo may potentially motivate a consumer looking for a specific good to make a purchase, becoming a competitive advantage factor since it is considered an element of a broadly understood quality of an offer. Given the high supply and similar transaction conditions in e-commerce, the photo may prove to be a cardinal factor.

2. The impact of product photography on marketing and the techniques used

The Internet without images would be of no interest at all, and nor would it be as effective in penetrating existing markets and conquering new ones. Chau and others (2000) compared the use of images and plain text in product presentation and found that when purchasing well-known products, images outperformed text in both efficiency and effectiveness. Song and Kim (2012), on the other hand, investigated the effect of image size on purchase intention and proved that larger images may provide the customers with more information and increase the propensity to make a purchase. An additional piece of information in the combination of text and image in a social setting that guides the buyer's perception contributes to increased consumer satisfaction and confidence in online shopping, as pointed out by Hassanein and Head (2007). So, does imagery lead to increased buyer attention, and how does it compare to other factors? The combination of product photography and its impact on online purchase intentions was studied by Li et al. (2014).

The fact that the use of photography influences customer purchase decisions, especially in terms of increasing trust in the content presented on the Internet, can be found in the results of another study entitled "A Picture Says More Than A Thousand Words" (Steinbruck et al., 2002). One experiment was conducted within the banking industry and concerned the effects of

photographs on the attitudes and actions taken by the users of a website. Three identical mock-up websites of an online bank were created for the purposes of empirical study. In this case, the authors studied the effectiveness of a relatively simple strategy, namely the placement of a photograph on an e-banking website, and it led to a substantial positive effect on the perceived trustworthiness of the studied website (Steinbruck et al., 2002).

Wei Di and colleagues (2014) also observed a clear upward trend between the number of images of a given offer being displayed and the chance of completing a transaction. They tested the validity of the assumption that viewing images anchors the user's interest in an item, while emphasising the ambiguity of the evidence presented in the literature regarding the correlation between images or other multimedia information and improved transaction rates. Images help increase buyer attentiveness, trust and conversion rates across product categories (Wei Di et al., 2014). Product categories expose differences in the strength of impact the images have on the perceived attractiveness of products. For instance, clothing, footwear and consumer electronics show a much stronger response to image quality than a category that includes more unique products such as coins and paper money or books (Wei Di et al., 2014).

Due to the lack of possibility to physically interact with the product, it is very important that the pictures provide the most accurate representation of all the details that characterise the product. The opportunity to see the details in the item is crucial for the customer to make a decision to buy the product. In order to enable the buyer to get to know the selected product in a convenient way, the right choice of light is necessary when taking the photograph that will end up on the retailer's website. The lighting technique plays an important role, as the display of goods depends on the correct choice. By using lighting modifications, the same item can be presented in different ways, putting its advantages in the foreground while hiding its imperfections.

Online retailers can use lighting techniques to persuade consumers to choose products that they might not have selected due to different lighting techniques, even at the same price. This is becoming increasingly important since online shopping is the preferred option for consumers because of the convenience of the process, access to more information, price differences between online and stationery shops and the greater choice of products on offer compared to stationery shops.

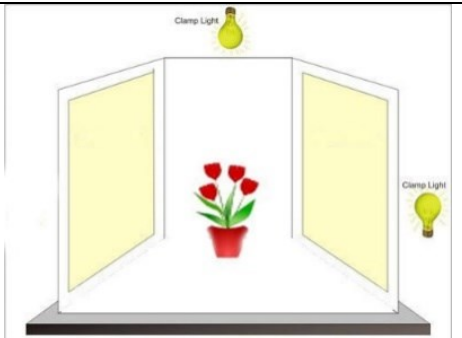
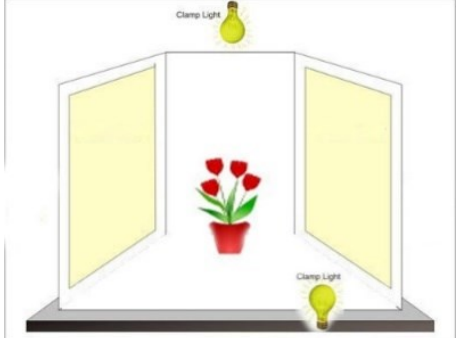
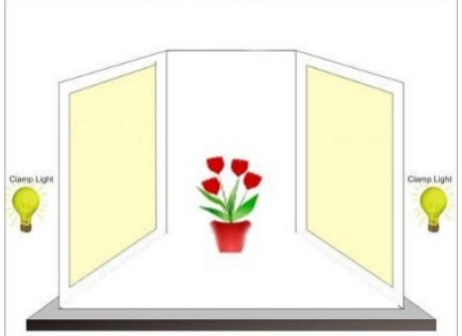
3. Methodology

The research problem was analysed in the context of preparing a sales strategy for e-commerce. The problem was the impact of product photography elements such as lighting, the type of backdrop and the product itself on the perceived attractiveness of an offer and its

translation into purchase decisions. The problem is further elaborated by evaluating the above elements in terms of their influence on the purchase decision in e-commerce.

The authors' research concept was to take 18 photographs of three different products P1, P2 and P3 (Table 2), using three lighting techniques O1, O2, O3 (Table 1), with a shadowless tent (BT) as a control sample. The selection of the products for the test was based on a preliminary examination of the frequency with which they were purchased online. The props used belonged to the category of goods purchased most frequently, as indicated in many different studies of the e-commerce industry. When it comes to illumination, a light set consisting of two flashlights was used. The impact of the backdrop on changing the perception of the product image and its attractiveness was evaluated. The same lighting techniques were used to take the product photos in the three constructed scenes: BT (shadowless tent, as a control scene), BTC (with the price visible) and BTCS (with additional elements).

Table 1.
Characteristics of lighting schemes O1, O2 and O3










Scheme designation	Drawing of the lighting scheme	Description of the scheme
O1 Lighting from above and from the right		With overhead lighting, the greatest amount of shadow becomes noticeable, making the photos appear spacious. The viewer's attention can be distracted from the main subject of the photo, the product itself. Backlighting from the right illuminates the product, highlighting its details.
O2 Lighting from above and from the front		Overhead lighting creates shadows behind the product, but frontal lighting softens the product and optically flattens it. This configuration may visually detract from the image, but the objects in the images are already very clear and all details are more apparent. The result is a more uniform background with softer shadows, making the object being photographed more eye-catching.
O3 Lighting from left and right side		The absence of overhead lighting eliminates shadows, giving visually a spatial effect. The flash lamps positioned opposite each other on both sides of the tent give the effect of a bright backdrop, which may disturb the viewer. The photographed products are visible, however their edges are less outlined compared to the previous photos.

Source: own study.

The evaluation of the photographs taken (Table 2) was conducted by surveying the respondents. Their propensity to purchase a given product under the influence of a viewed photograph was measured. The collected data on the influence of photography on purchase decisions under the influence of different techniques of photography of an example product determine the degree of influence of different versions of the image of the same object in virtual space. Moreover, they provide a rationale for indicating the most suggestive technique of taking a photograph for the purpose of publishing it on the Internet or an e-store website.

Table 2.

Evaluated product photos (P) with the use of different lighting techniques (O)

P/O	O1	O2	O3
P1			
P2			
P3			

Source: own photographs.

Finally, the research group was tasked with evaluating images of the same products using identical lighting techniques, but instead of a shadowless tent, a specially made, separate BTC and BTCS setting was used for each product. This part of the study sought to verify whether the additional element of the setting was meaningful in the respondents' decision-making process. An attempt was also made to answer the question of whether the use of additional accents in the setting of the presented products has any impact on the increase in inclination to purchase them. The answers obtained may constitute a premise for the purposefulness of the technique applied in Internet merchandising.

4. Perception of products and conversion factors in the light of the findings of the survey

Respondents' reactions to the photographs presented, as well as the differences in their ratings, were measured on a 5-point scale, with 1 indicating low impact and 5 indicating the highest impact. The average rating for each photograph was then calculated, taking into account lighting technique, product type and setting. The study was carried out on a group of people aged between 18 and 41 who were involved in photography as a hobby or professionally. Almost all of the respondents (97.1%) made purchases online, with electronics (68.7%) and clothes (64.2%) being the most popular choices. Shopping for groceries was declared by 13.4%. The vast majority of respondents (94.1%) paid attention to the images they were presented with, confirming that the presentation of the product in the photo affected the final purchase decision for the majority of them (83.6%). Most respondents were attracted to online shopping because of the pricing (82.1%), convenience (77.6%) and access to a wide range of products (74.6%).

Table 3.

The rating performances for photographs taken in the created settings

Type of setting	Type of product	Lighting scheme			Rating gap	Average rating for	
		O1	O2	O3		Product	Setting
BT	P1	2.76	2.82	2.50	0.18	2.69	2.61
	P2	2.73	2.57	2.55		2.62	
	P3	2.29	2.6	2.64		2.51	
BTC	P1	2.32	2.45	2.15	0.20	2.31	2.21
	P2	2.35	2.2	2.12		2.22	
	P3	2.04	2.26	2.03		2.11	
BTCS	P1	2.04	2.13	1.75	0.17	1.97	2.04
	P2	2.13	2.23	2.13		2.16	
	P3	2.19	1.91	1.87		1.99	

Source: results of the survey.

Almost 68% of respondents indicated a preference for product shots in BT scenery. Additional content in the photograph related to price (BTC) or richer settings (BTCS) appealed to them to a much lower extent. The exact differences between the compared product shots in the different settings are reflected in the average rating values (Table 3). The evaluation results of all photos taken range from $\bar{x}_{\min} = 1.75$ to $\bar{x}_{\max} = 2.82$. This suggests that although consumers pay attention to photographs when shopping online, the product lighting schemes used are no longer as important for conversion due to the small differences between them in the ratings. At the same time, the distribution of ratings is similar in all settings. In the first group of presented photos, taken with a shadowless tent (BT), the arithmetic averages of the photos are the highest. These images, called packshots, are therefore of marginal value for purchasing decisions (they are cardinal).

The additional piece of information, in the form of the visible product price (BTC), lowered the ratings. Thus it may be assumed that in the BT setting, shoppers gather information about the product and make a narrowing selection of the offer, while revealing the price in the photograph triggers the process of calculation as to whether the purchase is economically beneficial. The arithmetic averages of all three products, irrespective of the lighting scheme used (O1, O2 and O3), dropped by 0.39 on average, which is a significant value considering the differences in average ratings. Consequently, making the information about the product's price visible reduces its attractiveness. However, it can become an important factor distinguishing the product, especially on auction sites or in price comparison engines, affecting competition between sellers.

In the group of product photos taken in the corresponding settings, the mean ratings are the lowest and range from (1.75-2.17). This group also has the lowest arithmetic averages $\bar{x}_{P1}=1.75$ and $\bar{x}_{P3}=1.87$. This confirms that photos against a white backdrop (packshots) appeal to the customers the most.

Table 4 shows the average rating values for product photography in three different settings (BT, BTC and BTCS) under different lighting conditions (O1, O2, and O3). The different rating values are a result of the variation in the lighting of the evaluated photographs taken in the same settings. The lighting technique O1 showed the smallest differences in the average arithmetic results, which proves that this lighting method in product photography generates the most stable impression in the consumers' perception. The highest values produced in the study prove that the choice of lighting technique for a product can be a very effective conversion factor. This is also supported by the calculation of the averages for the entire study, as the highest ratings were obtained with this method of lighting the product. The least effective results are found when using the O3.

Table 4.

Results of the evaluation of photographs taken with the use of a shadowless tent (BT)

Product	BT			BTC			BTCS		
	O1	O2	O3	O1	O2	O3	O1	O2	O3
\bar{x}	2.59	2.66	2.56	2.24	2.30	2.10	2.12	2.09	1.92

Source: study results.

Over 82% of respondents noticed the differences in lighting. This was followed by attention to differences between shots with regard to colour (61.8%), saturation (67.7%) and contrast (64.7%). It was therefore confirmed that light is an important factor in determining the quality and attractiveness of product photography. Properly adjusted, it shows more details of the item, which in the case of e-commerce and the lack of possibility of physical verification (touching) of the product is of paramount importance and may consequently be decisive for the purchase.

In terms of the diversity of products photographed throughout the study, the highest values were obtained for the first product (P1). The difference between the highest and the lowest rating is as high as 1.07. The smallest differences in ratings were recorded for the second

product (P2). The manufacturer, model and brand of the product were not disclosed during the survey in order to eliminate any influence on respondents' perceptions. As for the third product (P3), the highest and lowest rating values were obtained using the O3 lighting technique. With this product, the backdrop against which the item was presented played a greater role in respondents' minds than the way it was illuminated. The highest rating was given to the product presented in the photograph taken with the use of a shadowless tent, while in the BTCS setting, the value was 1.87.

5. Summary and conclusions

The growing volume of online shopping means that online retailers have to compete with each other to attract customers to their stores. In order to do this, marketers use various techniques that refer to sensory marketing, seeking to develop an optimal way of attracting new customers. This study focused on evaluating the use of product photography in different settings and under different lighting conditions as a tool for online merchandising.

The variation in the results obtained was not as significant as initially assumed. Nevertheless, the study indicated that customers pay attention to the way the goods are presented by depicting the items using certain lighting techniques and that, depending on the technique used, the responses were more or less aligned with each other. The findings further indicate that the price of the product plays an important role as a determining factor for consumers to purchase the evaluated products presented in the photographs in the study. The disclosure of additional information concerning the price of a given product led to a change in the respondents' perception of the offer, regardless of the lighting technique used. According to the research assumption made, lighting played an important role in the perception of photographs by potential buyers. In the opinion of the respondents, the manner of lighting noticeably highlighted product details that were visible in the photographs.

The main conclusion drawn from the study is that the way of presenting photographs in the context of purchase decisions is important, according to the respondents. One element that interferes with a clear determination of impact is the addition of extra information. In this case, it involved the incorporation of various elements into a specific setting. This can be interpreted as an action that distracts attention from the details of the product. These were most clearly discernible in the case of the shadowless tent. These shots proved to be the most suggestive.

Based on the conducted survey and analysis of the collected data, a number of additional conclusions were drawn.

1. The customer pays attention to the way the goods are showcased using a particular lighting technique, even though the measured reactions to the presented photographs were poorly differentiated.

2. Out of the three examined factors: product, lighting technique and setting, it is the setting that most strongly determines the attractiveness of the image, which is confirmed by the high rating values obtained, be it for the product or the lighting technique.
3. Ultimately, it is of cardinal importance for e-commerce to create an image that is as close to the real product as possible and, therefore, as objective in communicating information as possible, without distortion, which proved sufficient with the use of a shadowless tent. (BT).
4. Displaying the price positions the product strongly in the buyer's mind and thus performs an important function in consumers' selection of their intention to buy the product, contributing to the change in respondents' perception of the product's value.

From the perspective of the pursuit of the highest possible conversion rate, additional elements that enhance and enrich the content conveyed through photography are altogether a marginal factor. The justification for the use of various procedures enriching the visualisation of products should be sought not so much in confining to the photography that statically distinguishes the offer in the competitive environment, but rather in the use of more advanced techniques, such as three-dimensional imaging.

Another important issue is gaining a competitive advantage in e-commerce by skilful use of lighting techniques that imitate natural conditions during remote product presentation.

References

1. Bazaarvoice (2021). *Bazaarvoice Shopper Experience Index*.
2. Chau, P., Au, G.K., Tam, K.Y. (2000). Impact of information presentation modes on online shopping: An empirical evaluation of a broadband interactive shopping service. *Journal of Organizational Computing and Electronic Commerce*, 10(2), 1-21.
3. Di, W., Sundaresan, N., Piramuthu, R., Bhardwaj, A. (2014). Is a picture really worth a thousand words? - on the role of images in e-commerce. *Association for Computing Machinery*, 633-642.
4. Hartman, A., Sifonis, J., Kador, J. (1999). *Net Ready: Strategies for Success in the E-economy*. McGraw-Hill.
5. https://eizba.pl/wp-content/uploads/2019/07/raport_GEMIUS_2019-1.pdf.
6. <https://www.bazaarvoice.com/shopper-experienceindex/>, 11.2021.
7. <https://www.ideo.pl/e-commerce/wiedza/dlaczego-kupujemy-przez-internet,69.html>, 11.2021.
8. <https://www.national-geographic.pl/arttykul/100-mln-bitow-informacji-w-ulamkach-sekundy-od-oka-do-mozgu-czyli-jak-dziala-nasz-zmysl-wzroku>, 29.10.2021.

9. Huerta de Soto, J. (2010). *Szkoła austriacka. Ład rynkowy, wolna wymiana i przedsiębiorczość (The Austrian School Market Order and Entrepreneurial Creativity)*. Warszawa: Fijor Publishing.
10. Kaczmarczyk, S. (2015). Podstawowa klasyfikacja komunikacji marketingowej (The Basic Classification of Marketing Communication). *Zeszyty Naukowe Uniwersytetu Szczecińskiego, Nr 866*, 33-43.
11. Kowlaczuk, J. (2018). The Evolvement of Online Consumer Behavior: The ROPO and Reverse ROPO Effect in Poland and Germany. *Journal of Management and Business Administration. Central Europe, Vol. 26, No. 3*, 14-29.
12. Li, X., Wang, M., Chen, Y. (2014). *The Impact of Product Photo on Online Consumer Purchase Intention: An Image-Processing Enabled Empirical Study*. PACIS.
13. Neslin, S.A., Shankar, V. (2009). Key Issues in Multichannel Management: Current Knowledge and Future Directions. *Journal of Interactive Marketing, Vol. 23, Iss. 1*, 70-81.
14. Steinbruck, U., Schaumburg, H., Duda, S., Kruger, Th. (2002). *A Picture Says More Than A Thousand Words - Photographs As Trust Builders in E-Commerce Websites*. Conference Paper, January 2002, CHI '02 Extended Abstracts on Human Factors in Computing Systems, 748-749.
15. von Mises, L. (2011). *Ludzkie działanie. Traktat o ekonomii (Human action. A Treatise on Economics)*. Warszawa: Instytut Ludwiga von Misesa.
16. Wells, J.D., Valacich, J.S., Hess, T.J. (2011). What signal are you sending? How website quality influences perceptions of product quality and purchase intentions. *MIS Quarterly, Vol. 35, No. 2*, 373-396.
17. Yang, Y., Gong, Y., Land, L., Chesney, Th. (2020). Understanding the effects of physical experience and information integration on consumer use of online to offline commerce. *International Journal of Information Management, Vol. 51*, 1-18.

PRESUMED CONSENT IN ORGAN DONATION – LIMITATIONS OF CONSENT MODEL REGARDING TRANSPLANTOLOGY IN POLAND

Igor SZYMAŃSKI^{1*}, Julianna STASICKA², Honorata STADNIK³

¹ Poznan University of Medical Sciences; 78905@student.ump.edu.pl, ORCID: 0000-0002-4598-5224

² Poznan University of Economics and Business; julianna.stasicka@phd.ue.poznan.pl,
ORCID: 0000-0003-1656-5877

³ Department of General and Transplant Surgery, University Hospital, Poznań; honorata.stadnik@wp.pl,
ORCID: 000-0001-7910-2998

* Correspondence author

Purpose: Organ transplantation is a treatment for patients with end-stage organ failure limited by the number of organs. The aims of this article are: to compare the relevance of the indicated systems for the number of donated organs, to analyze the status of organ donation, to identify current issues and possible measures in order to increase the number of donations from deceased donors in Poland.

Design/methodology/approach: The paper refers to theories from behavioral economics: status quo bias, human tendency to procrastinate, aversion to changes. It also analyzes statistical data of donated organs and the number of objections raised in Poland.

Findings: There is a widespread public approval for organ donation in Poland, however most people do not state their decisions. Countries with an opt-out system have a higher rate of organ donations. In Poland in 2020 less than 0,1% of population objected to donate organs, yet 12% of potential donors were disqualified due to record in the Central Register of Objections or family's statement. In 2016 only 20% of population was aware that presumed consent is legally binding. Moreover, 75% have never talked with their relatives about donating their organs.

Research limitations/implications: The article relies on general data from statistical databases and population-based survey studies, which do not include detailed information on the subject described, and thus do not provide data for reliable in-depth statistical analysis. Due to unavailability of numeric data on the reasons for abandoning the organ procurement, the article relied on the available general statistical classification. The authors find an qualitative research to be worth considering in the studied area in order to identify profound causes of the problem and to find a target group for future experimental research.

Practical implications: As majority of Polish population is pro-donation the presumed consent for organ donation is preferable to increase the number of donors.

Social implications: Profound ignorance of the legislations and broad unawareness of the family's preference is the foundation of public fear and uncertainty towards organ donation.

Originality/value: As the social factor appears to be the limiting factor for organ procurement it is fundamental to educate the society about transplantation in a relevant way in order to increase the number of donations in Poland.

Keywords: Organ Transplantation, Tissue and Organ Procurement, Presumed Consent.

Category of the paper: Research paper/General review.

1. Introduction

For end-stage organ failure, transplantation is the best and most cost-effective clinical solution (Lewis et al., 2020). For decades, organ transplantation has reduced suffering of patients with end stage disease, allowed restoring of organ function and provided a possibility to survive, preventing premature death (Bezinover, Saner, 2019; Reese et al., 2020; Vanholder et al., 2021). Existing organ shortage is the fundamental challenge in transplantology field which results in high numbers of patients signed on waiting lists (European Parliament, 2020). In United States of America (USA) each day 17 people die waiting for an organ transplant and 106 287 people are signed on a waiting list (Health Resources & Service Administration, 2022). In the European countries covered by Eurotransplant, 13 460 people were registered on the waiting list in 2021, of whom 5 622 received organs from deceased donors (Eurotransplant, 2022a). This data demonstrates a growing disproportion between the demand and the number of procedures performed, and indicate an insufficient scope of organ transplantation.

For all types of organs, there is a disparity between the need and availability (Bezinover, Saner, 2019). The most frequently transplanted organs are kidneys (European Parliament, 2020). In 2021 in the USA 24 670 kidney transplantations were performed, simultaneously including 90 483 patients on a waiting list (Health Resources & Service Administration, 2022). Other common transplantations include liver, heart, lung, and pancreas. It is worth underlining those new types of transplants are being developed at all times (European Parliament, 2020). In the Netherlands, Belgium, Luxemburg, Germany, Austria, Hungary, Croatia and Slovenia the number of transplanted organs from deceased people are shown in the Figure 1.

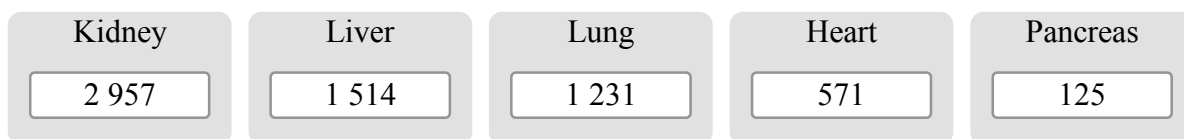


Figure 1. Number of organs transplanted from deceased people in 2021 in Eurotransplant area.

Source: own elaboration based on (Eurotransplant, 2022a, factsheet, reference date: 10.01.2021).

In 2010, the European Union legislation was adopted to encourage the optimal distribution of organs between member countries. Most EU member countries are already involved in cross-border exchange of donated organs either through bilateral agreements or other arrangements (Eurotransplant, 2022b).

Organ exchange carries three main objectives:

- Reducing the loss of donated organs due to mismatch of the donor and the recipient when there are no eligible recipients on the waiting list.
- Increasing the chances for certain groups of patients to receive organs from a compatible donor.
- Enabling optimal donor and recipient matching by expanding the donor and recipient pool (Weiss, Kocher, Immer, 2015).

International organ exchange increases the number of organs available for transplantation in the European Union by offering the possibility to transfer organs to a compatible recipient in another country in cases where there is no suitable recipient on the national waiting list (Eurotransplant, 2022b).

The organ donor recruitment process is based on neurological and circulatory criteria. Respectively, they diversify Donation after Circulatory Death (DCD) and Donation after Brainstem Death (DBD). The path from potential donor to an actual use is multi-step (Poltransplant, 2021). Actual deceased donor is an eligible DCD or DBD donor who had a surgical incision made with the intent to obtain an organ for transplantation or from whom at least one organ has been obtained for transplantation. A utilized donor is an actual donor from whom at least one organ has been transplanted (ODEQUS, 2013).

Transplantation carries an important role in preserving the lives of people with organ defects. Therefore, it is crucial to debate possible measures to increase organ donation. In Europe overall organ donation and transplantation activity is higher than on the other continents. However, differences in European countries are noticeable (Vanholder et al., 2021). In the next section of the work, the differences between the number of organ donations from deceased people in European union countries based on the type of consent are described. One of the purposes of the article is to compare two types of agreement systems for organ donation, specifically presumed consent and explicit consent to indicate the importance of both options for organ donation. Considerations were supplemented with behavioral economics theories including the status quo bias, people's tendency to procrastinate in case of making decisions and general aversion to changes (Halpern, Ubel, Asch, 2007; Beraldo, Karpus, 2021).

2. Methods

The paper refers to theories from behavioral economics, particularly status quo bias, the human tendency to procrastinate and aversion to changes. An analysis of statistical data illustrating the number of donated organs in certain European countries in relation to the form of consent and an analysis of the number of objections raised in Poland were performed. Moreover, the authors compared the results of public opinion studies on organ donations.

3. Results

Explicit consent and presumed consent in organ donation – background and implications

While there is a widespread public approval for organ donation, it has no reflection in actual donor registrations (Howard et al., 2016). In different countries, the number of potential deceased organ donors depends greatly on how the option of becoming or not becoming a donor is perceived and how the corresponding option is chosen (Beraldo, Karpus, 2021). The Figure 2 shows the number of organ donations per 1 million of inhabitants from deceased people in European countries.

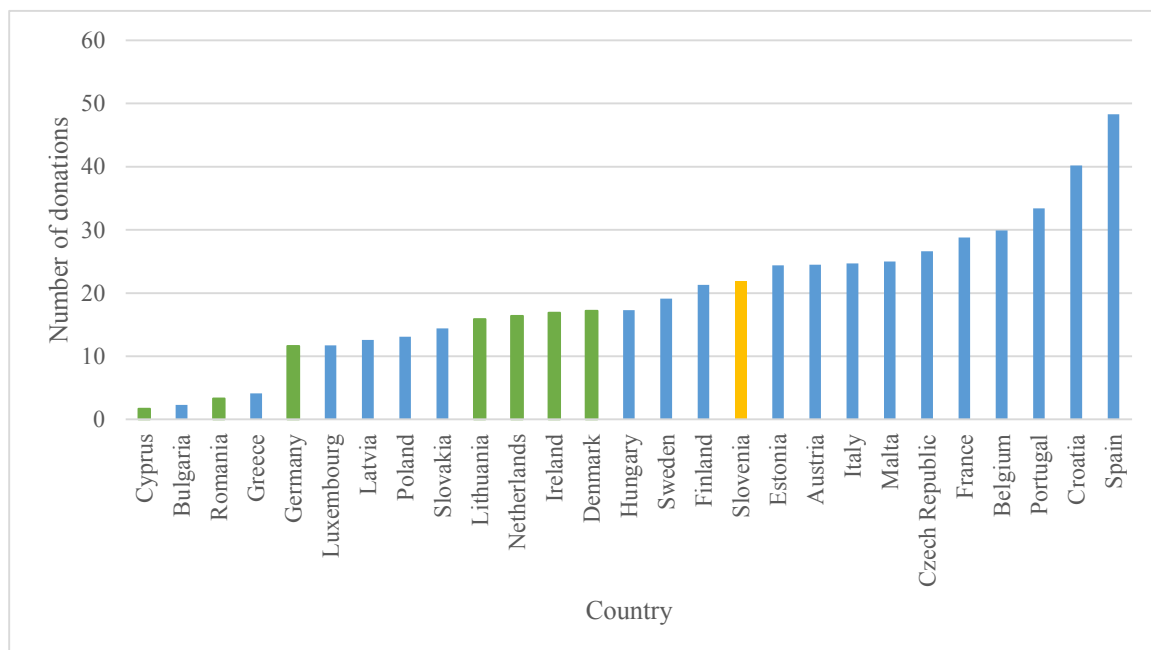


Figure 2. Number of organ donations per 1 million of population from deceased people in the European countries in 2018 (opt-in system – green, opt-out system – blue, mixed system – yellow).

Source: European Parliament (2020, p. 5).

In annual ratio both donors, DBD and DCD were included. In the Figure 2, it can be seen that the differences in deceased donation rates vary considerably between European countries. In all of the indicated countries, one of two strategies related to organ donation is in place. Exceptionally, in Slovenia the system is a mix of both systems previously mentioned.

In Cyprus, Romania, Germany, Lithuania, the Netherlands, Ireland and Denmark, the system is opt-in, which means that someone is not a potential organ donor unless that person registers as a donor, for example by obtaining a donor registration card (Beraldo, Karpus, 2021). In explicit consent countries, nobody is an organ donor without registering (Johnson, Goldstein, 2003). Opt-in is otherwise known as explicit (informed) consent. This is a legally valid permission to remove organs for transplantation according to a person's voluntary consent (ODEQUS, 2013).

Among other countries shown in the figure, system of organ donation is classified as opt-out, which assumes that people are donors by default unless they declare otherwise during their lifetime (Johnson, Goldstein, 2003; Beraldo, Karpus, 2021). This means that in the absence of an explicit refusal, by definition people are willing to donate tissues and organs after death (Williams, O'Donovan, Wilkinson, 2022). Presumed consent is a legally valid presumption of acceptance for the removal of organs for transplantation purposes whenever there was no individual and previously declared refusal of permission (ODEQUS, 2013). The policy of presumed consent assumes that, on principle, all citizens agree to donate organs, but have freedom to easily register their disagreement to become donors (Thaler, Sunstein, 2008).

It is noticeable that countries with an opt-out system generally have a higher rate of organ donations than countries with a predominantly opt-in system. The type of system adapted plays an important role because it is common that in an opt-in system undeclared people do not register as donors, while in an opt-out system they do not provide a declaration to be non-donors. In general, most people do not state their decisions, regardless of being for or against donation and independently from the system in place (Beraldo, Karpus, 2021). Most choices in public policy feature default inaction (Johnson, Goldstein, 2003). This issue of explicit consent (opt-in) and presumed consent (opt-out) is an extremely interesting aspect of behavioral economics. Based on evidence from social sciences and psychology regarding default effects (Williams, O'Donovan, Wilkinson, 2022), whether people are urged to choose what they believe to be the best choice depends largely on what causes them to stay with the default option. Causes of the effectiveness of defaults are following:

- the status quo bias,
- people's tendency to procrastinate (Beraldo, Karpus, 2021),
- aversion to changes (Halpern, Ubel, Asch, 2007).

The classic model of human decision making is the rational choice model, which concerns the highest chance of satisfying one's preferences. Making a decision that is inconsistent with one's preferences is therefore considered irrational (Breslin, 2018). An important assumption of the rational choice model is that an individual's decision under certainty or uncertainty is influenced by important preference characteristics. It means, neither labels nor the sequence in which alternatives are presented should affect the individual's choice. In real world conditions the alternatives are often connected with influential labels. One alternative inevitably connects the label status quo, indeed. An option to maintain one's previous or current decision is always an attractive option for not taking an action (Samuelson, Zeckhauser, 1998). Status quo bias, involves an increased attractiveness of choosing the default option by preferring the presumably worse option under the condition that better option requires abandoning the status quo, even if the costs of change are negligible (Karl et al., 2019). While considering to make a decision, it is often impossible to remain utterly passive, because even refraining from an active choice is *de facto* a certain kind of choice. In conclusion, preserving the status quo is also an option. This means that if a passive decision maker is presented with a choice, the effect of his

indecisiveness will be to automatically select the base option, which is the answer predicted by the choice architect (Baszczak, 2020).

This theory is grounded in economic psychology, public health and marketing. The status quo bias shows behavioral tendency to choose status quo option incommensurably often (Burmeister, Schade, 2007). The preference for one's present status also influences health decisions. A preference for the easiest path may explain some habits like physical inactivity, difficulty with quitting smoking and unwise daily eating habits, which are often a default choice (Karl et al., 2019). People are psychologically uncomfortable with changes and might adhere to the status quo, even if it directly conflicts with their preferences (Breslin, 2018). Because of this tendency to avoid decisions and the intention to preserve the status quo, default values are very effective in guiding choices even in important areas of life such as organ donation (Samson, Gigerenzer, 2016).

Procrastination involves unwanted and unnecessary delay to deadline realization, solution implementation and decision making. When a person is confronted with a choice situation and with liberally available alternatives, the preference for delay is a consequence of the "later" dictum (Svartdal, Granmo, Færevaaag, 2018). The opt-out approach links to reduce effects of peoples' procrastination and inertia in willing donors who fail to take the necessary time or effort to communicate a positive preference in organ donor registry. Opt-out clauses eliminate the possibility that eager individuals will "fail" to register a positive choice to donate an organ through the donor registry (Williams, O'Donovan, Wilkinson, 2022). Behavioral economics shows how the manner in which a choice is presented can influence different decisions. This is described in the assumptions of choice architecture (Reese et al., 2020). An alternative to mentioned two models which are by Thaler and Sunstein believed to be the best architecture of choice regarding organs donation is statutorily mandated choice (Thaler, Sunstein, 2008). The policy of a mandated choice requires that each person decides whether or not they want to be considered as a potential organ donor. This implies that instead of assuming one option to be the default choice, it requires everyone to actively decide and make a choice at some point in their lives. This is certainly a forced policy, but it is nevertheless being discussed as a viable option to overcome a number of problems associated with default rule nudging (Beraldo, Karpus, 2021).

In summary, the three fundamental solutions that can be implemented for organ donation are presumed consent, explicit consent and mandated choice.

Presumed consent or family's decision – issues with presumed acceptance of organ donation in Poland

Poland uses an opt-out system. This means that all citizens are classified as potential donors, but have a possibility to freely change their option by expressing their objection. Citizens of Poland may refuse to donate organs in 3 ways during their lifetime: by registration in the Central Register of Objections kept by Poltransplant, by a written declaration, provided with

a handwritten signature, and by an oral declaration of choice made in the presence of at least two witnesses, supported with their written confirmation (Dz.U. 2005, nr 169, poz. 1411, art. 6.1). According to Poltransplant (2016), when a potential deceased organ donor is reported, organ procurement may be discontinued if:

- there is no evidence of brain death (for BDB) or no irreversible cardiac arrest within the designated time frame (for DCD),
- there is no authorization by existing index to the register of objections or by donor's family statement,
- a medical contraindication is present,
- no suitable recipient can be found.

In order to illustrate the situation of organ donation in Poland, the number of potential and qualified deceased organ donors was analyzed in Figure 3, as well as the number of registered statements declaring opposition to organ donation after death in Figure 4.

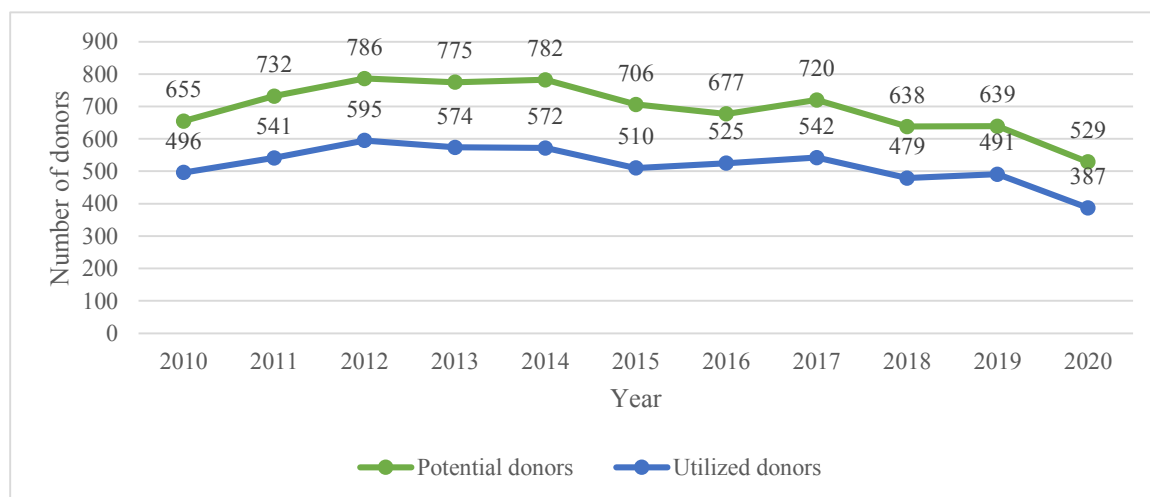


Figure 3. Number of deceased organ donors in 2010-2020 in Poland.

Source: own elaboration based on Poltransplant 2021, p. 6 and Poltransplant 2016, p. 14.

When analyzing the number of potential and utilized donors since 2012-2014, there is a negative linear trend in both. Considering the importance of every single organ transplantation and the constantly growing trend of patients waiting for this procedure, the situation presented is extremely unfavorable. What is more, approximately 38% of all disqualifications of potential donors are due to denial of authorization which is second only to medical contraindications (46%) (Poltransplant, 2021). Clinical practice suggests an unexplored issue which is the lack of registration process for deceased people who could become potential organ donors which is directly dependent on the activity of hospitals that theoretically have the capacity to procure organs but refrain to do so due to financial and organizational reasons (Paulo, 2010)

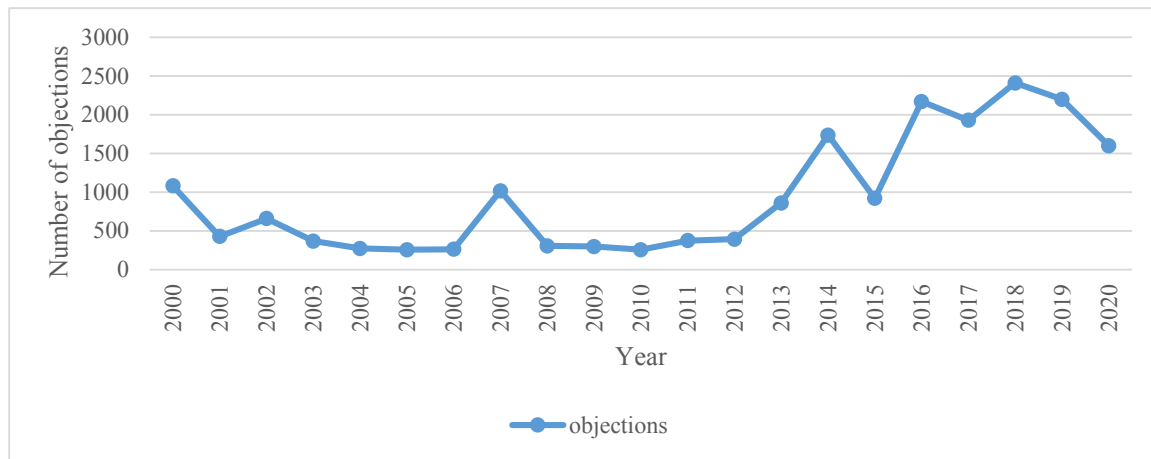


Figure 4. Number of declared objections registered in the Central Register of Objections in 2000-2020.

Source: own elaboration based on Poltransplant 2021, p. 60.

The number of registered declarations in the Central Register of Objections has an upward trend, which is also a major disadvantage for organ donation. On the other hand, at the end of 2020 there were 38 265 013 citizens in Poland (GUS, 2020) with 37 056 of them registered to the Central Register of Objections (Poltransplant, 2021). This would mean that less than 0,1% of referred Poland population objected to donate organs, yet approximately 12% of potential donors are disqualified due to lack of authorization resulting from existing record in the Central Register of Objections and potential donor's family statement (Poltransplant, 2021). Unfortunately, the report did not indicate the reasons why people chose to sign up for the registry nor the statistics of the mentioned 3 basis for disqualification due to lack of authorization. However, clinical practice may suggest an explanation for this phenomenon. Despite the fact that physicians are not required to obtain family's approval neither inform about ongoing organ procurement, the transplant community has come to the conclusion that the family's objection causes organ procurement to be abandoned (Nesterowicz, 2010, as cited in Woderska, 2018). Cause of that may lay in insecurity of presumed consent for organ procurement as the physician will not risk the procedure when the family may later testify in court that their close one categorically objected before death (Paulo, 2010).

The following consider the level of knowledge of current legislations and attitude towards organ donation in Poland. Figure 5 represents public awareness of current transplant law.

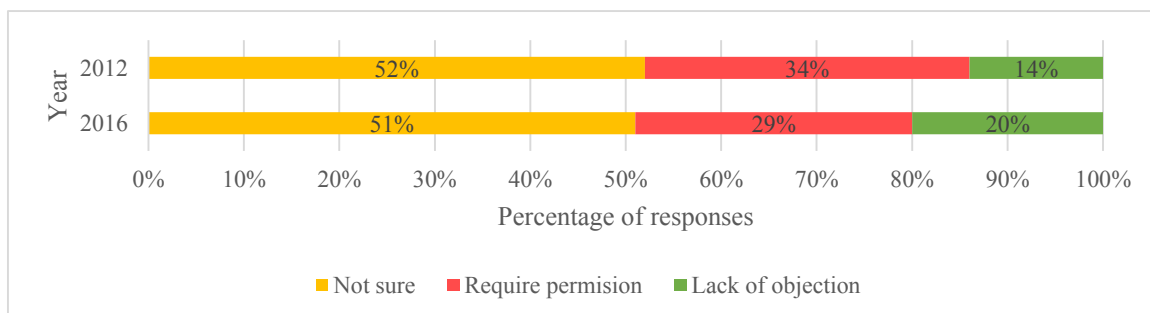


Figure 5. What society considers to be the terms of consent system for organ donation in Poland.

Source: own elaboration based on CBOS, 2016, p. 13.

Another ongoing and persistent issue is the level of awareness of Polish population in transplantation area. On the basis of CBOS research (CBOS, 2016) repeated every couple of years, it appears that only 20% of examined population is aware that presumed consent for organ donation is legally binding in Poland. Even more people (29%) indicate incorrectly that Poland uses an opt-in system of consent and requires their active declaration for them to be considered as potential donors. Public opinions regarding the law governing the procurement of organs from deceased donors are divided. The concept of positive declaration given during one's lifetime is supported by 43% (with a downward trend) and essentially the same 42% (with an upward trend) consider the principle of presumed consent to be more appropriate. 5% say that neither of these solutions is sufficiently good. The direction of changes should be considered favorable for transplantology. The belief that presumed consent is a better solution, to some extent, is related to the favorable attitude towards being an organ donor after death and the approval for possible donation from a close relative. On the other hand, support for providing informed consent - with more frequent opposition to it.

Family communication patterns

Figure 6 shows how many people discuss their decisions about organ donation with their families.

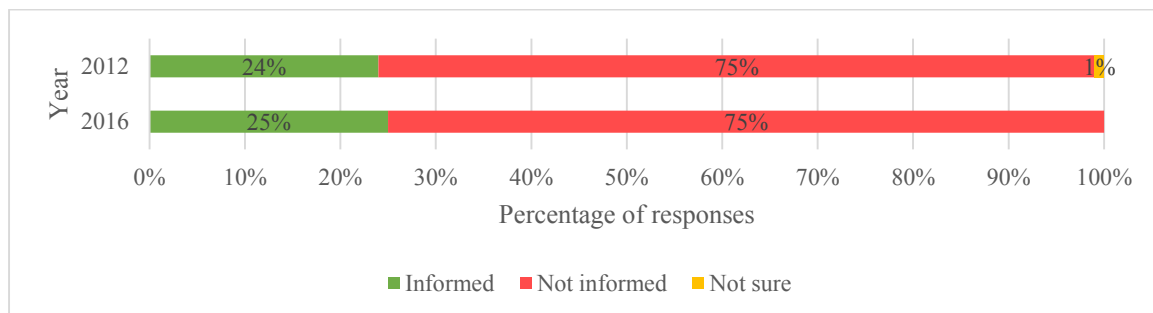


Figure 6. What part of the population has informed their family about their decision on organ donation. Source: own elaboration based on CBOS, 2016, p. 4.

According to the survey, three of four (75%) have never talked with their families about donating their organs after death and only one in four (25%) have shared their decision with their relatives. These were more often people with the best education, young people, residents of large cities, in good socioeconomical situation, and rarely the oldest people and respondents with primary education (CBOS, 2016). This conclusion may be supported with results of the study conducted among university students as within this group the number of respondents indicating that they have discussed this topic with their family is 67.7%. What is more, medical students were significantly more likely to engage in conversation than non-medical students (75,9% vs 52,2%) (Mazur et al., 2018). Basing on another study in a question concerning the source of knowledge gained in the field of transplantology we can learn that formal source of knowledge was indicated by 71% of medical students while only 17% of non-medical students pointed out this source with a prevalence for extracurricular and informal sources (Woderska,

2018). Considering that knowledge about the family's preferences in the field of organ donation aspires to be the most important factor responsible for donation rates increase (Kozlik et al., 2014), it is foremost important to formally educate society in the field of health sciences.

The connection between knowledge of the deceased's decision and family's reaction to organ procurement

Figures 7-9 indicate how knowledge of the deceased's decision regarding organ donation affects the family's consent.

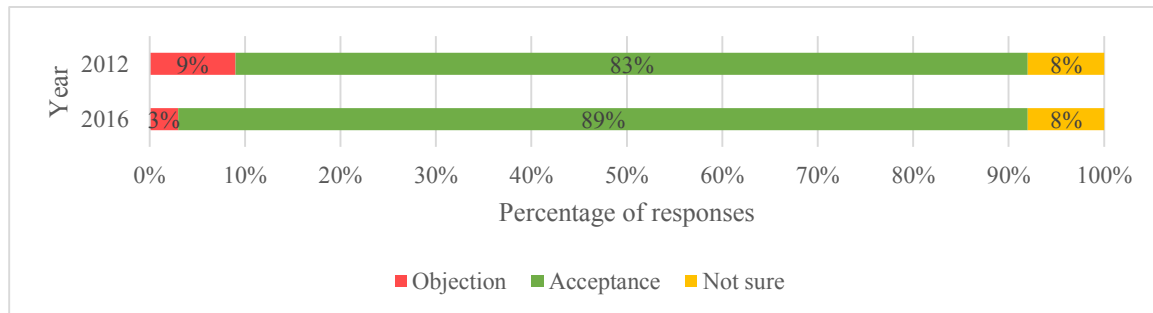


Figure 7. Acceptance for organ procurement from a related donor who had nothing against organ donation.

Source: own elaboration based on CBOS, 2016, p. 7.

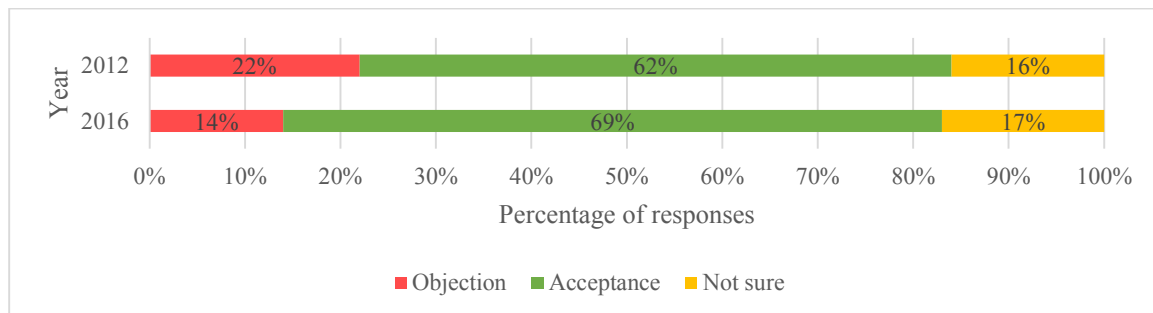


Figure 8. Acceptance for organ procurement from a related donor who said nothing or was unsure about organ donation.

Source: own elaboration based on CBOS, 2016, p. 7.

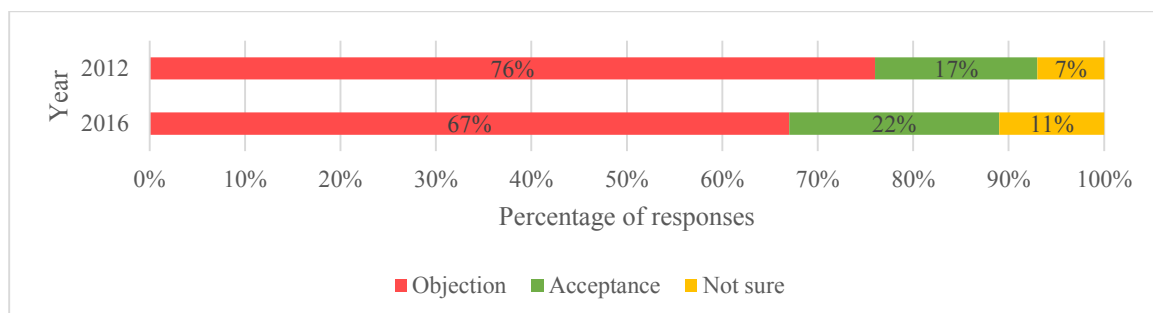


Figure 9. Acceptance for organ procurement from a related donor who was against organ donation.

Source: own elaboration based on CBOS, 2016, p. 7.

When examining the graphs, it appears that the majority of respondents declare their willingness to respect the wish of the deceased and in the case of their consent to organ donation, 89% of respondents would not oppose organ procurement. In the case of unfamiliarity with the deceased person's view on organ donation, 69% of respondents would not oppose organ procurement, while rest of respondents are unsure how they would act or would express their objection (17% and 14% respectively). A similar study conducted in 2020 among citizens of Gdańsk presented comparable results and is also worth mentioning (Ruszkowski et al., 2020). Due to the broad unawareness of the family's preference for organ donation and the general public's support for donation, the difference in responses between results obtained when we know that the deceased wanted to donate organs after death and not knowing about their decision is an area of potential donor loss.

While exploring the main reasons of families' objections to organ procurement from related donors we can find reluctance and fear of invading the body of the deceased, inability to accept the death of a close family member and to decide in such a crisis, lack of knowledge of the deceased's declaration for organ donation and a general reluctance to make decisions on someone else's behalf to be the main one's (Groot et al., 2015; CBOS, 2016; Woderska, 2018).

4. Discussion

Transplantation is a treatment option for patients who have developed organ failure (Howard et al., 2016). There are many challenges in the field of transplantation, and its main limiting factor is the shortage of available organs (Van Dalen, Henkens, 2014; European Commission, 2022). Due to the persistent imbalance between supply and demand for organs, maximizing the use of available organs is extremely important (Sharif, 2022).

Basing on evidence of default effects from social sciences and psychology, people's postponement of decisions and inertia among willing but unregistered donors, leads to conclusion that changing the consent system from opt-in to opt-out in European countries would contribute to increasing the number of organs from deceased donors and closing the transplantation gap (Williams, O'Donovan, Wilkinson, 2022). People by nature exhibit an aversion to changes, a fear of making mistakes, or a desire to maintain the status quo. Therefore, a valid default option is crucial (Halpern, Ubel, Asch, 2007).

Despite all mentioned issues, the direction of changes in peoples' acceptance towards organ donation and awareness of factual and legal terms are positive but slow-growing. Currently prevailing model of consent supports organ donation in many of the European countries, nevertheless it still requires active and thoughtful support. Unawareness of the Polish society concerning current transplantation law and unwillingness to discuss organ donation within families strongly suggest that the subject of transplantology is perceived as taboo, which as

a phenomenon frequently results from lack of factual knowledge. Continuing this point, it appears that the low level of knowledge about organ donation and transplantation or the principle of presumed consent might mean that fear and insecurity around organ donation still remains prevalent (CBOS, 2016).

The current number of recorded objections in the Central Register of Objections has an upward trend. It is critical to recognize the reasons why individuals choose to make this decision as it may provide a basis for qualitative research with Ethical Committee approval due to the sensitivity of the topic. The nonverbal message encased in the question concerning the deceased's family consent to organ donation is also not without significance, as it assumes that lack of consent on behalf of mentioned behavioral theories is the default option. Theoretically, the family of the deceased should not be asked to declare their choice, but to consider whether the patient has ever made a decision or declaration that they do not wish to donate organs after death, and if possible, to find their declaration in order to place it into the records. Practically, in situation where family is not aware of presence of the presumed consent policy and is unaware of the approach of the deceased to organ donation, odds for the acceptance for organ procurement are considerably lower regardless of their legal insignificance. At this point some findings (Groot et al., 2015; Molina-Pérez et al., 2022) emphasize the model of expressed informed consent as it seem more difficult for families to question or overrule, thus prevent some of the dilemmas and make burdening decisions easier.

In the scope of medical law and professional ethics (Dz.U. z 2009 r. Nr 52, poz. 417; Dz.U. z 2008 r. Nr 136, poz. 857), non-life-saving surgical procedures require informed and voluntary permission. Concept of presumed consent is capable to fulfill these requirements only when the subject is aware of regulations in force. It is worrisome that according to the data from CBOS (CBOS, 2016) 80% of population does not know that they are considered as potential donor thus, by definition, are unable to give the required informed consent for organ donation. Even though *ignorantia iuris nocet* (lat. not knowing the law is harmful), for 80% of population a presumed blanket consent for organ donation seems far from sufficient. In everyday practice physicians have no instruments to pursue organ procurement if the family, not without justification, fiercely resist it as it is morally questionable in case of potential absence of the deceased's approval. According to Biały (2016 as cited in Woderska, 2018), when considering the lack of evidence for organ donation approvement, it does not appear that the only possible answer will always be yes. The deceased, while still alive, may have been unaware of the applicable legal principles. Moreover, they may also have postponed the decision to announce the wishes for another time. This causes that organ procurement limited to the basis of implied consent is always an action in the presence of doubt.

5. Summary

The positive aspect of presumed consent is that the majority of Polish population is pro-donation which is supported by numerous studies (CBOS, 2016; Ruszkowski et al., 2020; Woderska, 2018). This means that the essence of presumed consent is met. Still, majority of people, wish to be taken into account as potential donors as they believe in the life saving aspect of this gift regardless of lack of factual knowledge in the field of transplantology and law. But in order to ensure voluntariness and liberty of decision as well as to prevent violation of one's right to self-determine it is fundamental to undertake activities such as public awareness campaigns and to inform patients about their rights in order to educate the society about transplantation in a relevant way. Some authors suggest (Molina-Pérez et al., 2022) that in an ideal model of consent to organ donation, aimed at increasing the number of donors and respecting their decisions, family should be prevented from questioning the consent of the deceased and be moved away from decision made under the influence of extreme emotions. As for now, family's acceptance of organ donation impacts greatly on the possibility to donate organs in Poland.

References

1. Act of July 1, 2005 on the collection, storage and transplantation of cells, repair and storage, Dz.U. 2005, nr 169, poz. 1411, art. 6.1. <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20051691411/U/D20051411Lj.pdf/>.
2. Act of November 6, 2008 on the rights of patients and the Patient's Rights Ombudsman, Dz.U. z 2009 r. Nr 52, poz. 417, art. 18.1. <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20090520417/U/D20090417Lj.pdf/>.
3. Announcement by the Marshal of the Sejm of the Republic of Poland from July 21, 2008 on the announcement of the uniform text of the Act on professions of physician and dentist, Dz.U. z 2008 r. Nr 136, poz. 857, art. 34.1. <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20081360857/U/D20080857Lj.pdf/>.
4. Baszczak, Ł. (2020). Ekonomia behawioralna w Pracowniczych Planach Kapitałowych – analiza skuteczności. *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze*, 7(13), 5-17. 10.26366/PTE.ZG.2020.175.
5. Beraldo, D., Karpus, J. (2021). Nudging to donate organs: do what you like or like what we do? *Medicine, Health Care and Philosophy*, 24(3), 329-340. <https://doi.org/10.1007/s11019-021-10007-6>.

6. Bezinover, D., Saner, F. (2019). *Organ transplantation in the modern era*. BMC Anesthesiology. doi.org/10.1186/s12871-019-0704-z.
7. Biały, S. (2006). *Wybrane zagadnienia z bioetyki*. Olecko: Wydawnictwo Wszechnicy Mazurskiej Acta Universitatis Masuriensis.
8. Breslin, J. (2018). The status quo bias and decisions to withdraw life-sustaining treatment. *Canadian Medical Association Journal*, 190(9), E265-E267. 10.1503/cmaj.171005.
9. Burmeister, K., Schade, C. (2007). Are entrepreneurs' decisions more biased? An experimental investigation of the susceptibility to status quo bias. *Journal of Business Venturing*, 22(3), 340-362. 10.1016/j.jbusvent.2006.04.002.
10. CBOS (2016). *Postawy wobec transplantacji narządów – komunikat z badań nr 119/2016*. Retrieved from: https://www.cbos.pl/SPISKOM.POL/2016/K_119_16.PDF, 10.05.2022.
11. European Commission (2022). *Organs*. Retrieved from: https://ec.europa.eu/health/blood-tissues-cells-and-organs/organs_en, 9.04.2022.
12. European Parliament (2020). *Organ donation and transplantation. Facts, figures and European Union action*. Retrieved from: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/649363/EPRS_BRI\(2020\)649363_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/649363/EPRS_BRI(2020)649363_EN.pdf), 9.04.2022.
13. Eurotransplant (2022a). *Factsheet*. Retrieved from: https://www.eurotransplant.org/wp-content/uploads/2022/02/ET_Factsheet_2021.pdf, 16.04.2022.
14. Eurotransplant (2022b). *International organ exchange*. Retrieved from: <https://www.eurotransplant.org/about-eurotransplant/international-organ-exchange/>, 16.04.2022.
15. Groot, J., van Hoek, M., Hoedemaekers, C., Hoitsma, A., Smeets, W., Vernooij-Dassen, M., van Leeuwen, E. (2015). Decision making on organ donation: the dilemmas of relatives of potential brain dead donors. *BMC Medical Ethics*, 16(1). doi: 10.1186/s12910-015-0057-1.
16. GUS (2020). *Ludność według płci i województw – rok 2020, ogólnopolskie, tablica 01*. Retrieved from: https://demografia.stat.gov.pl/bazademografia/Downloader.aspx?file=pl_lud_2020_00_01.zip&sys=lud, 4.05.2022.
17. Halpern, S., Ubel, P., Asch, D. (2007). Harnessing the Power of Default Options to Improve Health Care. *New England Journal of Medicine*, 357(13), 1340-1344. DOI: 10.1056/nejmsb071595.
18. Health Resources & Service Administration (2022). *Organ donation statistics*. Retrieved from: <https://www.organdonor.gov/learn/organ-donation-statistics>, 16.04.2022.
19. Howard, K., Jan, S., Rose, J.M., Wong, G., Craig, J.C., Irving, M., Cass, A. (2016). Preferences for Policy Options for Deceased Organ Donation for Transplantation. *Transplantation*, 100(5), 1136-1148. 10.1097/tp.0000000000000940.
20. Johnson, E., Goldstein, D. (2003). Do Defaults Saves Lives? *Science*, Vol. 302, pp. 1338-1339. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1324774, 9.04.2022.

21. Karl, F., Holle, R., Schwettmann, L., Peters, A., Laxy, M. (2019). Status quo bias and health behavior: findings from a cross-sectional study. *European Journal of Public Health*. 10.1093/eurpub/ckz017.
22. Koźlik, P., Pfitzner, R., Nowak, E., Kozynacka, A., Durajski, Ł., Janik, Ł., Przybyłowski, P. (2014). Correlations Between Demographics, Knowledge, Beliefs, and Attitudes Regarding Organ Transplantation Among Academic Students in Poland and Their Potential Use in Designing Society-wide Educational Campaigns. *Transplantation Proceedings*, 46(8), 2479-2486. doi: 10.1016/j.transproceed.2014.09.143.
23. Lewis, A., Koukoura, A., Tsianos, G., Gargavanis, A., Nielsen, A., Vassiliadis, E. (2020). Organ donation in the US and Europe: The supply vs demand imbalance. *Transplantation Reviews*, 100585. 10.1016/j.trre.2020.100585.
24. Mazur, A., Lisowska, D., Budzińska, K., Ścieranka, M., Smoleń, E. (2018). Zachowania studentów dotyczące przeszczepiania narządów z uwzględnieniem czynników socjodemograficznych. *Hygeia Public Health*, 53(4), 371-376. Retrieved from: <http://www.h-ph.pl/pdf/hyg-2018/hyg-2018-4-371.pdf>, 10.05.2022.
25. Molina-Pérez, A. et al. (2022). Should the family have a role in deceased organ donation decision-making? A systematic review of public knowledge and attitudes towards organ procurement policies in Europe. *Transplantation Reviews*, vol. 36(1). doi: 10.1016/j.trre.2021.100673.
26. Nesterowicz, M. (2010). *Prawo medyczne*. Toruń: Wydawnictwo Dom Organizatora.
27. ODEQUS (2013). *Quality Criteria & Quality Indicators in Organ Donation*. Retrieved from: http://www.poltransplant.pl/Download/odequs/ODEQUS_Quality_Criteria_and_Quality_Indicators.pdf, 16.04.2022.
28. Paulo, M. (2010). Zapaść w transplantologii. *Medycyna Praktyczna*. Retrieved from: <https://kardiologia.mp.pl/publikacje/problemy-kardiologiczne/54802,zapasc-w-transplantologii>, 3.05.2022.
29. Poltransplant (2016). *Biuletyn informacyjny, nr 1(24)*. Downloaded from: http://poltransplant.pl/Download/Biuletyn_2016_www.pdf, 21.11.2021.
30. Poltransplant (2021). *Biuletyn informacyjny, nr 1(30)*. Downloaded from: https://www.poltransplant.pl/Download/Biuletyn_2021_www.pdf, 21.11.2021.
31. Reese, P., Glanz, K., Shah, A., Mussell, A., Levsky, S., Shuda, L., Shults, J., Kessler, J. (2020). A Randomized Trial of Theory-Informed Appeals for Organ Donor Registration Using Internet Advertisements. *Kidney Int. Rep.*, Dec; 5(12), 2238-2245. DOI: 10.1016/j.ekir.2020.09.013.
32. Ruszkowski, J., Heleniak, Z., Czaplińska, M., Dębska-Ślizień, A. (2020). Stosunek do transplantacji I jego umotywowanie wśród gdańszczan – przekrojowe badanie kwestionariuszowe. *Forum Nefrologiczne, tom 13, nr 4*, 184-19. Retrieved from: https://journals.viamedica.pl/forum_nefrologiczne/article/download/75010/54876, 10.05.2022.

33. Samson, A., Gigerenzer, G. (2016). *The Behavioral Economics Guide*. Retrieved from: <https://fehradvice.com/wp-content/uploads/2016/06/BEGuide2016.pdf>, 10.04.2022.
34. Samuelson, W., Zeckhauser, R. (1998). Status Quo Bias in Decision-Making. *Journal of Risk and Uncertainty*, 1(1), 7-59. 10.1007/BF00055564.
35. Shariv, A. (2022). Risk Aversion, Organ Utilization and Changing Behavior. *Transplant International*. doi.org/10.3389/ti.2022.10339.
36. Svartdal, F., Granmo, S., Færevag, F. (2018). On the Behavioral Side of Procrastination: Exploring Behavioral Delay in Real-Life Settings. *Frontiers in Psychology*, 9. 10.3389/fpsyg.2018.00746.
37. Thaler, R., Sunstein, C. *Impuls. Jak podejmować właściwe decyzje dotyczące zdrowia, dobrobytu i szczęścia?* Poznań: Wydawnictwo Zysk i S-ka.
38. Van Dalen, H., Henkens, K. (2014). Comparing the effects of defaults in organ donation systems. *Social Science & Medicine*, 106, 137-142. 10.1016/j.socscimed.2014.01.
39. Vanholder, R., Domínguez-Gil, B., Busic, M., Cortez-Pinto, H., Craig, J.C., Jager, K., Mahillo, B., Stel, V., Valentin, M., Zoccali, C., Oniscu Oniscu, G. (2021). Organ donation and transplantation: a multi-stakeholder call to action. *Nature Reviews Nephrology*, 17(8), 554-568. 10.1038/s41581-021-00425-3.
40. Weiss, J., Kocher, M., Immer, F. (2015). International collaboration and organ exchange in Switzerland. *Journal of Thoracic Disease*. 10.3978/j.issn.2072-1439.2014.12.44.
41. Williams, N., O'Donovan, L., Wilkinson, S. (2022). Presumed dissent? Opt-out organ donation and the exclusion of organs and tissues. *Medical Law Review*, pp. 1-31. doi.org/10.1093/medlaw/fvac001.
42. Woderska, N. (2018). *Wiedza i opinie młodzieży dotyczące dawstwa narządów do transplantacji*. Retrieved from: <https://repozytorium.ukw.edu.pl/bitstream/handle/item/5221/Wiedza%20i%20opinie%20mlodziezy%20dotyczace%20dawstwa%20narzadow%20do%20transplantacji.pdf?sequence=1>, 10.05.2022.

RISK ANALYSIS OF CONSTRUCTION A LOGISTIC CENTRE IN ECONOMIC AND ENVIRONMENTAL ASPECTS

Daniel TOKARSKI

University of Lodz; daniel.tokarski@uni.lodz.pl, ORCID: 0000-0002-3475-1115

Purpose: The article attempts a qualitative risk analysis of the feasibility of the construction project of a logistics centre (a warehouse hall with a monolithic reinforced concrete structure), with particular emphasis on the implementation phase. Risk factors may have a negative impact on individual stages of the investment process, and when detected at the right moment, they can be minimized - which will beneficially contribute to changing the investor's risk level.

Design/methodology/approach: The influence of selected risk factors on the scope of works carried out during construction was examined. Particular attention was paid to the time and cost of the investment implementation as well as its impact on the nearest natural environment. The analysis was carried out using modern tools supporting the engineer's work, including computer methods. The Norma PRO 4.75 cost estimating program was used, Microsoft Project supporting project management in terms of resources, time and finances, and Risky Project 7.2 used to manage project risk.

Findings: The components of the construction process that are most exposed to the risk of failure were identified, and preventive measures should be taken against them. The main factors threatening the implementation of the project assumptions, having a significant impact on the extension of time and the increase in the costs of feasibility, include the risk of equipment failure, the risk of employee absenteeism and the risk of negative impact of the works carried out on the immediate natural environment. The key processes in the construction of the logistics centre turned out to be foundation works and assembly of structural elements, due to their complexity, labour-intensity, implementation time and high costs.

Research limitations/implications: Research limitations result from the analysis of a deliberately selected case, which does not allow for formulating general conclusions. Nevertheless, the article refers to engineering practice and describes the challenges faced by the construction sector in the logistics industry.

Practical implications: The information contained in the publication may be of interest to representatives of the business sector, students and doctoral students of technical faculties, analysing the impact of sustainable development on warehouse infrastructure and innovation of project systems in the national and international dimension.

Originality/value: The publication covers the subject of construction logistics in the process of implementation of the project, as well as an analysis of selected risk factors, their definitions, and its reduction possibilities. Based on the project a qualitative risk analysis was performed, the result of this analysis was the identification of risks for which preventive measures should be introduced. After identifying the risk, it is recommended to be thorough estimation of risk factors and their evaluation, as well as planning the response to risk based on the selected model.

Keywords: construction economics, infrastructure and environment, logistic centre, risk management.

Category of the paper: Case study.

1. Introduction

Construction is a field of technology in which the implementation of individual technological processes, in comparison to the implementation of analogous processes occurring in other areas of the economy, takes place in specific conditions. In the design, implementation and execution phase of investment projects, one of the basic assumptions is the problem of maximally shortening the construction period and reducing costs, which results primarily from the fact that both the contractor and the investor strive to minimize the planned duration of the project and minimize costs. Very often decision-making is then treated in two-criterion terms as time-cost. The basis for planning construction production is the analysis of material expenditures, which is also the basis for the operation of IT systems. Project managers strive to quickly and reliably determine the use of construction time and costs in order to make appropriate operational decisions (Sypniewski, 2011; Tokarski, 2021).

The problems of determining the appropriate workload are very often underestimated. Contractors most often try to complete tasks quickly, without taking into account the global effects of doing so. However, one should realize that the effectiveness of organizational solutions is measured globally by the cost of lost time (Rytel, 2009; Drzewiecka et al., 2011). The optimal selection of technology for construction processes is an issue that every designer of construction technology and organization encounters very often (Xia et al., 2018).

The idea of engineering construction projects concerns specialized knowledge, skills and competences necessary to develop and make decisions determining the manner, time, costs and place of investment implementation, which is the basis and subject of the study. A construction project can be defined as the construction, extension, modernization or repair of buildings planned and organized at a specific place and time in order to meet the needs of a specific investor. Therefore, it is a complex purposeful process, carried out on and off the construction site, which consists of properly structured construction processes and the necessary processes of information, decision-making, material and technical support coupled with them (Śladowski, 2021).

It can be stated that the development of the construction concept and construction design, due to the required knowledge, skills and competences, is a relatively independent part of the project, which is implemented in accordance with separate rules. However, always taking into account the functional, technical, technological, organizational, economic, system and environmental requirements and conditions that are related to the preparation and

implementation of works and the operation of the facility (Obolewicz, 2016; Motowidlak, Tokarski, 2022).

In order to limit the negative effects of random events disrupting the implementation of the adopted plan, the risk of investment implementation should be taken into account. This risk is always associated with the probability of a given event not occurring (Siemaszko, Jakubczyk-Gańczyńska, 2014). Risk management is a process aimed at developing and introducing a risk control strategy to the planned project. It makes it possible to forecast the occurrence of an undesirable event by applying appropriate methods and processes and developing scenarios to prevent it (Aven, 2016; Banera, 2021). The risk management procedure is an integral part of the documentation of complex investment or construction projects, etc. and should be a project management subsystem. When designing a construction project, risk management is usually concerned with the deadline and the closely related cost (time-cost risk). However, in the investment implementation process, it is broken down into the management of many risk-bearing components, such as, for example, unforeseen ground and water conditions, weather conditions, availability of human resources, materials or equipment (Tokarski, Sawicki, 2021).

2. Motivation and purpose

Defining the concept of risk is not easy, especially due to its ambiguity. It is mainly an indicator of a condition or event that may lead to some loss. In colloquial speech, it usually defines some measure or assessment of a threat or danger resulting either from probable events beyond our control or from the possible consequences of decisions made. Each investment carries a risk, this also applies to construction companies. There is no such investment that is risk-free, and construction is sometimes referred to as a high-risk industry. The issue of risk in construction projects is noticeable not only at the planning stage, but also during the implementation period (e.g. by monitoring the actual time and costs of the investment). Identification of random factors, determining the probability of their occurrence and their impact on the course of the construction project are the main elements of the project risk management process. As a result, this is reflected in the deviation of the actual time as well as the cost of the works from the originally planned (Teixeira et al., 2011).

Among the issues discussed in the construction industry, there was the issue of creating risk assessment procedures, schematic diagrams using a systemic approach, as well as algorithms of conduct. In order to simplify the procedure of risk management, its three basic links can be distinguished: identification, quantification and response (PN-ISO 31000:2018). Of course, this procedure is definitely a more extensive process depending on the expectations of the decision maker, the ability to control and analyse the effects. The identification stage includes specifying the hazardous factors that may occur during the execution of a given project.

This method of risk assessment is characterized by ease of calculation and readability of its results. The purpose of risk management is to analyse the initially selected and unwanted random factors, as well as to determine their impact on the price and duration of the construction project, as well as to prepare an alternative solution (Kos, 2019). The methods of identifying risk factors and areas include, among others, assessments by experts and consultants, brainstorming, ready-made "checklists" and internal control in the enterprise. This method of risk analysis includes: local and global risks, external and internal risks, macro and micro level risks, as well as risks closely related to the project. There is also a proposal to classify the risk taking into account the relationship between the amount of damage and the probability of its occurrence (ISO/IEC 31010:2009).

An even more detailed breakdown of existing threats is possible, so professional computer software can help. It is very important to carefully determine the risk factors taking into account the characteristics and size of the project. The purpose of the quantification stage, i.e. the assessment of risk factors, is their analysis and quantitative description. Appropriate tools should be used to assign appropriate measurable values to risk factors, only then it is possible to analyse a construction project according to the forecasted completion time and costs. The risk assessment primarily involves quantifying two factors (probability of occurrence, impact on the project if materialized) to decide what action should be taken on each of them. The final stage is the adoption of one of the proposed risk reduction strategies (Miszewska, Niedostatkiewicz, 2020), namely:

- a) transfer of risk - transfer of possible costs related to the possibility of a loss of a participant in the investment process,
- b) risk reduction - possible elimination of the risk problem by introducing changes to the design, organization of construction works, etc.,
- c) risk avoidance - targeting avoiding solutions for which losses can be expected,
- d) risk absorption – taking the possible consequences of adverse events on oneself in their entirety.

Due to the nature and specificity of the construction industry, the analysis of the impact of risk factors on the investment project is undertaken more and more often, despite the considerable difficulty of their quantification. The issue of risk management is not so much up-to-date as important for the efficient planning and implementation of a construction project. When choosing the method of analysis and final risk assessment, one should be guided by its usefulness as well as readability and ease of interpretation of the results obtained. Unfortunately, there is a lack of analyses, models and tools that would support the process of managing the risk of construction projects. Therefore, the creation of a risk management system model will allow in the future to support control and prevent the effects of threats in this activity. Taking this into account, it can be concluded that the risk associated with the planning, implementation and operation of a construction project is a complex issue that is difficult to clearly define, and even more so to manage effectively. Apart from theoretical knowledge, it certainly also requires some practical experience (Szafranko, 2014).

3. Methodology

The subject of the study is the analysis of the project of technology and organization of the construction of a logistics centre, which consists of a hall with a monolithic structure intended for a warehouse, designed in accordance with the currently applicable standards (PN-EN 1992-1-1:2008). The implementation process of the discussed construction project includes: organizational works, earthworks, foundations (including the construction of reinforced concrete columns), assembly of structural elements (i.e. frames and frame systems, wall and roof panels, corner elements, gate sets), installation (e.g. water, sanitary and rainwater drainage, gas, heating, internal mechanical ventilation and electrical installations on the premises), finishing works, paving works and fencing of the plot. The construction design, description of the hall structure, cost estimate and schedule are part of a separate study.

The outlays have been determined for works carried out in average local conditions, in areas enabling the delivery and storage of materials in the zone near the facility, without taking into account any special difficulties. The outlays include all technological processes, assuming proper organization and technology of works and taking into account all activities and expenditures necessary to perform elements or works. The catalog lists expenditures for the execution of structural elements or works for the adopted measurement units. Labour and equipment expenditures specified in the catalog apply regardless of the height or depth of execution, with the reservation of vertical transport by a shaft or goods and passenger hoist to a height above 18 m. Labour expenditures include basic works specified in the specification of works on boards, as well as the following works and activities auxiliary (KNR 2-02):

- internal horizontal and vertical transport of materials and accessories to the average distances and heights occurring on the construction site, taken into account when determining expenditures for cost estimation purposes,
- setting, moving, moving and removing temporary supports and portable scaffolding, enabling the performance of works at a height of up to 4 m,
- stacking, segregating and sorting product materials at the construction site or in the warehouse at the facility,
- operation of equipment that does not have full-time staff,
- checking the correctness of the execution of works,
- removal of defects and faults and repairing damage caused during the execution of works,
- keeping the workplace clean and tidy,
- performing activities related to the liquidation of the workstation.

The schedule was created to estimate and optimize the duration of the investment. The preparation of the schedule began with determining the duration of individual works. For this purpose, a bill of quantities was made and a detailed cost estimate was prepared on its basis. Then, the number of brigades performing individual construction works was determined and a list of equipment planned to be used was prepared. The next stage was to determine the time of completion of these works (number of working days) and to determine the appropriate sequence of construction processes resulting from the technology. The sequence of individual works was optimized in such a way as to maintain the continuity of work of the teams and at the same time not significantly extend the course of the investment implementation. Simultaneous performance of several non-colliding works within the plot in order to shorten the duration of the project was not ruled out. Commencement of the investment is scheduled for May 9, 2021, while the complete completion of the construction of the facility suitable for commissioning according to the schedule is set for March 13, 2022. A one-shift, 8-hour working time from 6:00 a.m. to 3:00 p.m. with two breaks not included in the working time (the first one, in the morning, 20 minutes long, and the lunch break, lasting 40 minutes), 5 working days a week, from Monday to Friday). The course of work is carried out by 14 construction brigades, and their composition is permanent (Banach, Marcinkowski, 2016). The list of the number of construction brigades involved in the implementation of the logistics warehouse construction process is presented in Table 1.

Table 1.

List of the number of construction brigades in the process of building a logistics centre

No.	Brigade	No. of employees
1	General construction workers A	5
2	General construction workers B	5
3	Bulldozer operator	1
4	Crawler excavator operator	1
5	Truck driver	1
6	Surveyor	1
7	Electricians	3
8	Contractors of water and sewage installations	3
9	Steel construction fitters	5
10	Armorers	3
11	Concrete mixers	5
12	Bricklayers	5
13	Roofers	5
14	Pavers	6

Source: own study based on research results.

Table 2 contains a list of equipment planned to be used during the implementation of the assumptions of the discussed investment project.

Table 2.*List of equipment in the process of building a logistics centre*

No.	Equipment	No. of sets
1	Crawler bulldozer	1
2	Backhoe crawler excavator	1
3	Wheel loader 3.5 m ³	1
4	Self-dumping truck 20-25 T	2
5	Compactor 100 kg	4
6	Diesel rammer 200 kg	8
7	Concrete pump on the car	4
8	Electric slow fall concrete mixer	4
9	Electric lift	4
10	Reinforcement equipment	4
11	Scaffolding	4

Source: own study based on research results.

The risk analysis was performed using Risky Project 7.2, a software for planning, scheduling, quantitative and qualitative risk analysis and measuring the progress of projects with multiple risks and uncertainties developed by the Intaver Institute (Risky Project Version 7.2, 2022). The risks whose impact on the course of the construction process was examined included:

- risk of employee absenteeism,
- risk of equipment failure,
- risk of negative impact on the natural environment,
- risk of adverse weather conditions,
- risk of not maintaining standards,
- risk of insufficient qualifications of employees (employee efficiency),
- risk of poor management of material resources.

Table 3 summarizes the activities carried out in the course of the implementation of the project assumptions, along with specific risk values broken down into individual activities and their percentage probability of occurrence during the construction process.

Table 3.*List of risk values in individual activities of building a logistics centre*

No.	Activity	Risk	Chance of occurrence [%]
1	Organizational works	Risk of employee absenteeism	10.0
		Risk of equipment failure	5.0
		Risk of negative impact on the natural environment	2.0
		Risk of adverse weather conditions	2.0
		Risk of not maintaining standards	1.0
2	Earthworks	Risk of employee absenteeism	5.0
		Risk of equipment failure	10.0
		Risk of negative impact on the natural environment	10.0
		Risk of adverse weather conditions	4.0
		Risk of not maintaining standards	2.0

Cont. Table 3.

3	Foundations	Risk of employee absenteeism	10.0
		Risk of equipment failure	15.0
		Risk of negative impact on the natural environment	5.0
		Risk of adverse weather conditions	4.0
		Risk of not maintaining standards	4.0
		Risk of insufficient qualifications of employees	5.0
4	Assembly of structural elements	Risk of employee absenteeism	10.0
		Risk of equipment failure	15.0
		Risk of negative impact on the natural environment	5.0
		Risk of adverse weather conditions	4.0
		Risk of not maintaining standards	4.0
		Risk of insufficient qualifications of employees	5.0
		Risk of poor management of material resources	3.0
5	Installation execution	Risk of employee absenteeism	10.0
		Risk of equipment failure	10.0
		Risk of negative impact on the natural environment	5.0
		Risk of adverse weather conditions	5.0
		Risk of not maintaining standards	5.0
		Risk of insufficient qualifications of employees	4.0
		Risk of poor management of material resources	3.0
6	Finishing works	Risk of employee absenteeism	10.0
		Risk of equipment failure	10.0
		Risk of adverse weather conditions	5.0
		Risk of not maintaining standards	5.0
		Risk of insufficient qualifications of employees	5.0
		Risk of poor management of material resources	2.0
7	Paving works	Risk of employee absenteeism	10.0
		Risk of negative impact on the natural environment	5.0
		Risk of adverse weather conditions	2.0
		Risk of not maintaining standards	2.0
		Risk of poor management of material resources	2.0
8	Plot fence	Risk of employee absenteeism	5.0
		Risk of negative impact on the natural environment	2.0
		Risk of adverse weather conditions	1.0
		Risk of not maintaining standards	1.0

Source: own study based on research results.

While the risk factors appearing in the process of building a warehouse that is part of a logistics centre related to the area of human, material and technical resources are sufficiently specified, the significance of the impact of the risk of negative impact on the natural environment requires explanation. Most often, environmental risk is understood as a specific type of risk, which is primarily associated with a negative impact on the environment and excessive exploitation of raw materials (Tokarski, 2022). Therefore, environmental risk can be defined as a combination of the likelihood of an environmental event and its consequences. The aforementioned effects of the environmental event should be considered on the basis of the assessment of the threat to: natural elements (ecological risk), property assets (property risk), human health and life (health risk). When characterizing environmental risk, one cannot forget about its dynamics. This is because it indicates the development over time of a potential threat resulting from human activity. At the same time, it becomes important to take into account the changes taking place in the society in which a given enterprise operates (PN-ISO 31000: 2018-08).

4. Results

The risk analysis of the construction project was carried out using the capabilities of the Risky Project 7.2 program. Components used: risk matrix, cost analysis, cash flow, risk chart (task duration, total task cost), success ranking, critical tasks, project summary (for three variants, i.e. 100, 95 and 80% probability of occurrence), project report .

The risk matrix shows the impact of a given risk based on the calculated probability of occurrence, which is very low in the case of the risk of poor management of material resources (12%) and the risk of insufficient qualifications of employees (23%). The risk associated with failure to maintain standards at the construction site also has a low probability of occurrence (30%). The risk of adverse weather conditions (33%) and the risk of negative impact on the natural environment (43%) are low, but with an increasing tendency. The risk related to equipment failure (82%) and employee absenteeism (88%) should be included among the risks with the highest degree of probability of occurrence, due to the complexity of processes at subsequent stages of construction and the high failure rate of machines during the construction process.

The Cost Analysis module shows the costs in a graph. The actual cost means the actual costs incurred so far, the current schedule indicates the assumed budget. Subsequently, the costs were analysed, which show the total cost of the works before and after taking into account the risks. By moving the slider located under the graph, you can track the cost in subsequent phases of the project. The largest expenses are related to foundation works processes (USD 54,225.04) and assembly of structural elements (USD 52,806.76). The costs of the current schedule amounted to USD 374,877.00, while after the simulation involving risks, the costs increased by USD 12,587.00 and amounted to USD 387,464.00.

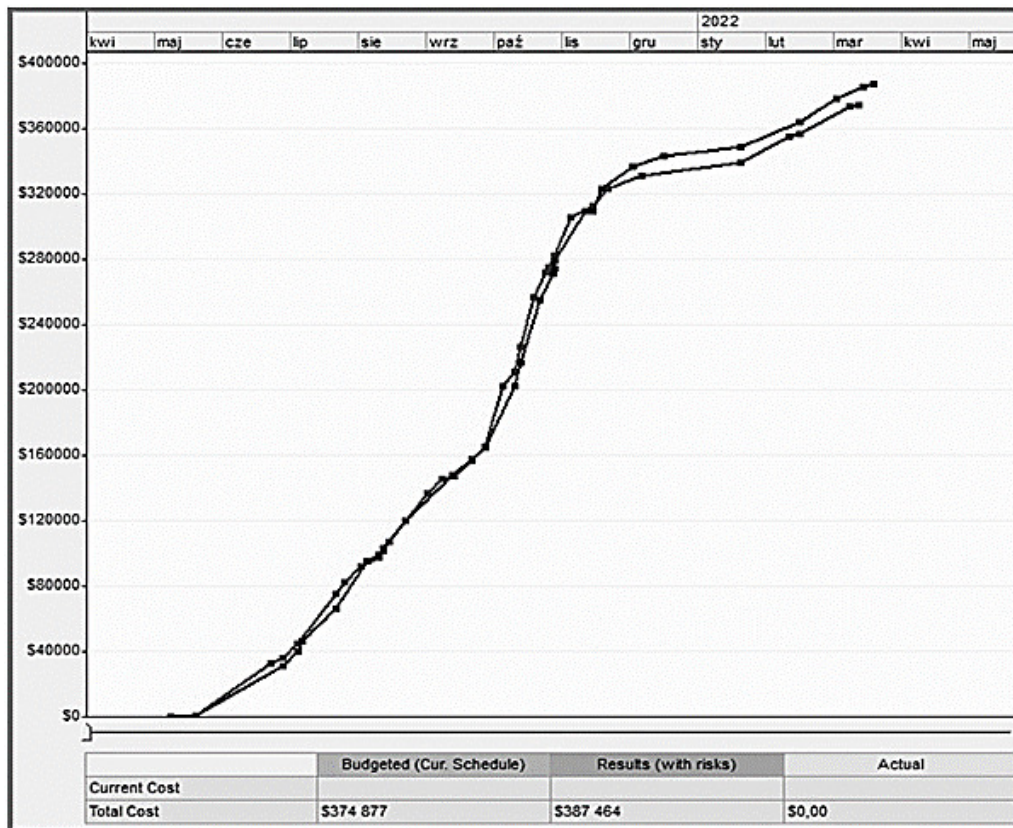


Figure 1. Cost Analysis.

Source: own study based on research results.

The Cash Flow module contains information about the cash flow in the selected period. Expenses related to the process of building a warehouse are systematized. The increase recorded at the turn of October and November is the reason for the increase in expenses related to the start of the "assembly of structural elements" process. Expenditures gradually decreased as construction works approached completion. The costs with the calculated risks are comparable to the basic ones, which does not pose a threat to the profitability of the entire project.

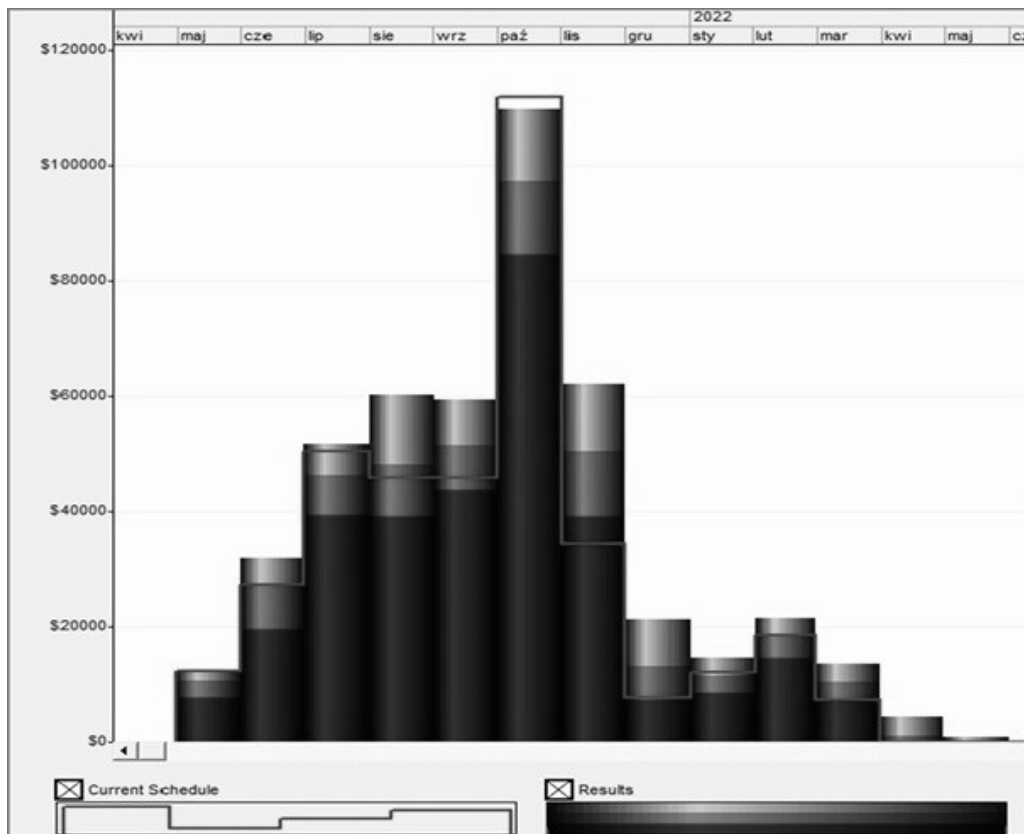


Figure 2. Cash Flow.

Source: own study based on research results.

The Risk Graph module calculates the cost or duration against the risk. In the case of the Task duration (Current Schedule) chart - the risk due to duration has the highest probability of occurring in the assembly process of structural elements, as well as during foundation works. The smallest, however, during the installation of the plot fencing. Total Task Cost (Current Schedule) presents a risk due to the total cost of the task, which turned out to be the highest during foundation works (USD 54,225.04) and assembly of structural elements (USD 52,806.76). The lowest costs are tasks related to fencing the plot (USD 5,322.22). Increased costs of construction works may come from increased (compared to standard) outlays for their execution, exceeding contractual deadlines or the need to employ workers and machines overtime.

Thanks to the Success Rate module, the probability of success or completion for individual tasks was calculated. The results are marked in different colours on the Gantt chart. Tasks with a high success rate are shown in green, medium in yellow, and low in red. In the case of the logistics warehouse construction process, all scheduled tasks have a high success rate of 100%.

The Crucial Tasks module indicates the correlation between risks and the probability of completing tasks. The higher the correlation, the more the risk affects the performance of the task. Uncertain ones whose variable duration has the greatest impact on the project are shown in red. In the case of the construction of a logistic warehouse, the least certain action is

"assembly of structural elements". In the critical operation of finishing works, all types of risks included in the project are present as the only one.

In the Project Summary module, the budget range, duration and end date of the project are given. Using the program, three variants of the effectiveness of activities related to the implementation of the construction process were analysed.

And so for variant I - the most probable,

- the budget range was USD 387,377.75 with 50% probability,
- the duration of the construction process with 66% probability was estimated at 234 days,
- the date of completion of the construction process with 65% probability is scheduled for no earlier than March 30, 2022.

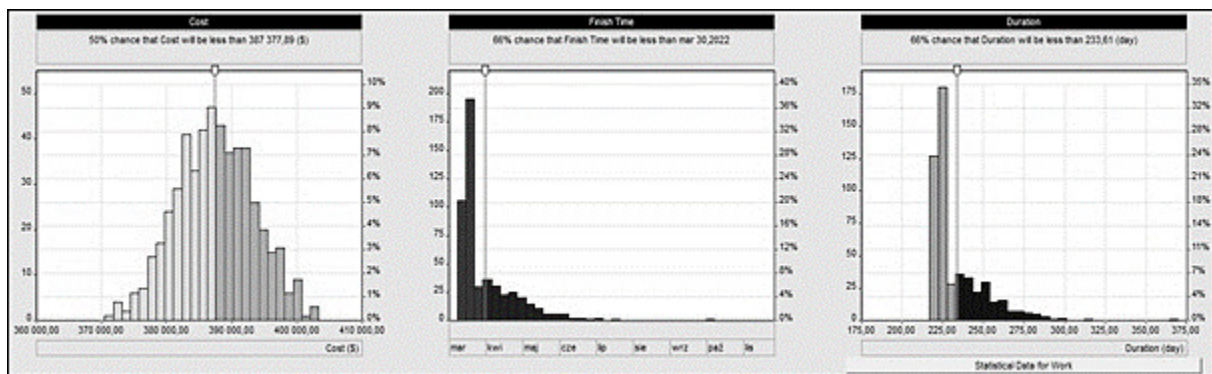


Figure 3. Project Summary – Variant I (the most probable).

Source: own study based on research results.

Variant II - 80% probability,

- the budget range was USD 392,390.75,
- the duration of the construction process was estimated at 246 days,
- the date of completion of the construction process is scheduled for no earlier than April 17, 2022.

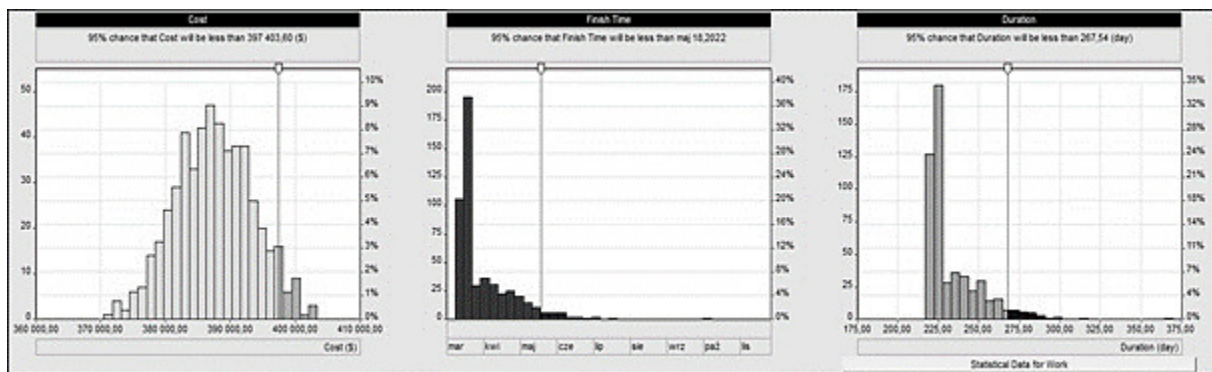


Figure 4. Project Summary – Variant II (80% probability).

Source: own study based on research results.

Variant III - 95% probability,

- the budget range was: USD 397,403.60,
- the duration of the construction process was estimated at 268 days,
- the date of completion of the construction process is scheduled for no earlier than May 18, 2022.

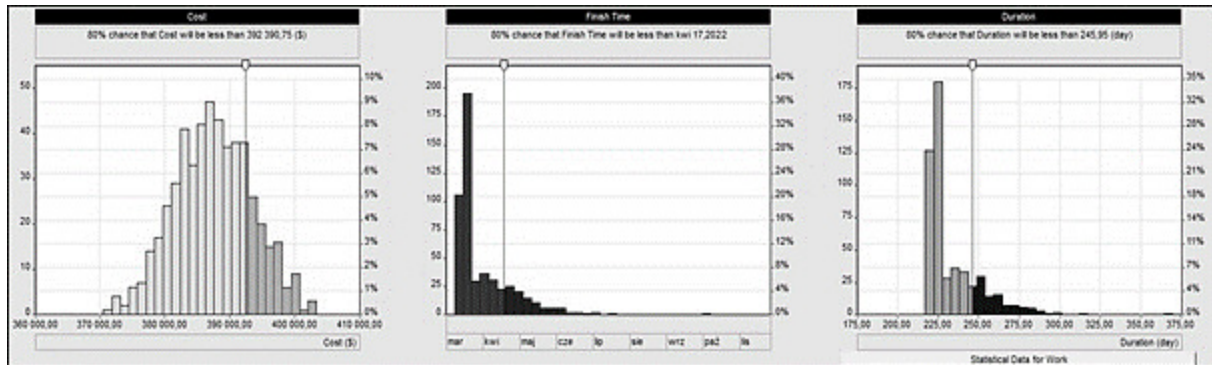


Figure 5. Project Summary – Variant III (95% probability).

Source: own study based on research results.

The most advantageous solution is the most probable variant due to the lowest costs, completion date and duration of the construction process. The project report contains information about the three most important parameters of the project, the three most crucial tasks and the three most critical risks.

5. Conclusions

The conducted analysis showed that the most important parameters of the project implementation are the total investment costs, which amounted to USD 374,877.00 without including the risks, and increased by USD 12,587.00 and amounted to USD 387,464.00 with the risks taken into account. Another important parameter is the time of completion of the investment, which in the case of not including the risks provides for the completion of works on March 13, 2022, while with the risks taken into account, the process was extended by 13 days and its completion date is scheduled for March 26, 2022.

The most common risk factors threatening and delaying the date of implementation of the investment project turned out to be:

- the risk of equipment failure, the probability of which was 82% and occurred in 6 activities out of 8,
- the risk of employee absenteeism, the probability of which was 88% and occurred in all 8 activities,

- risk of negative impact on the natural environment, the probability of which was 43% and occurred in 7 out of 8 activities,
- the risk of adverse weather conditions, the probability of which was 33% and occurred in all 8 activities,
- the risk of not maintaining standards, the probability of which was 30% and occurred in all 8 activities,
- the risk of insufficient qualifications of employees, the probability of which was 23% and occurred in 4 out of 8 activities,
- the risk of poor management of material resources, the probability of which was 12% and occurred in 4 out of 8 activities.

The key process of building the logistics centre turned out to be the foundation works and assembly of structural elements, due to their complexity, demanding scope of work (labour-intensive), high costs and time-consuming.

The conducted research does not exhaust the issues of identification and hierarchy risk factors in construction projects. However, they draw a picture the problem of risk analysis and assessment. The method of risk analysis presented by the authors can be used for its initial estimation. Detailed analysis requires more application sophisticated methods, e.g. RAMP: Risk Analysis and Management for Project (Carr, Tah, 2001), ICRAM: Model for International Construction Risk Assessment (Hastak, Wstrząśnięty, 2000), MOCRA: Method of Construction Risk Assessment (Połoński, 2013) and tools: Pertmaster (Połoński, Bogusz, 2005), Microsoft Project (Marmel, 2011), Primavera Project Planner (Zima, 2003), Statistica Neural Network (Hilbe, 2007). The possibilities of using the above-mentioned methods and tools will be presented in the following articles by the authors.

References

1. Aven, T. (2016). Risk assessment and risk management: Review of recent advances on their foundation. *European Journal of Operational Research*, Vol. 253, No. 1, pp. 1-13, doi: 10.1016/j.ejor.2015.12.023.
2. Banach, M., Marcinkowski, R. (2016). Harmonogramowanie robót budowlanych z wykorzystaniem przedmiarów dodatkowych w kosztorysowaniu. *Materiały Budowlane*, No. 6, pp. 6-7, doi: 10.15199/33.2016.06.02.
3. Banera, J. (2021). Zasady zarządzania ryzykiem w branży budowlanej. *Izolacje*, Vol. 26, No. 7-8, pp. 42-46.
4. Bizon-Górecka, J., Górecki, J. (2019). Ryzyko przedsięwzięć budowlanych w perspektywie podmiotowej. *Przegląd Naukowy Inżynieria i Kształtowanie Środowiska*, Vol. 28, No. 2, pp. 244-256, doi: 10.22630/PNIKS.2019.28.2.23.

5. Carr, V., Tah, J.H.M. (2001). Rozmyte podejście do oceny i analizy ryzyka projektu budowlanego: system zarządzania ryzykiem projektu budowlanego. *Postępy w oprogramowaniu inżynierskim*, Vol. 32, No. 10-11, pp. 847-857.
6. Drzewiecka, J., Paślawski, J. Paślawska (2011). Analiza zakłóceń procesów budowlanych. *Budownictwo i Inżynieria Środowiska*, No. 2, No. 4, pp. 475-479.
7. Hastak, M., Wstrząśnięty, A. (2000). ICRAM-1: Model międzynarodowej oceny ryzyka budowlanego. *Czasopismo zarządzania w inżynierii*, Vol. 16, No. 1, pp. 59-69.
8. Hilbe, J.M. (2007). Statistica 7: przegląd. *Statystyk amerykański*, Vol. 61, No. 1, pp. 91-94.
9. ISO/IEC 31010:2009 – Risk management – Risk assessment techniques. Polski Komitet Normalizacyjny (2009).
10. KNR 2-02: Konstrukcje budowlane. Warszawskie Centrum Postępu Techniczno-Organizacyjnego Budownictwa Wacetob (2017).
11. Kos, A. (2019). Zarządzanie ryzykiem w projekcie. *Zeszyty Naukowe Państwowej Wyższej Szkoły Zawodowej im. Witelona w Legnicy*, Vol. 1, No. 30, yadda: bwmeta1.element.baztech-e2552703-e3de-446e-9140-c6a5994c2825.
12. Marmel, E. (2011). *Microsoft Project 2007 Bible*, Vol. 767. John Wiley & Sons.
13. Miszewska, E., Niedostatkiewicz, M. (2020). Dobór analizy strategicznej przedsięwzięć budowlanych w aspekcie zrównoważonego rozwoju. *Przegląd Budowlany*, Vol. 91, No. 6, pp. 21-25, yadda: bwmeta1.element.baztech-b6723b80-aa30-430c-94a0-ea43ed80dfd4.
14. Motowidlak, U, Tokarski, D. (2022) *Infrastruktura magazynowa i transportowa w dobie zrównoważonego rozwoju gospodarki*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego, doi: 10.18778/8220-895-5.
15. Obolewicz, J. (2016). Koordynacja budowlanego procesu inwestycyjnego. *Budownictwo i Inżynieria Środowiska*, Vol. 7, No. 3, pp. 153-163, yadda: bwmeta1.element.baztech-cad766c0-00c6-4a80-b38b-63764f76c26a.
16. PN-EN 1992-1-1:2008 – Eurokod 2: Projektowanie konstrukcji z betonu. Część 1-1: Reguły ogólne i reguły dla budynków. Polski Komitet Normalizacyjny (2008).
17. PN-ISO 31000:2018 – Risk management – Guidelines. Polski Komitet Normalizacyjny (2018).
18. Połośki, M. (2013). Harmonogramowanie projektów budowlanych z uwzględnieniem buforów czasowych określonych na podstawie analizy ryzyka. *Budownictwo i Architektura*, Vol. 12, No. 1, pp. 47-52.
19. Połośki, M., Bogusz, W. (2005). Analiza zasobów wsparcia inżynierskiego w harmonogramie sieciowym na podstawie programu Pertmaster Professional + Risk. *Przegląd Naukowy. Inżynieria i Kształtowanie Środowiska*, Vol. 14, No. 2/32, pp. 126-133.
20. *Risky Project Version 7.2*. Retrieved from: <https://www.intaver.com/products/riskyproject-version-7-2/>, 2.11.2022.
21. Rytel, O. (2009). Specyfika produkcji budowlanej. *Zeszyty Naukowe Akademii Podlaskiej w Siedlcach. Administracja i Zarządzanie*, Vol. 10, No. 83, pp. 159-171.

22. Siemaszko, A., Jakubczyk-Gałczyńska, A. (2014). Identyfikacja ryzyka zakłóceń logistycznych podczas planowania procesu inwestycyjnego na wybranym przykładzie. *Logistyka*, Vol. 3, pp. 5670-5677.
23. Sobotka, A. (2021). Inżynieria przedsięwzięć budowlanych – nauka, kształcenie, współpraca. *Przegląd Budowlany*, Vol. 92, No. 7-8, pp. 37-44.
24. Sypniewski, D. (2011). *Nadzór nad procesem budowlanym*. USA: LexisNexis Polska.
25. Szafranko, E. (2014). Analiza porównawcza metod szacowania poziomu ryzyka w budownictwie. *Logistyka*, No. 5, pp. 1498-1507.
26. Śladowski, G. (2021). Myślenie systemowe w proaktywnym podejściu do planowania przedsięwzięć budowlanych w warunkach ryzyka. *Przegląd Budowlany*, Vol. 92, No. 7-8, pp. 132-136.
27. Teixeira, J.C., Kulejewski, J., Krzemiński, M., Zawistowski, J. (2011). *Zarządzanie ryzykiem w budownictwie*. Warszawa: Biblioteka Menedżerów Budownictwa, Guimaraes.
28. Tokarski, D. (2021). Location determinants of city logistics centres in the concept of sustainable development. *Ekonomia i Środowisko*, Vol. 4, No. 79, pp. 58-69, doi: 10.34659/2021/4/27.
29. Tokarski, D. (2022). Jak skutecznie kształtować infrastrukturę zrównoważonego rozwoju? In: M. Burchard-Dziubińska (Eds.), *W poszukiwaniu zielonego ład* (pp. 247-260). Łódź: Wydawnictwo Uniwersytetu Łódzkiego, doi: 10.18778/8220-870-2.14.
30. Tokarski, D., Sawicki A. (2021). Risk analysis of the construction venture in the economic aspect. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, Vol. 153, pp. 495-505, doi: 10.29119/1641-3466.2021.153.35.
31. Xia, N., Zou, P.X., Griffin, M.A., Wang, X., Zhong, R. (2018). Towards integrating construction risk management and stakeholder management: A systematic literature review and future research agendas. *International Journal of Project Management*, Vol. 36, No. 5, pp. 701-715, doi: 10.1016/j.ijproman.2018.03.006.
32. Zima, R.M. (2003). Planowanie budowy z Primavera Project Planner. *Inżynieria kosztów*, Vol. 45/10, No. 24.

PLASTIC WASTE MANAGEMENT IN THE SMART CITIES: POLAND AND TURKEY AS A CASE STUDY

Medine Gül ÜNLÜ¹, Vildanur DİNÇ², Katarzyna MIDOR³, Grażyna PŁAZA^{4*}

¹ Manisa Celal Bayar University, Engineering Faculty, Turkey; gulunlu99@outlook.com,
ORCID: 0000-0001-9660-4295

² Manisa Celal Bayar University, Engineering Faculty, Turkey; vildanur70@gmail.com,
ORCID: 0000-0001-6433-5609

³ Silesian University of Technology, Faculty of Organization and Management; katarzyna.midor@polsl.pl,
ORCID: 0000-0001-5680-7354

⁴ Silesian University of Technology, Faculty of Organization and Management; grazyna.plaza@polsl.pl,
ORCID: 0000-0001-5862-0905

* Correspondence author

Introduction/background: Waste in various forms, such as solid waste, gaseous waste, and liquid waste, increases as a result of population growth, urbanization, and industrialization, and has a global impact. Waste management entails activities such as reuse, recycling, and reducing waste generation, as well as other strategies to combat the effect of waste generation caused by increasing population and industrialization. Monitoring is a critical function of waste management because it is required to address waste management issues such as waste generation, waste collection, waste transportation, waste treatment, and waste disposal. The article presents plastic waste management in the context of smart cities.

Purpose: The goal of the article is to present and compare of the production of plastic waste in Poland and Turkey in the context of smart cities. Sustainable and eco-innovation plastic waste management solutions to reduce plastic waste are provided to be implemented in smart cities. In this study, smart cities are explained, how to manage plastic waste by using smart city components, and methods of dealing with plastic waste are explained.

Methodology: The article is based on a review of the literature, own observations and own experience. The currently available plastic waste management solutions were analyzed and examples in the implementation of the technology in a smart city are described.

Findings: The incorporation of smart city technology into waste management practices provides a smart way to solve waste issues. The main of plastic waste management is to develop methods to transform plastic waste into a circular economy. As estimated by 2030 plastic leakage to ecosystems should be 30% reduced, double the global recovery of plastic (collection and recycling), and shift to sustainable inputs for remaining plastic, including recycled content, sustainably sourced biocontent, advanced products and reducing unnecessary plastic through a business model, innovation, reduction and substitution.

Originality: The goal of waste management is to recover as much useful material as possible, including energy. Waste generated in smart cities is a category of municipal waste. Traditional approaches to waste management have failed because they are not reliable or sustainable because they require a lot of input for little or no work output. The incorporation of smart city

technology into waste management practices provides a smart way to solve waste issues. The main of plastic waste management is to develop methods to transform plastic waste into a circular economy.

Keywords: Plastic wastes, waste management, smart cities, eco-innovation solutions.

1. Introduction

Within the scope of research carried out by the United Nations to design a more livable future, it is predicted that approximately seventy percent of the world's population will live in cities by 2030. The United Nations advises member states to take action as soon as possible to establish sustainable solutions for urban life because it forecasts that the population of cities will utilize the world's resources much more in the near future than it does now. The United Nations is also trying to find solutions to increase efficiency and energy savings for complex systems such as waste management, water management, public transportation management, mass lighting and heating management in megacities. At the start of these incentives, basic systems such as street lighting and traffic lights are equipped with more environmentally friendly solutions. Zero waste initiatives seek to unite cities around smart waste management solutions, which, in the eyes of the United Nations, is one of the most critical needs of cities. They are especially supported at the local government level.

2. Smart cities and waste management

2.1. What is smart city?

The same issues have existed since people first started settling in cities more than 6000 years ago: sanitization, crime, traffic, tax collection, upkeep of public infrastructure, and emergency services (Albino et al., 2015) . Infrastructure is also necessary for the development of significant technological advancements, including the electric grid, telephone and cell phone networks, internet (including fiber optic and cable networks), hot and cold running water, water and waste treatment, garbage and recycling collection, public parks and recreation facilities, rail, light rail, and automotive streets, roads, thoroughfares, and rights-of-way (Achmad et al., 2018; Fayomi et al., 2021). The main components of a smart city are presented in the Figure 1.

A smart city, to put it simply, is a place where existing networks and services are improved for the benefit of its citizens by using information, digital, and telecommunication technologies to make them more adaptable, efficient, and sustainable. To put it another way, in a smart city,

the utilization of digital technologies translates into improved public services for residents and better resource management with lower environmental effect (Balaban, 2019; Örselli, Akbay, 2019; Baran et al., 2020).

The following is one of the official definitions of the smart city: a city that "connects the social, business, information-technology, and physical infrastructure to exploit the collective intelligence of the city". "A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, and environmental aspects", states another formal and thorough definition (Mohanty, 2016; Barlow, Levy-Bencheton, 2018; Liu et al., 2020; Singh, Jara, 2022).

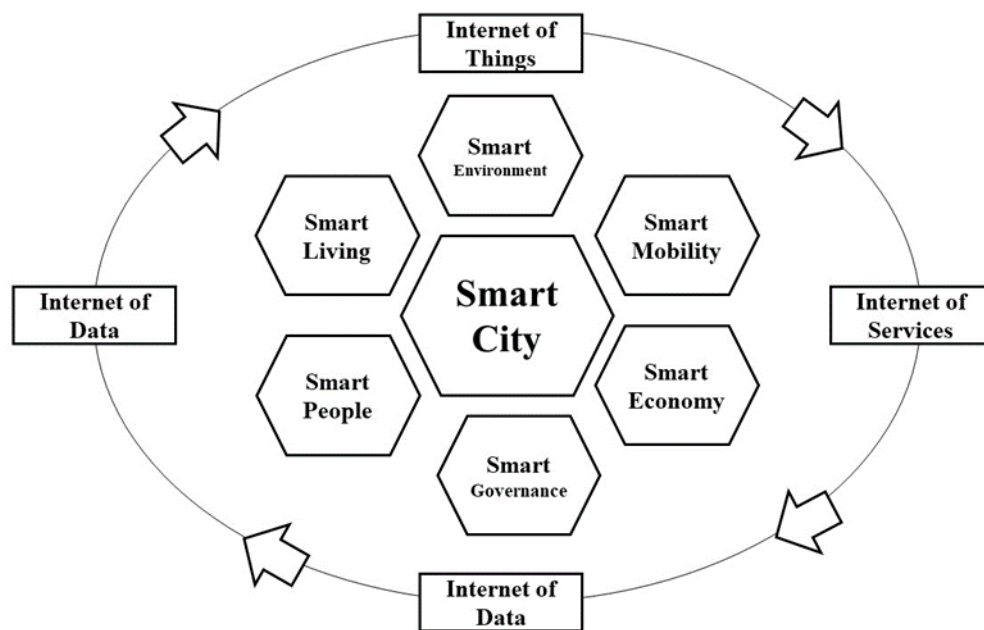


Figure 1. The main components of a smart city.

Source: Modified from Khatoun and Zeadally (2016).

2.1.1. Smart city in Turkey

It is seen that some targets regarding smart cities have been determined in both development plans and programs as well as different policy and strategy documents since the 2000s in Turkey. The following documents: The 10th Development Plan, Annual Programs, National Science and Technology Policies, 2003-2023 Strategy Document-Vision 2023, Information Society Strategy and Action Plans are the ones that draw the most attention. However, the Smart Municipalism Summits, Smart Cities Congress, Smart Cities Transformation Movement Project, Smart City Fair and Smart Cities Automation System are some of the organizations that bring the public and private sectors together in developing of idea of smart cities in Turkey (Adıgüzel, 2017).

The project to establish an eco-tech settlement started in Yalova at the beginning of 2000 is the Informatics Valley Project, which is accepted as Turkey's first smart city application. After this implementation, the Informatics Valley Projects started to be put on the agenda by other cities, especially Bursa, Kocaeli and Ankara. In addition, it is possible to come across municipality-based projects such as three-dimensional street imaging that works in harmony with the GoogleEart program of Fatih and Beyoğlu municipalities. However, the first smart city project, which was prepared as a solution to manage city services as a whole, was started in our province of Karaman. Efficiency will be experienced in all processes in city life with 20 applications integrated with sensors, IoT components, infrastructure, kiosks, touch screens, information screens, mass message systems, smart park and TEDES (Traffic Control Systems), data center and operation center (Bıyık, 2019; Soydan, Benliay, 2020).

It is planned to ensure the sustainability of the city by using smart irrigation, smart lighting, smart meter reading systems and water and energy resources efficiently; thus, it is tried to strengthen the communication between the municipality and the citizens by increasing the quality of service. With the Smart City Automation System project, a knowledge-based management approach and participatory municipalism were aimed as a result of on-site determination of information about the city and its inhabitants on the basis of addresses and real estate. It is possible to mention data analysis center, geographic information system (GIS), traffic control center, vehicle tracking system with GPS, waste management, wifi, central communication, navigation, security cameras and partially renewable energy projects as common points of our major metropolitan cities within the scope of smart city (Dener, 2018; Çetin, Çiftçi, 2019).

With the Istanbul Fatih Municipality web-based GIS project, for the first time in the world, floor sections and independent sections can be interrogated and analyzed in three dimensions with a sketch-based field study and compared with existing projects. Fatih Municipality has also included the Augmented Reality application into Smart City projects. With the "FatihAr" application, historical, cultural, public areas and parcel information in Fatih can be displayed verbally, picture, audio and video in four different languages. When the image of any building in Fatih Municipality is taken and sent to the relevant service center with 3G-4G communication technology, the information about that building can be transferred to the user immediately from the information center. In addition, approximately 20 different cleaning activities carried out in the field are monitored with the ÇEVKO mobile application, and data is entered into the system instantly.

Izmir Metropolitan Municipality, while trying to reduce carbon emissions with its projects of environmentally friendly ships, tram, subway, suburban and electric bus fleets, also provides the electricity required for the vehicles in the fully electric bus fleet with the 10 thousand m² solar power plant installed by ESHOT on the roof of the workshop buildings in Buca. In addition, in order to meet the electricity needs of Ekrem Akurgal Life Park, the roofs of the gym and parking areas in the park have been converted into energy facilities. With solar panels,

45 thousand kilowatt hours of electrical energy was provided in three months, preventing 19 tons of carbon dioxide emissions.

2.1.2. Smart City in Poland

In Poland, the idea of the smart city is gaining popularity. The National Urban Policies 2023, the fundamental document outlining the functions of the Polish government administration in the area of urban development, first introduced the idea of the smart city. The standard PN-ISO 37120:2015 03 Sustainable social development - Indicators of urban services and quality of life, which is a part of a set of ISO standards presenting an integrated approach to sustainable development, was also published by the Polish Committee for Standardization. Thirdly, initiatives and conferences like the "Smart City Forum," the biggest conference in Poland entirely devoted to the subject of smart cities, which was attended by local government representatives, presidents of major corporations, and international experts, demonstrate interest in the idea of the smart city.

In 2020, only two Polish cities - Warsaw and Wrocław - were included in the IESE Cities in Motion Index ranking the most smart cities in the world. However, other largest Polish cities, as well as much smaller centers, have already entered the road to being a smart city. In the IESE Cities in Motion Index for 2020, Warsaw was ranked 69th and Wrocław 95th. Both cities also took two leading places in the "Polish Cities of the Future 2050" ranking prepared by Saint Gobain. In both rankings, both Warsaw and Wrocław were recognized for their transport investments. In Wrocław, most projects related to the smart city project concern getting around the city. One of the key projects was the launch of the Intelligent Transport System (ITS) in 2014, under which 1,285 cameras were installed at 159 Wrocław intersections. Additionally, nearly 650 trams and buses were equipped with on-board computers and detectors cooperating with the software.

The ITS system is also coordinated with the Dynamic Passenger Information system. For the majority of people traveling in the largest Polish cities, but also in smaller towns, electronic boards informing about directions and real times of departure of buses and trams are almost the norm. Moving around the city by public transport, both in Wrocław, in Gdańsk, they also have the opportunity to see where the bus or tram they are waiting for is located. All they need to do is install the appropriate applications on the phone.

Since 2018, in Wrocław, in addition to traditional paper tickets available in stationary machines at stops, there are also virtual ones available in machines installed in trams and buses. The Urbancard system automatically assigns the purchased ticket to the number of the payment card with which the passenger makes the purchase. For the 8.5-year contract under which the system will operate, the city paid almost PLN 174 million.

Systems that allow residents to report problems also help to increase safety on city streets. As long as, like Big Brother, they are supported by a camera system.

According to the authorities of Katowice, the local Intelligent Monitoring and Analysis System consisting of 300 cameras scattered over more than 160 square kilometers of the capital of the Silesian province. The number of car thefts decreased over four years - from 337 in 2016 to 79 in 2020. On the other hand, police data show that from 2017 to 2020 the number of crimes is decreasing, and their detection rate constantly exceeds 65%.

2.2. What is waste management?

Reuse, recycling, and other waste management practices reduce trash production while also reducing the impact of waste generation brought on by industrialization and population growth. One of the most important tasks in waste management is monitoring, since it is necessary to deal with the problems that arise during the processes of trash generation, waste collection, waste transportation, waste treatment, and waste disposal (Saleh, 2020). To manage the trash effectively and attain zero waste, it is crucial to characterize garbage. Recent studies on intelligent waste management have come down to achieving zero waste, which is motivated by resource and raw material conservation and lowering municipal waste problems in smart cities (Fayomi, 2021). By reusing, recycling, composting garbage, and minimizing waste, we can address these problems, which include the production of toxic gases and air pollution through incineration, as well as land pollution and contamination that can cause disease outbreaks through landfilling (Figure 2). In other words, collection, storage, transportation, and disposal of garbage are all included in waste management. It depends on a collection of integrated resources and procedures used in the proper management and disposal of these wastes. This entails correctly classifying wastes, maintaining disposal trucks, maintaining dumping sites, and establishing a system that complies with environmental requirements. The complete management system should be planned to guarantee effective waste disposal while avoiding health risks and safeguarding the environment. Because different regions are obligated to abide by the rules and environmental restrictions put out by their governments, waste disposal practices may vary from one location to another (Adeniran et al., 2017).

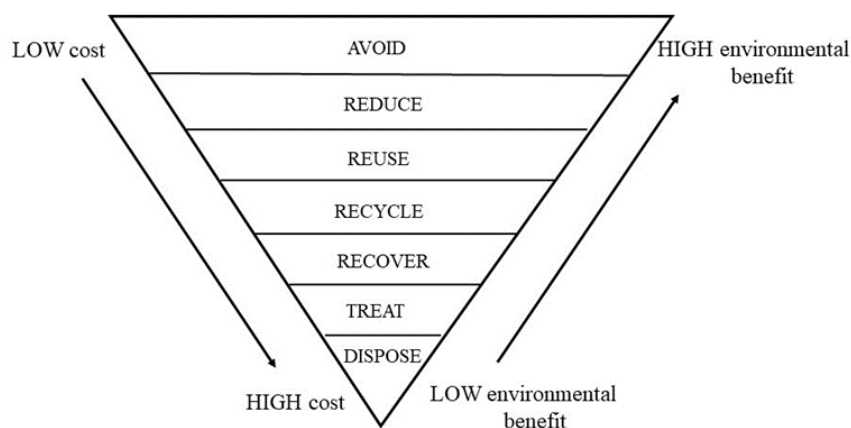


Figure 2. The strategies in waste management.

Source: Modified from Fatimah et al. (2019).

Effective waste management is a crucial prerequisite for ecologically sustainable development in many nations. In today's world, efficient garbage sorting is a significant problem. The consumption society in Europe has contributed to an ever-increasing amount of trash creation. This is a result of consumer behavior that is made worse by packing. It is demonstrated that western Europe produces close to 1.2 kilograms of garbage each day per person (Glouche et al., 2015).

Contrarily, the same consumers who care about environmental protection frequently express opposition to increasing land-filing or incinerators. As a result, garbage should be appropriately disposed of and managed to minimize its influence on the environment. The market for waste management services is expanding, and for the service providers, however the garbage collection procedure is a crucial component. The following are the key objectives: 1) reducing waste generation, 2) ensuring that waste is disposed of properly, 3) recycling and reusing discarded goods (Bolivar, 2015; Fayomi et al., 2021).

Regulations and taxes are being put in place to reward moral behavior in order to accomplish these goals. There is a growing tendency toward individual billing, where people are paid according to how much rubbish they dispose of, specifically to reduce waste creation.

2.3. The significant of waste management

One of the most important public causes is waste management. The main fraction of waste management is solid waste management (Figure 3). According to the UNEP, annual urban waste generation in OECD countries ranges between 7 and 10 billion tons. While waste is conceptually collected, segregated, recovered, and disposed of by a landfill or incineration process, the majority of waste typically accumulates at the landfill stage (UNEP, 2015; Mokale, 2019). Scheme of waste management in smart cities is presented in the Figure 4.

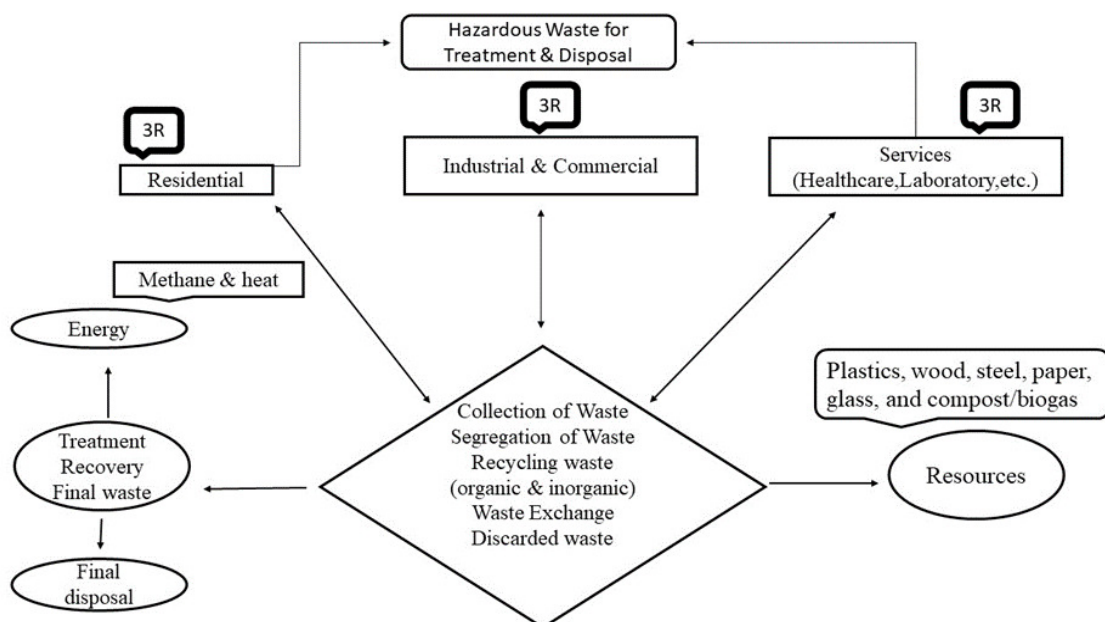


Figure 3. Solid waste management diagram.

Source: UNEP (2015).

Developing countries are particularly vulnerable due to a lack of collection coverage and controlled disposal. While municipal budgets for solid waste management range from 20 to 50%, the World Bank estimates that 30 % to 60 % of urban solid waste in developing countries goes uncollected (Gade et al., 2021). Uncontrolled landfill is especially common at the municipal level, and untreated waste on open sites frequently causes public health concerns as well as environmental pollution. As a result, preventing this accumulation through proper waste management will improve global competence in addressing the world's current environmental challenges (Esmailian et al., 2018; Cesconetto et al., 2020).

The ASEM Eco-Innovation Index (ASEI), developed by the ASEM SME Eco-innovation Center, is also linked to the concept of adequate waste management (ASEIC). The ASEI fundamentally assesses Asia and Europe's sustainability, and it is a comprehensive index comprised of four main categories: capacity, supporting environment, activity, and performance. Among those categories, supporting the environment and performance are particularly relevant to the issue of waste management (Surapaneni et al., 2018).

Despite global efforts to manage waste, it is especially difficult to dispose of nonbiodegradable waste because its innate character is not decomposable over time.



Figure 4. Scheme of waste management in smart cities.

Source: Modified according to Mahajan and Quazi (2017).

3. Plastic waste management

3.1. Plastic and microplastic waste

In 1972, the world became aware of the presence of micro-sized plastic particles in the aquatic environment for the first time, when it was reported for the first time that a large number of small floating plastic particles were found in the surface water of the Sargasso Sea. In 2004, these small particles were defined as microplastics. Later, plastics smaller than 5 mm were

accepted as microplastics by the Steering Committee of the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program. In the future, plastics of different sizes were standardized. Accordingly, Macroplastic ≥ 25 mm, Mesoplastic 25-5 mm, Microplastic ≤ 5 -1 mm, Mini-microplastic < 1 mm- $1\mu\text{m}$ and Nanoplastic $< 1\mu\text{m}$ (Faraca, Astrup, 2019). Although the main source of microplastics in the aquatic environment is microplastics formed as a result of the breakdown of larger plastic parts, microplastics are also produced industrially for different purposes ([https://mikroplastik.org/...](https://mikroplastik.org/))

Plastic waste mainly includes macroplastics with a diameter ≥ 5 mm such as bags, balloons, bottles, or straws, most of them cause serious harm to habitats and wildlife. Now, there is growing research focused on the widespread presence and impacts of microplastics particles with a diameter < 5 mm (Koelmans et al., 2017; Piehl et al., 2018). Microplastics consist of plastic fragments, flakes, fibers, or pre-production pellets.

Plastic is everywhere and is unquestionably the foundation of globalization. There is an increasing need in packaging, agriculture, autos, and biomedical fields due to the fabrication of desired shapes and specifications appropriate for future clients. Due to the development of information technology and smart packaging systems, they are crucial to the modern world. Globally, critical waste management issues have arisen as a result of rapid urbanization, population growth, and industrial expansion. Environmental issues frequently come into conflict with concomitant economic progress and modernization. According to the US Environmental Protection Agency, since the 1960s, the usage of plastic has increased significantly, and as a result, the percentage of plastic trash in the overall municipal solid waste stream has climbed from 1% to roughly 13% (Ritchie, Roser, 2020). The using of plastics in various industrial activities is presented in Figure 5.

According to research by the United Nations Environment Programme, some 400 million tonnes of single-use plastic (SUP) waste is produced annually (47% of all plastic waste), and roughly half of this amount is used for disposal, or purchases that are thrown away within a year.

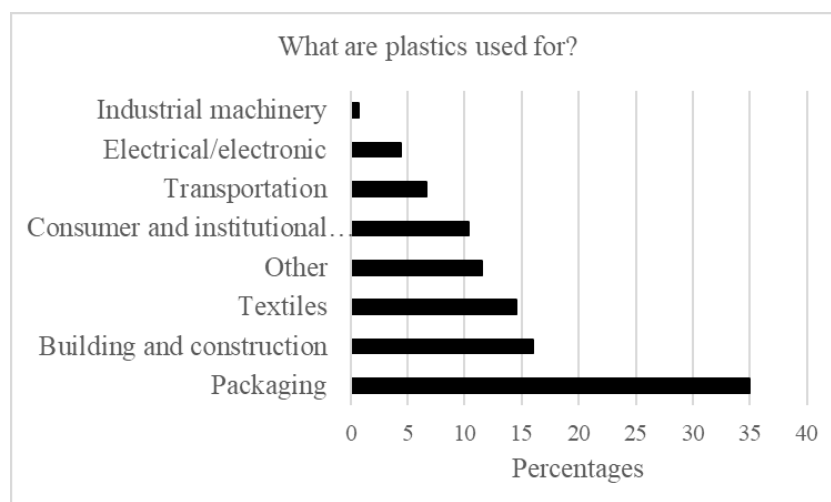


Figure 5. Using of plastics in various human activities (in %).

Source: Modified from Singh and Trivedi (2020).

Bakelite, the first synthetic material, was created in 1907, marking the beginning of the world plastics industry. However, it took until the 1950s for the exponential development in worldwide plastic manufacturing to be understood. Plastics production has more than doubled in the last 200 years. This is roughly equivalent to the mass of the entire world's population (Lombardi et al., 2012).

While concerns regarding the viability of reuse, recycling, and disposal are on the rise, so are the usage and consumption of plastic. Plastics are becoming less recyclable due to changes including the increase in chemicals used to change their strength, texture, flexibility, color, resistance to microorganisms, and other properties. Additionally, some plastics have a very limited market value, which forces communities to landfill or burn plastic as waste. The Environmental Protection Agency estimates that just 8% of plastic supplies are recycled (EPA, 2020).

The lifespan of plastics and the lack of clarity surrounding their biodegradation raise serious concerns about their disposal in the waste stream.

It is estimated that the majority of plastics will take between 500 and 1000 years to totally break down into organic components. Due to its durability and low recycling rate, the majority of our plastic trash is disposed of in landfills or as litter. It is undeniable that plastic garbage has an impact on living things across the ecosystem, either directly or indirectly. This impact on aquatic life, both at the macro and micro scales, is disturbingly large. In fact, the United Nations estimates that plastic makes up over 80% of marine waste (Dąbrowska et al., 2021).

3.2. Popular ways to deal with plastic waste

Landfills and Incineration

One of the following approaches is typically used to control waste: Incineration simply involves transporting substantial amounts of waste to facilities for waste management, where it is burned to produce carbon. In addition to being buried underground in landfills, a significant amount of the rubbish we produce also frequently ends up being dumped in open areas, leaving streets and rural areas littered (quite unfortunately). Despite the fact that these techniques are frequently used, they nonetheless have drawbacks. The majority of the waste we produce is disposed of by incineration or landfilling. Building landfills can be challenging, and burning waste produces a lots of greenhouse gases that are released into the environment. These problems cause both techniques to have a detrimental environmental impact (Mahajan, Quazi, 2017).

What are the differences between these approaches, which is more efficient, and what are the repercussions? As garbage decomposes in a landfill, methane is produced. It is possible to recover this gas and use it to produce electricity. In this regard, landfilling is a successful technique of disposing of certain municipal solid waste (MSW), although plastic trash remains an ongoing issue. Plastic garbage decompose very hard or change composition as it sits in landfills. It is just unsustainable for plastic garbage to accumulate in landfills.

When plastic is burned, a significant amount of fossil carbon is released as CO₂ into the air. It is possible to reduce the amount of greenhouse gases discharged into the atmosphere by using plastic separation techniques prior to incineration, but this is easier said than done. The management of waste involves several aspects. However, increasing the effectiveness of plastic separation may be less harmful to the environment. Even though incinerating wastes a lot of energy, some of it can be recovered. Although removing plastic trash from the equation lowers greenhouse gas emissions, there is a significant decrease in the amount of energy that can be obtained from incineration without plastics. The goal of waste management is to recover as much useful material as possible, including energy. Thus, a variety of elements are involved.

Techniques for recycling plastic waste

Plastic waste material that would otherwise become solid garbage is collected, segregated, processed, and then put back to use through a process known as recycling or reprocessing. Collecting, sorting, cleaning, and ultimately reclamation are steps that must be taken in order to develop an effective and affordable method for recycling waste plastics that have completed their intended function, removing them from the waste stream, and getting them back into the manufacturing process. Recycling via mechanical (or physical) processes is the economically preferable form of recovery for homogeneous plastic waste streams. However, chemical and thermal procedures are more effective at handling or treating heterogeneous plastic waste streams in order to recover essential chemicals and/or energy.

Some recycling methods can be listed as follows: mechanical recycling, monomerization, blast furnace feedstock recycling, coke oven, chemical feedstock recycling, gasification, liquefaction and thermal recycling (Mahajan, Quazi, 2017; Köseoğlu, Demirci, 2018).

3.3. Importance of plastic waste management

There is only one environment, and it ought to be respected as such. It makes sense to reuse raw materials that have already been mined whenever possible. As a result, reserves will be more durable in the future. Recycling plastic garbage also helps protect natural resources, notably raw materials like energy and oil. Natural resources will last longer for future generations if more is recycled. It indicates that activities like mining, quarrying, drilling for oil and gas, clearing forests, and the like have less of an impact on the environment. Less of these operations will protect the ecosystem from ongoing deterioration and damage.

Recycling may also reduce atmospheric emissions of pollutants like carbon dioxide (CO₂), which is a benefit to the environment. From "life-cycle" analyses of raw and reprocessed plastics, it is known that recycled plastics emit significantly fewer CO₂, SO₂, and NO_x (NO and NO₂) emissions than virgin materials. Therefore, if recycling is practiced on a wide scale, the environment will be better protected from air pollution and global warming. Groundwater and surface waters will both be protected from pollution by recycling plastic trash. This is due to the fact that, if disposed of carelessly, they clog gutters and may even find their way into

bodies of water that supply towns and cities with drinking water. Additionally, they contribute to the development of leachate, which can contaminate groundwater resources when it seeps into the ground.

3.4. Plastic waste management in Europe

Unfortunately, energy recovery accounts for 41.6% of all disposal methods for plastic trash in the EU. Only slightly more waste is recycled (31.1%) than is dumped in landfills (27.3%). Poland's (27%) rate of plastic trash recycling is lower than the EU average. 44% of Polish plastic trash is landfilled. One of the major issues is that a lot of the plastic is made to only be used once before being thrown away. Therefore, around 60% of the plastic trash is made up of single-use plastic packaging (EPRO, 2018). Ireland, Estonia, and Luxembourg are the EU nations that produce the highest plastic packaging waste per person (58 kg, 50 kg, and 58 kg, respectively). The nations with the lowest rates, on the other hand, are Croatia, Bulgaria, and Greece.

Poland generates less trash from plastic packaging than the EU as a whole (Figure 6). There are notable variations among member states, although the EU's recycling rate for packaged plastic waste is slightly greater than that for other plastic trash (42%). The three newest members, Lithuania (74%), Bulgaria (65%), and Cyprus (62%), have the highest recycling rates for this kind of garbage. The nations with the lowest rates, in comparison, are Malta (24%), Finland (27%), and France (27%). Poland recycles plastic packaging waste at a rate of 35% versus 42% for the EU as a whole (Ritchie and Roser, 2020). As a result, Poland is far from meeting the EU's goals, and there is a chance that they won't be accomplished by the end of 2030.

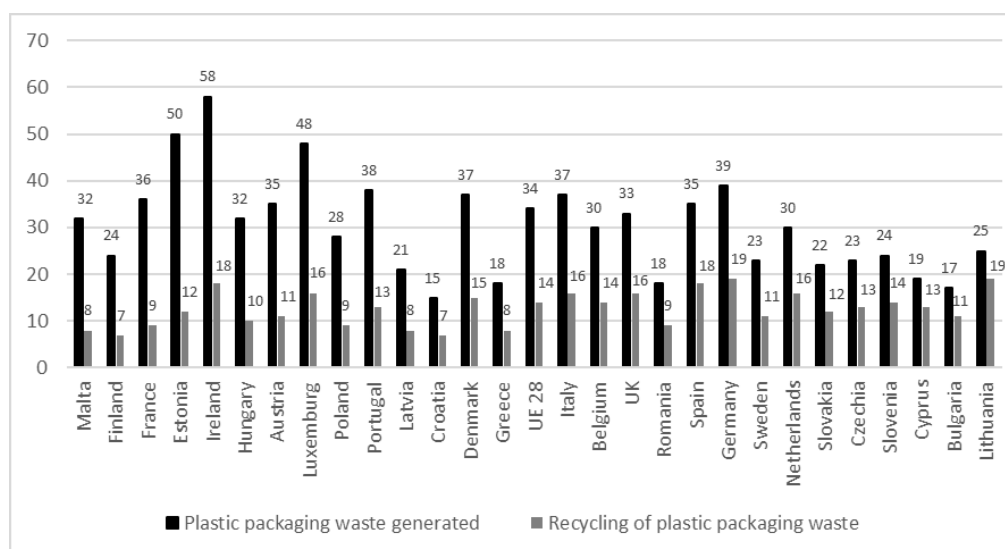


Figure 6. The rate of plastic packaging waste generated and recycled in EU countries (in %).

Source: own calculations based on EPRO (2018).

3.5. Plastic waste management in Poland

Poland produces a comparable quantity of rubbish each year (110-130 million tonnes). There were 128 million tonnes in 2018, and 10% of that was municipal garbage. Poland produces 325 kg less municipal garbage per person than the EU average (486 kg) and other countries (including Denmark, which produces 781 kg, Germany, which produces 633 kg, and Luxemburg, which produces 607 kg). The poor rate of recycling, however, is the issue. Only 57% of the municipal waste that was collected in 2018 was intended for recovery, of which 26% was recycled mechanically and chemically and 23% was recycled for energy (EPRO, 2018).

Poland produces less plastic garbage than the other EU-15 countries, but its recycling rate is below the EU average. Plastic waste recycling relies heavily on easily-collectible garbage from industrial networks and transportation. When the selective collection and recycling of home waste is intensified, the recycling rate will be able to rise even more. To do this, nevertheless, calls for significant social campaigns to raise the general public's ecological consciousness in addition to governmental and organizational improvements. The Polish recycling and plastics manufacturing sectors will need to invest more in technology and work more closely with R&D facilities.

The most recent data indicates that 259 projects were launched in Poland's garbage sector last year. At the end of 2019, 286 licensed landfills and 1,868 wild dumps were still being counted nationwide.

Waste-to-energy conversion is becoming more and more significant. There are currently nine waste-to-energy facilities running in Bydgoszcz, Białystok, Konin, Kraków, Poznań, Rzeszów, Szczecin, and other cities. In Gdansk (Gdansk), work has started on a new waste-to-energy facility with a 160,000-ton annual capacity. The towns of Olsztyn and Wrocław are also planning waste-to-energy plants that will produce heat and electricity, and the town of Rzeszów is even thinking about building a second facility. The decision about Veolia's request to construct a waste-to-energy facility at Łódź has not yet been made. The Warsaw trash incineration plant will be expanded by the South Korean company Posco Engineering & Construction, bringing its annual capacity from 40,000 tons to 305,000 tons ([https://waste-management-world.com/...](https://waste-management-world.com/)).

Paper, cardboard, glass, metals, plastics, organic garbage, and mixed rubbish are all being collected separately. Based on the amounts produced, 50% of municipal waste in Poland must be recycled starting in 2020. But energy recovery is also considered to be a part of recycling. Municipalities are in charge of execution, or the development of the related rules.

In Poland, over 127 million tons of trash were produced in 2019. There was 332 kilos of volume per person. The mining and extraction industry produces the most garbage, accounting for 55.8% of total waste production, followed by industry (23.8%) and the energy industry (12.3%). 5% of the waste was disposed of elsewhere, albeit it can be presumed that this was

hazardous waste. According to CIS statistics, while 49% was recycled, 43% was landfilled ([https://waste-management-world.com/...](https://waste-management-world.com/)).

Municipal garbage was collected separately 31% of the time in 2019. One third of the four million tons of waste that were collected separately was made up of PPK, glass, and plastic. Biowaste made up 30% of the waste, while packaging, electronic garbage, and worn textiles made up 21%. As of 2018, 58.5% packaging was recycled. Steel packaging, including sheet metal, has a 90% recycled content. It was 83% for PPK packaging, 52% for aluminum packaging, 62% for glass packaging, and slightly more than 30% for wood and textile packaging. In 2018, roughly 30% of plastic packaging was landfilled and 30% was recycled for electricity.

Because of its potential for economic growth and in light of environmental limits, a circular economy has emerged as a strategic objective at the EU level. Stakeholders will be required to behave in a certain way as a result of legal requirements, which will replace their prior reliance on their own goodwill with a legal obligation. Real changes can then be anticipated when this is combined with rising consumer awareness. The biggest influence on the process of change in the Polish recycling industry will come from EU rules.

3.6. Plastic waste management in Turkey

Following China's 1st January 2018, ban on plastic imports, Turkey grew to be a significant global importer of plastic garbage. Before the ban, Turkey only imported 261,864 tonnes of plastic garbage annually; by 2020, that number had risen to 772,831 tonnes. Turkey has imposed import limitations on plastic trash (quotas, a 1% contamination limit, and a ban on mixed plastic waste imports), yet widespread reports of unlawful dumping and burning persist. Turkey is the second-largest producer of plastics in Europe and seventh globally, but the country's current recycling and waste management systems are unable to keep up with the growth of domestic plastic garbage. Approximately 90% of Turkey's municipal solid waste is disposed of in landfills. Mismanagement of plastic trash causes plastic to leak into the Mediterranean Sea, with Turkey accounting for the largest share (16.8%) of the plastic pollution in the seas of Europe. Turkey now has the chance to expand and improve its own domestic waste management infrastructure in order to reduce indiscriminate plastic marine contamination thanks to this most recent import limitation ([http://antalya.bel.tr/...](http://antalya.bel.tr/)).

The Ministry of Environment and Urbanization is responsible for waste management on a national scale in Turkey. The role of the Ministry is to make legal arrangements and to supervise all institutions and organizations related to waste management. It is the responsibility of the local governments to collect the waste separately at the source, to ensure that it is separated if it cannot be collected separately, and to transport and dispose of it. Obligations regarding the separate collection of waste and the temporary storage of these wastes are determined by the Communiqué on the Waste Import Center and the Zero Waste Regulation.

Recycling or recycling of waste should be carried out in recycling facilities to be established by local governments and in accordance with the Packaging Waste Control Regulation. Various organizations have been authorized to collect packaging waste from the market within the scope of EMR (Extended Manufacturer Responsibility). In addition, various NGOs are working on raising awareness about waste management, taking initiatives on pollution and improving the waste management system in Turkey.

According to the Turkish Statistical Institute, 98.8% of waste was collected in Turkey in 2018, with the vast majority being disposed of in landfills. Wastes sent to landfills are mixed municipal wastes and plastics are taken to these areas mixed with other wastes. While 67.2% of the collected waste is disposed of in licensed sanitary landfills that meet the technical conditions, 20.2% is disposed of in wild landfills that do not meet the technical conditions and cause harm to the environment. The number of landfills, which was 134 in 2016, increased to 159 in 2018. In 2016, the number of irregular landfills was approximately 800.

4. Methods of against plastic waste: examples

4.1. Reduce disposable plastics

Single-use plastic items are used once or for a short time before being discarded. For example, the average lifetime of plastic bags is 15 minutes. In contrast, the environmental impacts are global and the consequences can be severe. The short life span of single-use plastic products increases the possibility of reaching the seas. The 10 most common (70%) of all marine litter in the EU are single-use plastic items. The EU aims to be a pioneer in the global fight against marine litter and plastic pollution. EU rules aim to reduce the amount and impact of certain plastic products on the environment (Özgür, 2021).

The following actions are recommended for measures to reduce the consumption of single-use plastics (Özgür, 2021):

1. Ensuring that all stakeholders are included in the works to be done for the reduction and correct management of other plastic packaging wastes within the scope of waste management process, with the steps that follow the positive results obtained after the pricing of disposable plastic bags.
2. Taking into account that the correct implementation of bans and finding suitable alternatives will often be costly and present difficulties. In addition, considering the fact that the success of the ban depends on the careful evaluation of the possible effects of the ban on different groups, the measures considered in this context should be given priority in the directives.

3. Establishing incentives to shift the demand for single-use plastic products to alternative products that can be used more than once; imposing a higher tax on single-use plastic products to encourage consumers to choose reusable products.
4. Making joint decisions, in consultation with the waste management sector, for the evaluation/determination of promoted alternatives; establish a national waste management plan that bans/reduces certain single-use plastic products.

Only 29.7% of the plastic waste produced in the EU (25.8 million tonnes) is recycled, this is mainly due to the packaging waste (i.e. main plastic waste fraction). The holistic process for increasing the recycling rates of packaging waste is envisaged. The process involves four key steps: the 1st step – develop of innovative collection systems - smart containers which identify the quantity (using ultrasonic level sensors) and the quality (using a labeling system and RFID card) of packaging deposited into the containers, ensures better separation of plastic waste and reduces the amount of mixed waste generated; the 2nd step focuses on transport - by using a special CAN-Buss device, optimized routes, skipping empty containers route, and eco-driving, all the steps are integrated into a mobile application; by using the modern transport of waste, the transport fees will be reduced and fuel costs will be minimized. The 3rd step refers to sorting – using innovative technologies such as spectrometers the quality of the recovered plastic will increase using better separation solutions for different plastics in treatment plants, including multilayer and multi-material packaging. The 4th and final step involves reprocessing the materials into products such as automotive parts, foam boards for wind turbines, roofing structures, rubbish bags, asphalt, fences, and benches—a closed-loop model will be developed.

4.2. Implementation of refilling systems

In addition to the active daily life in our cities, tourism activities, especially in summer, lead to a great increase in the consumption of disposable plastic bottles. In order to prevent environmental pollution from these plastic bottles, it is necessary to provide public drinking water, develop refill networks and expand structures that will allow access to these water sources worldwide. With the expansion of public drinking water sources such as fountains, the need for plastic water bottles for domestic consumption will decrease (Lamba et al., 2021; Özgür, 2021).

1. Developing replenishment networks and expanding nationwide programs/structures centered on access to public drinking water, such as fountains; Establishing, operating and improving water filling stations.
2. Inclusion of actions aimed at reducing plastic waste and garbage in local action plans of municipalities.
3. Sustainable design of the treatment and transmission systems that will ensure the drinking quality of tap water throughout the country and updating the existing systems within this framework.

4. Launching awareness-raising campaigns about the quality of tap water and ensuring the effective use of filling stations. Directing citizens to these points with remarkable internet applications and markings.

4.3. Implementation of policies aiming to reduce microplastics

It is known that the most common microplastics in the natural environment come from treatment plants and are formed through the erosion of unmanageable plastics. Since treatment and waste management systems do not completely prevent the mixing of these microplastics with nature, it is necessary to try to prevent pollution by creating inventories of the products that are the source of these microplastics. Policy measures should also include directives that prohibit or limit products containing microplastic particles. With the prohibitions that may be imposed on the production, sale and import of products containing microparticles, the mixing of microplastics with nature can be reduced to a certain extent (Özgür, 2021).

1. Inventory of products and services that cause microplastic pollution; bringing together all relevant stakeholders and working together to search for alternatives to microparticles.
2. Prohibition of production, sale and import of products containing microplastic particles.
3. Improving the regulations regarding the storage conditions of plastic production raw material particles and their mixing with nature.

5. Conclusions

To ensure environmental safety, an in-depth understanding of each factor is taken into account when making decisions about how to best manage waste. Waste generated in smart cities is a category of municipal waste. Traditional approaches to waste management have failed because they are not reliable or sustainable because they require a lot of input for little or no work output. Because of the increase in population, urbanization, and industrialization, waste generation has increased at an alarming rate, and traditional approaches are unable to collect and analyze data from waste dumps. The incorporation of smart city technology into waste management practices provides a smart way to solve waste issues. The main of plastic waste management is to develop methods to transform plastic waste into a circular economy and bioeconomy. As estimated by 2030 plastic leakage to ecosystems should be 30% reduced, double the global recovery of plastic (collection and recycling), and shift to sustainable inputs for remaining plastic, including recycled content, sustainably sourced bio content, advanced products and reducing unnecessary plastic through a business model, innovation, reduction and substitution. In this study, smart cities are explained, how to manage plastic waste by using smart city components, and methods of dealing with plastic waste are explained.

Acknowledgements

This paper was prepared as part of the scholarship from the Erasmus+ KA 131 internship program for students Medine Gül ÜNLÜ and Vildanur DİNÇ, during the academic years 2021-2022. Financial support of the manuscript was from BK-288/ROZ3/2022 (13/030/BK_22/0070) entitled: „Zastosowanie nowoczesnych metod i narzędzi do prowadzenia badań w zakresach związanych z Priorytetowymi Obszarami Badawczymi Politechniki Śląskiej”.

References

1. Achmad, K.A., Nugroho, L.E., Djunaedi, A. (2018). *Smart city model: A Literature review*. 10th International Conference on Information Technology and Electrical Engineering, pp. 488-493.
2. Adeniran, A.E., Nubi, A.T., Adelopo, A.O. (2017). Solid waste generation and characterization in the University of Lagos for a sustainable waste management. *Waste Management, No. 67*, pp. 3-10.
3. Adıgüzel, M. (2017). *An evaluation model for Turkish cities in the context of smart city* (Unpublished master's thesis). Ankara: Middle East Technical University, Department of City Planning.
4. Albino, V., Berardi, U., Dangelico, R.M. (2015). Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology, No. 22*, pp. 3-21.
5. *Antalya'da Akıllı Kent Uygulamaları Yaygınlaşıyor (Smart City Application are becoming widespread in Antalya)*. Retrieved from <http://antalya.bel.tr/haberler/antalyada-akilli-kentuygulamalari-yayginlasiyor>, 20.06.2021.
6. Balaban, O. (2019). Smart cities as drivers of a green economy. In: S. Acar, E. Yeldan (Ed.), *Handbook of Green Economics* (pp. 69-92). Elsevier.
7. Baran, M., Kłos, M., Chodorek, M., Marchlewska-Patyk, K. (2022). The resilient smart city model – proposal for Polish cities. *Energies, No. 15*, pp. 1818.
8. Barlow, M., Levy-Bencheton, C. (2018). *Smart cities, smart future*. John Wiley & Sons Inc.
9. Bıyık, C. (2019). Smart Cities in Turkey: approaches, advances and applications with greater consideration for future urban transport development. *Energies, No. 12*, pp. 2308.
10. Bolivar, M.P. (2015). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences, No. 82*, pp. 392-408.

11. Cesconetto, J., Augusto Silva, L., Bortoluzzi, F., Navarro-Cáceres, M., Zeferino, C.A., Leithardt, V.R.Q. (2020). PRIPRO—Privacy profiles: user profiling management for smart environments. *Electronics*, No. 9, p. 1519.
12. Çetin, M., Çiftçi, Ç. (2019). Investigation of the smart city concept with examples from the world and our country. Literature Review. *National Journal of Environmental Sciences Research*, No. 2, pp. 134-143.
13. Dąbrowska, J., Sobota, M., Swiąder, M., Borowski, P., Moryl, A., Stodolak, R., Kucharczak, E., Zięba, Z., Kazak, J.K. (2021). Marine waste - sources, fate, risks, challenges and research needs. *MDPI, IJERPH*, Vol. 18, Iss. 2, p. 433, doi: 10.3390/ijerph18020433.
14. Dener, M. (2018). Smart cities companies in Turkey. *The Eurasia Proceedings of Educational & Social Sciences (EPESS)*, No. 9, pp. 344-348.
15. EPA (2020). *Best practices for solid waste management: A guide for decision makers in developing countries*.
16. EPRO (the European Association of Plastics Recycling and Recovery Organisations). *Plastics – the Facts 2018 An analysis of European plastics production, demand and waste data*, <https://plasticseurope.org/wp-content/uploads/2021/10/2018-Plastics-the-facts.pdf>, 18.06.2022.
17. Esmaeilian, B., Wang, B., Lewis, K., Duarte, F., Ratti, C., Behdad, S. (2018). The future of waste management in smart and sustainable cities: A review and concept paper. *Waste Management*, No. 81, pp. 177-195.
18. Faraca, G., Astrup, T. (2019). Plastic wastes from recycling centers: Characterization and evaluation of plastic recyclability. *Waste Management*, No. 95, pp. 388-398.
19. Fatimah, Y.A., Murniningsih, R., Setiawan, A., Aman, M. (2019). *A smart sustainable approach for waste management in post natural disaster phase*. IOP Conf. Series: Materials Science and Engineering, 674, 012042.
20. Fayomi, G.U., Mini, S.E., Fayomi, O.S.I., Mbonu, C.C., Udoeye, N.E. (2021). *Sustainable smart city and its promising urban value: An overview*. IOP Conf. Series: Earth and Environmental Science, 655, 012040.
21. Fayomi, G.U., Mini, S.E., Chisom, C.M., Fayomi, O.S.I., Udoeye, N.E., Agboola, O., Omole, D.O. (2021). *Smart waste management for smart city: Impact on industrialization*. IOP Conf. Series: Earth and Environmental Science, 655, 012040.
22. Gade, P., Dipak, S., Aithal, P.S. (2021). Smart city waste management through ICT and IoT driven solution. *International Journal of Applied Engineering and Management Letters*, No. 5, pp. 51-65.
23. Glouche, Y., Sinha, A., Couderc, P. (2015). A smart waste management with self-describing complex objects. *International Journal On Advances in Intelligent Systems*, No. 8, pp. 1-16.

24. Khatoun, R., Zeadally, S. (2016). Smart cities: concepts, architectures, research opportunities. *Communications of the ACM, No. 59*, pp. 46-57.
25. Koelmans, A.A., Besseling, E., Foekema, E., Kooi, M., Mintenig, S., Ossendorp, B.C., Redondo-Hasselerharm, P.E., Verschoor, A., van Wezel, A.P., Scheffer, M. (2017). Risks of plastic debris: Unravelling fact, opinion, perception and belief. *Environmental Science & Technology, No. 51*, pp. 11513-11519.
26. Köseoğlu, Ö., Demirci, Y. (2018). Smart cities and employing innovative technologies for tackling urban policy issues. *International Journal of Political Studies, No. 4*, pp. 40-57.
27. Lamba, P., Kaur, D.P., Raj, S., Sorout, J. (2021). Recycling/reuse of plastic waste as construction material for sustainable development: a review. *Environmental Science and Pollution Research, No. 2*, pp. 78-92.
28. Liu, Q., Ullah, H., Wan, W., Peng, Z., Hou, L., Rizvi, S.S., Ali Haidery, S., Qu, T., Muzahid, A.A.M. (2020). Categorization of green spaces for a sustainable environment and smart city architecture by utilizing big data. *Electronics, No. 9*, p. 1028.
29. Lombardi, P.L., Giordano, S., Farouh, H., Yousef, W. (2012). Modelling the smart city performance. *innovation: The European Journal of Social Science Research, No. 25*, pp. 137-149.
30. Mahajan, R., Quazi, T.Z. (2017). Review paper on plastic waste management for smart city. *International Journal of Scientific & Engineering Research, No. 8*, pp. 194-198.
31. *Mikroplastik*. Retrieved from <https://mikroplastik.org/mikroplastik-nedir/>, Mikroplastik Nedir?, 15.05.2022.
32. Mokale, P. (2019). Smart waste management under smart city mission – Its implementation and ground realities. *International Journal of Innovative Technology and Exploring Engineering, No. 8*, pp. 3095-3102.
33. Örselli, E., Akbay, C. (2019). Technology and transformation in urban life: smart cities. *Journal of International Management Academy, No. 2*, pp. 228-241.
34. Özgür, G. (2021). Türkiye'de Plastik Atık Sorunu ve Politika Önerileri. WWF. Retrieved from <https://www.wwf.org.tr/11580/Turkiyede-Plastik-Atik-Sorunu-ve-Politika-Onerileri>, 7.12.2021.
35. *Plastic wastes and its management*. Published on line at bioenergyconsult.com. Retrieved from <https://www.bioenergyconsult.com/plastic-wastes-management>, 9.05.2022.
36. Ritchie, H., Roser, M. *Plastic Pollution*. Published online at Our World In Data.org. Retrieved from <https://ourworldindata.org/plastic-pollution>, 6.08.2020.
37. Singh, P., Trivedi, L. (2020) Plastic waste management. *GIS Science Journal, No. 7*, pp. 25-31.
38. Singh, D., Jara, A.J. (2022). Transforming future cities: Smart city. *Electronics, No. 11*, pp. 1534.
39. Soydan, O., Benliay, A. (2020). Evaluation of the smart city applications in terms of users: the case of Turkey. *European Journal of Science and Technology, No. 20*, pp. 381-391.

40. Surapaneni, P., Symala, M., Maguluri, L.P. (2018). Solid waste management in smart cities using IoT. *International Journal of Pure and Applied Mathematics*, No. 118, pp. 635-640.
41. UNEP. Retrieved from <https://www.unep.org/news-and-stories/press-release/mounting-problem-worlds-cities-produce-10-billion-tonnes-waste-each>, 12.02.2015
42. *Waste Management Recycling*, by *WEKA Industrie Medien*. Retrieved from <https://waste-management-world.com/artikel/recycling-poland-is-slowly-catching-up/>, 10.04.2021, 9.11.2021.

TIG WELDING OF 1.4462 DUPLEX STEEL IN ANTENNA AND CAR STRUCTURES

Tomasz WĘGRZYN^{1*}, Bożena SZCZUCKA-LASOTA², Krzysztof LUKASZKOWICZ³,
Adam DÖRING⁴

¹ Politechnika Śląska; Tomasz.Wegrzyn@polsl.pl, ORCID: 0000-0003-2296-1032

² Politechnika Śląska; Bożena.Szczucka-Lasota@polsl.pl, ORCID: 0000-0003-3312-1864

³ Politechnika Śląska; krzysztof.lukaszko@polsl.pl, ORCID: 0000-0003-1511-9066

⁴ Wyższa Szkoła Bankowa w Gdańsku; adoring@wsb.gda.pl, ORCID: 0000-0001-5114-9401

* Correspondence author

Purpose: The aim of the article was to obtain high-quality connectors for the automotive industry and antenna structures.

Design/methodology/approach: For the welding joint the duplex steel and parameters of TIG welding process were chosen. The mechanical properties of the joint were carefully checked.

Findings: Relations between process parameters and the quality of welds.

Research limitations/implications: In the future, it can be suggested to investigate the effect of micro addition of nitrogen in gaseous shielding mixtures of the welding process.

Practical implications: The development allows to obtain high-quality welded joints made of duplex steel. The solution can be implemented in the automotive industry or for the production of antenna structures.

Social implications: Modifying the welding method will not affect the environment and production management methods.

Originality/value: The article is addressed to manufacturers of stainless steel for automotive industry and to manufacturers of antenna instrumentation.

Keywords: welding, 1.4462, duplex, automotive, antenna.

Category of the paper: Research or technical papers.

1. Introduction

The paper presents the results of tests leading to the selection of the TIG welding parameters of a structure made of 1.4462 duplex steel (stainless material). Duplex steel is an important material in the construction of transport and antenna means. The stainless steels can be used for car bodies, truck frames, and antenna elements (Fig. 1).



Figure 1. Applications for superduplex stainless steel in seawater: Fasteners for rubber dock fenders (part b) (Francis, Burne, 2021).

Duplex steels could be used for antenna holders and towers due to their very high strength and anti-corrosive properties (Francis, Burne, 2021). The weldability of duplex steel depends on the selected process (Jaewson et al., 2011; Darabi, Ekula, 2016).

Mainly, these steels are connecting by low-oxygen welding processes (basic coated electrodes and TIG welding). Also it is possible to weld these steels with MAG, laser and with the tubular cored metal arc (136)-process (Hadryś, 2015). In order to get good results, it is necessary to carefully choose main welding parameters (Golański et al., 2018; Skowrońska et al., 2017; Szczucka-Lasota, Piwnik, 2017).

- welding current,
- arc voltage,
- welding speed,
- beveling method,
- type of filler materials,
- composition of shielding gas,

Duplex stainless steels usually contain more than 20% chromium and 9% of nickel (which can easily be found in a Schaeffler diagram, Fig. 2).

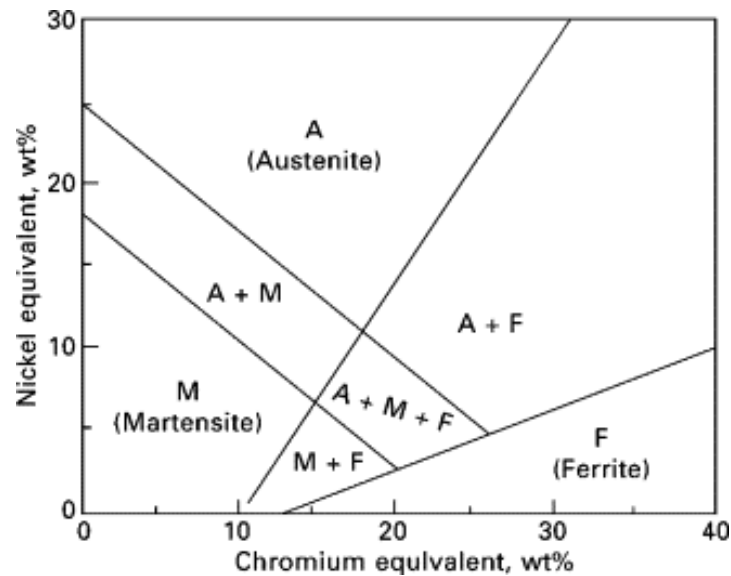


Figure 2. Schaeffler diagram (<https://www.sciencedirect.com/topics/engineering/Schaeffler-diagram>).

Due to the chemical composition, duplex steel can have 30% to 60% austenite in the delta ferrite. Super duplex stainless steels should contain approximately 50/50 austenite and ferrite in their structure. The small addition of nitrogen gives higher strength, better corrosion resistance, and improved weldability (Francis, Burne, 2021). Welding of 1.4462 duplex steel is treated as more complicated compared to austenite steel (Silva et al., 2019). Welding of duplex stainless steel is different from welding of austenitic stainless steel due to the different structure (the phase nature) (Shwachko et al., 2000; Fydrych, 2013; Szymczak et al., 2020)

The aim of the article is the use of an argon shielding mixture with a micro addition of nitrogen (much below 1%) for welding in the TIG process. Such mixtures have been produced for a short time and checking duplex steel welding with such a mixture can be treated as a material and technological novelty.

2. Materials

TIG welding process was chosen to the investigation regarding duplex steel welding. Table 1 shows the mechanical properties of the 1.4462 duplex steel.

Table 1.
Tensile strength of 1.4462 duplex steel

YS, MPa	UTS, MPa	A5, %
430	670	23

Source: Golański, Chmielewski, 2018.

Corrosion resistance and good mechanical properties result from the chemical composition. High content of nickel and chromium (and equivalents) gives especially anti-corrosion and good plastic properties and also high strength by producing a beneficial structure consisting of austenite and delta ferrite (Table 2).

Table 2

Chemical composition of 1.4462 duplex steel

Material	C, %	Si, %	Mn, %	P, %	S, %	Ni, %	Cr, %	Mo, %
1.4462	0.029	0.91	1.94	0.027	0.18	9.7	22.9	2.9

Source: Golański D., Chmielewski T., 2018.

Chemical composition of 1.4462 duplex steel is rather similar with filler material composition AWS A5.9: ER 2209 (Tab. 3).

Table 3.

Wire 2209 – chemical composition

Material	C, %	Mn, %	Cr, %	Mo, %	Ni, %	Si, %	P, %	S, %
2209	0.026	1.8	23.1	3.2	9.1	0.8	0.027	0.018

Source: Shwachko V., 2000.

The comparison of table 2 and table 3 shows that the chemical composition of both materials is similar, which should translate into the formation of a ferritic-austenitic structure.

3. Research methods

The welded joints were made from duplex steel 1.4462 with a thickness of 4 mm in a flat position with V beveling. The groove shape and the method of arranging subsequent layers are shown on the Figures 3.

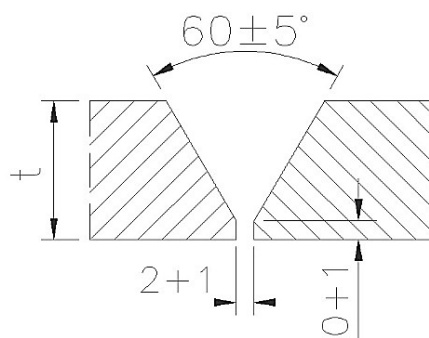


Figure 3. The groove shape and beveling method from the duplex steel 1.4462 o with a thickness $t = 4$ mm.

After making the TIG welded joints from duplex steel 1.4462 with a thickness of 4 mm with various parameters (different composition of shielding gas mixture), visual tests were realized in accordance with the PN-EN 970: 1999 standard. The tests aimed to verify the correctness and quality of the welds. The tests were extended with the results of non-destructive tests:

penetrant (PN-EN 571: 1999) and ultrasonic tests (PN-EN 1714: 2002). After that, all joints were seriously checked also with the use of main destructive tests. The bending test was performed in accordance with EN ISO 5173: 201 standard. The tensile test was carried out according to the PN-EN ISO 6892-1: 2020 standard and hardness test according to the PN-EN ISO 9015-1: 2011 and PN-EN ISO 6507-1: 2018-05 standards. The main welding parameters included:

- I_1 - current intensity of the first layer,
- U_1 - arc voltage of the first layer,
- v_1 - welding speed of the first layer,
- I_n - current intensity of the next layers,
- U_n - arc voltage of the next layers,
- v_n - welding speed of the next layers,
- type of a shielding gas: Ar and gas mixture of Ar with small addition of N_2 .

When laying the first layer, the current intensity I_1 was modified in the range of 60-80 A, U_1 - arc voltage in the range of 10-12 V and welding speed v_1 in the range of 65 mm/min to 115 mm/min. The welds were made using direct current with negative polarity on the electrode. The shielding gas was argon with small addition of nitrogen. The gas flow rate was at the constant level of 13 l/min in all tested cases. Due to the proper shape of the root layer, it has been established that the best results are obtained when:

$$I_1 = 75 \text{ A,}$$

$$U_1 = 11 \text{ V,}$$

$$v_1 = 75 \text{ mm/min.}$$

When laying next stitches, the current I_n was modified to the value of either 90 A or 120 A. The value of the arc voltage U_n was always 11 V, based on the observations made while selecting the arc voltage for the first stitch. The welding speed v_n was also modified in the range from 65 mm/min to 115 mm/min. The influence of the current intensity, welding speed, and chemical composition of shielding gas is presented in Table 4.

Table 4.
The results of the NDT tests (non-destructive test)

Sample mark	Current intensity, A	Welding speed, mm/min	N_2 in shielding gas mixture, % ppm	Observation
S1	70	70	0	cracks
S2	70	70	0.3	cracks
S3	70	80	0	cracks
S4	70	80	0.3	positive
S5	80	70	0	positive
S6	80	70	0.3	positive
S7	80	80	0	positive
S8	80	0.3	0.3	positive
S9	90	70	0	cracks
S10	90	70	0.3	cracks
S11	90	80	0	cracks
S12	90	80	0.3	cracks

Source: own research.

Based on non-destructive observations (Table 4), the following conclusions were put down:

- occurrence of the small cracks in the case of poorly selected parameters,
- lack of any defects and incompatibilities for the B level (according to the PN-EN-ISO 5817: 2005) for joints made with low linear energy (samples S4, S5, S6, S7, S8),
- when creating joints, it is recommended to use a direct current with negative polarity on the electrode.

Only those welds which presented lack of incompatibilities energy (samples S4, S5, S6, S7, S8) were chosen for the bending test. For the analyzed welds, the bending test was carried out in accordance with the EN ISO-5173: 2010 standard. For the tests a sample with a thickness of $a = 4$ mm, width $b = 10$ mm, mandrel $d = 34$ mm and roll distance 60 mm was used, with the bending angle at 180° . 5 bending measurements were done both from the face and from the root side of the weld. In all tested cases, no cracks were found. results of the bending test show that the welded joints were made correctly, and that the welding. Thus, it can be assumed that bending tests confirmed that the joints were made correctly

The next part of the investigation included tensile strength test. The strength tests were realized on the ZWICK 100N5A testing machine. The results of the tensile strength of the joints (average of 3 measurements) are presented in the Table 5.

Table 5.
Tensile strengths of the tested joints

Sample	UTS, MPa	Elongation, %
S4	589	23
S5	587	23
S6	604	23
S7	569	22
S8	575	22

Source: own research.

The results of the mechanical tests must be treated as very positive. All welds are characterized with a high tensile strength above the recommended value of 500 MPa for the construction of stainless steel for automotive or antenna supports.

Next, the microstructure of the same tested welds (S4, S5, S6, S7, S8) was tested. Results are presented in Table 6.

Table 6.
Percentage of austenite in joints

Sample	Percentage of austenite, %
S4	40
S5	39
S6	40
S7	39
S8	40

Source: own research.

The dominant structure of the steel and the weld is delta ferrite. The structure results (table 6) indicate that nitrogen as an austenitic element slightly increases the austenite content in the weld. Due to the fact that an increase in the austenite content in the weld was observed, it was decided to check the nitrogen content in the weld, which was performed on the LECO ONH836 analyzer. The test results are presented in Table 7.

Table 7.
Nitrogen in weld metal deposit (WMD)

Sample	Nitrogen in WMD, ppm
S4	55
S5	50
S6	55
S7	50
S8	55

Source: own research.

From the analysis of the data in Table 6 and Table 7, it can be seen that the addition of 0.3% nitrogen to the argon shielding gas raises the nitrogen content to 55 ppm. The last part of the research was to measure the HV hardness in the central part of the weld. The tests were carried out for S4, S5, S6, S7, S8 joints, which were characterized with the lack of welding defects (Table1). The hardness in the base material (BM), heat effected zone (HAZ), and the weld (W) was observed. Test results, the average of 3 measurements, are presented in the Tab. 8.

Table 8.
Hardness distribution in the duplex joint

Sample	BM	HAZ	W
S4	274	298	281
S5	274	293	287
S6	274	295	289
S7	274	293	288
S8	274	292	289

Source: own research.

The hardness test results are positive. In all tested samples, a comparable hardness was found along the all tested areas of the joint. The hardness value did not exceed value of 300 HV.

4. Conclusion

In the paper, it was decided to analyze weldability of duplex 14462 steel with TIG process.

It was decided to carefully re-analyze the welding parameters, paying attention to the fusion layer and the remaining welds. It was noticed that the selection of the welding current intensity, welding speed and the composition of the shielding gas have a large impact on the quality of

the welds. In the TIG process, active gases are rarely added to the argon. The article decided to study a small addition of nitrogen at the level of only 0.3%. This resulted in a more favorable metallographic structure and better mechanical properties of the joint. For this purpose, 12 joints were created with the use of different welding parameters. After NDT (non-destructive test) observations it was noted that only 5 joints (S4, S5, S6, S7, S8) were made correctly. During further destructive tests, only those joints were verified. After the bend test, it was noted, that all tested joints presented lack of cracks. Similarly, the analysis of the tensile strength proved the good mechanical properties of the duplex joint. The structure analysis showed that delta ferrite is the dominant phase and that austenite is on the level of 40%. Based on the performed investigation, the main conclusions were drawn:

- the TIG welding applied to create antenna supports or automotive elements allow to obtain joints with a good quality and good mechanical properties.
- better results were achieved using a shielding mixture containing 0.3 nitrogen in relation to the shielding gas, which was pure nitrogen.

Acknowledgments

The article is related to the implementation of the COST project, CA 18223 and BK-270/RT1/2022.

References

1. Darabi, J., Ekula, K. (2016). Development of a chip-integrated micro cooling device. *Microelectronics Journal*, Vol. 34, Iss. 11, pp. 1067-1074, <https://doi.org/10.1016/j.mejo.2003.09.010>.
2. Francis, R., Burne, G. (2021). Duplex stainless steels _ Alloys for the 21 Century. *MDPI, Metals*, 11(5), 836, <https://doi.org/10.3390/met11050836>.
3. Fydrych, D., Łabanowski, J., Rogalski, G. (2013). Weldability of high strength steels in wet welding conditions. *Polish Maritime Research*, Vol. 20(2(78)), 67-73. <https://doi.org/10.2478/pomr-2013-0018>.
4. Golański, D., Chmielewski, T., Skowrońska, B., Rochalski, D. (2018). Advanced Applications of Microplasma Welding. *Biuletyn Instytutu Spawalnictwa w Gliwicach*, Vol. 62, Iss. 5, 53-63. <http://dx.doi.org/10.17729/ebis.2018.5/5>.
5. Hadryś, D. (2015). Impact load of welds after micro-jet cooling. *Archives of Metallurgy and Materials*, Vol. 60, Iss. 4, pp. 2525-2528, <https://doi.org/10.1515/amm-2015-0409>.

6. <https://www.sciencedirect.com/topics/engineering/schaeffler-diagram>.
7. Jaewson, L., Kamran, A., Jwo, P. (2011). Modeling of failure mode of laser welds in lap-shear specimens of HSLA steel sheets. *Engineering Fracture Mechanics, Vol. 1*, pp 347-396.
8. Krupicz, B., Tarasiuk, W., Barsukov, V.G., Sviridenok, A.I. (2020). Experimental Evaluation of the Influence of Mechanical Properties of Contacting Materials on Gas Abrasive Wear of Steels in Sandblasting Systems. *Journal of Friction and Wear, Vol. 41, Iss, 1*, pp. 1-5.
9. Shwachko, V.L. (2000). Cold cracking of structural steel weldments as reversible hydrogen embrittlement effect. *International Journal of Hydrogen Energy, no. 25*.
10. Silva, A., Szczucka-Lasota, B., Węgrzyn, T., Jurek, A. (2019). MAG welding of S700MC steel used in transport means with the operation of low arc welding method. *Welding Technology Review, Vol. 91, No. 3*, PL ISSN 0033-2364, 23-30.
11. Skowrońska, B., Szulc, J., Chmielewski, T., Golański, D. (2017). Wybrane właściwości złączy spawanych stali S700 MC wykonanych metodą hybrydową plazma + MAG. *Welding Technology Review, Vol. 89(10)*, 104-111. <http://dx.doi.org/10.26628/ps.v89i10.825>.
12. Szczucka-Lasota, B., Piwnik, J. (2017). New technological concept for thermal spray protective coatings. *Arch. Metall. Mater., vol. 62*. DOI: 10.1515/amm-2017-0232.
13. Szymczak, T., Makowska, K., Kowalewski, Z.L. (2020). Influence of the welding process on the mechanical characteristics and fracture of the S700MC high strength steel under various types of loading. *Materials, 13, 5249*, 1-17. [10.3390/ma13225249](https://doi.org/10.3390/ma13225249).

INDIVIDUAL INNOVATIONS

Radosław WOLNIAK

Politechnika Śląska, Wydział Organizacji i Zarządzania, Instytut Ekonomii i Informatyki; rwolniak@polsl.pl,
ORCID: 0000-0003-0317-9811

Purpose: The aim of the paper is to analyze the individual innovation processes in industrial enterprise.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The publication concentrate on problems connected with various aspects of individual innovations. In the paper we presented the analysis of differences between terms – innovation, reform and change and its impact on industrial management. Also we analyzed in detailed way the main trends in management in the context on their impact on individual innovations. We analyzed the activities organization should use to boost the innovativeness level in the enterprise. The innovativeness can be done in centralized or decentralized way. This is an important factor influencing the results of innovations activity. We try to analyze the situation of strong centralization of R&D activities in a company with an analysis of its advantages and disadvantages. We think that the decentralization of R&D give the company possibility to easy identify market opportunities and treats and because of that it can easy adapt new product and processes to the customer requirements.

Originality/value: Detailed analysis of all subjects related to the problems connected with individual innovation in an industrial enterprise.

Keywords: Industry 4.0; innovation, industrial enterprise, individual innovation, research and development.

Category of the paper: literature review.

1. Introduction

The issues of innovation are very important for the modern economy. Basic concepts of innovation can be defined as follows (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021):

- Innovation - the result of creative activity, aimed at introducing changes in the system of the organization concerning products, processes or management which meet the needs of the organization and brings benefits in terms of growth, profits and prestige.

- Innovative activities - the whole of the organization's activities focused on the development and implementation of the necessary and beneficial innovation.
- Innovation process - a process involving clarification of the needs of innovative idea generation, its design, implementation and operation.

In the literature, the most common division of innovation is as follows:

- product innovations,
- process innovations,
- service innovations.

The aim of the paper is to analyze the individual innovation processes in industrial enterprise.

2. Basic definitions

Most of the literature defines innovation as the implementation not just of new ideas, knowledge and practices, but also of improved ideas, knowledge and practices (Oslo Manual, 2005; Avvisati et al., 2013; European Ambassadors, 2009; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018; Grabowska et al., 2019, 2020, 2021). Innovation is different from reform or change, which does not necessarily mean the application of something new, nor does it imply the application of improved ideas or knowledge (Montonen, Eriksson, 2013). The competition between three concepts: innovation, reform and change (Table 1) can be very interesting. By referring to Table 1, we can say that innovation is not the same as change.

Table 1.

Innovation, reform and change

	Innovation	Reform	Change
Definition	Implementation of improved ideas, knowledge and practices	Structured and conscious process of producing change	Transformation or alteration that may be an intended or unintended phenomenon
Key characteristics	Implies novelty and brings benefits	Produces change (though in some cases only little or none)	Is historical, contextual and processual
Types	Process, product, marketing or organizational; Incremental, radical or systemic in form	Radical, incremental or systemic	Differentiated by pace (continuous or episodic) and scope (convergent or radical)

Source: (Oslo Manual, 2005).

These types can be defined as follows (Oslo Manual, 2005):

- Product innovation is the launch of the product when the technological characteristics or intended use differs significantly from previously manufactured products or the operation of which has been substantially improved, and at the same time it can provide the consumer with objectively new or increased benefits.

- Process innovation is the adoption of new or significantly improved methods of manufacturing or delivery of products. This might involve changes in the organization, technology, human resources, working methods, hardware, or a combination of such changes.
- Service innovation is the launch of a service which is new or is perceived by someone as new. It is therefore a service which offers consumers a new benefit or value. Such innovation is the change of an existing service or proposes a new one. Innovation in services is defined by multiple divisions including product innovation.

Although innovative processes benefit from collaboration (see next chapter of this book), new knowledge in real-life networks can begin with an individual. Individual perspective to innovation is underrepresented in research (Peschl et al., 2014; Standing et al., 2016; Mulder, 2012; Habek, Wolniak, 2013, 2016; Hys, Wolniak, 2018). The competences needed in innovation processes can refer to knowledge, skills and attitudes, but the influence of an individual characteristic on it also seems to be significant (Sturing et al., 2011).

3. Trends in management with impact on individual innovations

Employees are a knowledge resource for their employing organizations. In many areas of management, they should have realized that the human element of organizational development is connected with the innovative capability of an organization (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021). To recipe a success on the market an organization is claimed to be focused on a creative and innovative workforce (Amo, 2005).

We can find in the literature conception of individual innovation competence. It can be understood as a synonym to the set of personal characteristics, knowledge, skills or abilities that are connected to creating concretised and implemented novelties via collaboration in complex innovation processes. Similar to other competences, innovation competence can be learned and developed (Hero et al., 2017; Kwiotkowska et al., 2021, 2022; Orzeł, Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021).

The growth of importance of individual innovative behavior in the organization is due to current trends in the management sciences. In table 2 we presented the main trends which have an impact on individual innovations in organizations.

Table 2.
Trends in management with impact on individual innovations

Trend	Characteristic
Dynamicity and turbulence	Market arenas are getting more and more turbulent and dynamic: customer needs, competitors, business models and the set of competencies necessary to compete in a definite industry change over time with a frequency much higher than ever.
Globalization of markets and business activities	Globalization has fostered homogeneity in customer needs but, at the same time, has renewed companies' interest toward the satisfaction of local demand
Increased competition	Globalization, liberalization and convergence of markets and technologies have increased competition in several industries, both at a domestic and at a global level
Rapid advances in technology	New knowledge is developed and applied to products and services faster and faster. Consequently, life-cycles are shortening in some product categories, a greater number of new products and services are being introduced over time, and the time between subsequent innovations is decreasing.
End of the linear model of innovation	Traditionally, technological innovation was conceived as a sequential process that linearly proceeded from idea generation, through development, prototyping and testing, manufacturing and market launch. The input of this process was either a technology advancement (the technology push approach), the identification of a market need (the market pull approach), or a combination of the two (the interactive or coupling model). This point of view has radically changed in the last decades; technological innovation has become a flexible, iterative process, contemporarily involving R&D and other functions, characterized by a strong participation of both suppliers and lead users and by a systemic nature.
Increased reliance upon external sources of technology	Firms generally lack the financial and technical resources to build the whole range of competencies they need and hence move towards a higher level of technical specialization, concentrating internal R&D efforts on core activities where they are more likely to excel. Contemporarily, they rely strongly on external sources of technology to access the other required competencies and to feed their innovation pipeline with higher frequency and continuity.
Leverage on multiple channels for technology exploitation	Traditionally, firms have exploited innovations, incorporating them into products or services that were internally developed and launched in the final market. Nevertheless, the costs required to develop new technologies and the speed at which new knowledge is developed make sustainable long-term growth even more dependent on the continual and full leverage of a company's technology basis. Therefore, firms are contemporarily using multiple channels for converting their technologies into incomes, among which external exploitation paths (such as patent sale or licensing out, new venture spin-off or contract research) are used more and more.
The entrepreneurial nature of R&D	Traditionally, R&D was considered part of the firm's overhead costs and conceived as a technology-led unit where all innovation opportunities were generated and developed until ready to be released to manufacturing and marketing. Nowadays, internal R&D becomes the repository of the firm's core technological competencies but, at the same time, it is the engine of the innovation process and performs critical brokering functions, such as the scouting of the external environment for the identification of valuable sources of knowledge and the integration of internally generated with externally acquired technologies.
Birth and growth of markets for technology	The search for multiple channels for commercializing the output of firms' innovative efforts, the specialization in knowledge production and the related division of labor within innovative activities have brought the birth of so-called markets for technology. The capability to interact with these markets for technology has become a further critical determinant of most successful firms' innovative behavior.
Management of R&D and innovation on an international scale	Finally, the management of technological innovation has assumed a prominent international dimension. In fact, studies of the internationalization of innovation processes indisputably show that foreign R&D is becoming a significant component of many countries' R&D base

Source: On basis (Ortt, Verburg, 2008; Ortt, Smith, 2006; Jones, Teegen, 2002).

Some research suggests that obtaining conventional rewards play a very small role in stimulating innovativeness. The participation itself is a sufficient reward for conducting an innovative behavior of peoples (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022). Also, it is worth mentioning that when employees perceive that efforts are fairly rewarded by the organization, they are willing to cope innovatively with higher levels of demand in the work environment (Amo, 2005). According to literature we can define innovative behavior as a complex process consisting of generating, promoting and implementing ideas that are novel and useful within a particular social context (Yuan, Woodman, 2010; Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011).

Organizations can take many activities towards enhancing the innovative potential among their workers. Especially organization which is adjusted to innovative people enhancement should follow points like (Ortt, Verburg, 2008):

- the organization for external innovation,
- the coexistence of innovating and operating organizations within the firm's overall structure,
- the organizational decentralization of innovative activities,
- the organizational separation between research and development activities,
- the resource allocation mechanism in the organization for innovation.

Spite of several action could be used to spur innovation at the organizational level, including (Srobl et al., 2020):

- leadership,
- creative work environment,
- organizational culture,
- organizational climate.

The social network a particular person exists has an important impact on the innovative behavior of this person. Social networks characterized by weaker relationships are an important determinant of creativity. The weaker ties an individual has, the better it would be for his creative outcomes. The intermediate level of weak ties was positively related to creativity when the employees' conformity value was low (Wolniak, Jonek-Kowalska, 2021; 2022). Also, a more central position of an individual in respect to the others is associated with creativity, because such a position provides an individual with higher social status. Because of that the social network can provide an individual actor with opportunities for exhibiting innovative actions (Nedkovski, Guerci, 2015).

Another very important factor influencing individual innovative behavior is work motivation. It plays a critical role in organizational behavior because it determines the quality and extent to which the employees would engage into the working activities. In the case of

intrinsic qualities self-determination and sense of competence at work are feelings that give rise to people's intrinsic motivation. When an individual is enjoying a high level of intrinsic motivation, his interest and involvement in the job task rises to a level that can provide him with a sense of merging with his working activity and higher level of innovativeness (Nedkovski, Guerci, 2015).

Innovativeness is also enhanced by personal values of the particular person. Some studies show the relation between personal values and creativity and innovative behavior (Sousa, Coelho, 2013). The natural way to pursue important values is to behave in ways that express them or promote.

Therefore, we can expect that some values can be useful to foster innovative behavior in employees and others to be negatively related to. The very important value from an innovative point of view is openness to change which comprises self-direction and stimulation. Self-direction has been argued to be a value that is the most important for creativity. The motivational goal of self-direction involves independence in thought and action, self-direction can be reflected through exploration and free choice which are perceived to be crucial for creative individuals. In the case of situations when employees ranked low on openness to change they were less creative (Pure, Lagun, 2019).

Other, conservative values like: conformity, security and traditions seem to have a negative effect on employees' innovativeness (Schwartz, 1992). Such values predispose individuals to attempt customary behavior and establish procedures and ideas which are undoubtedly not conducive to innovativeness. Because the goal of conformity is to restrain actions, inclinations and impulses to avoid upsetting social norms, employees who attribute high importance to this value may avoid undertaking innovative initiatives because it is not easily welcome for others within the organization (Purc, Lagun, 2019).

There are two ways of enhancing the innovative attitude among people. We can use a totally centralized approach or totally decentralized approach. In the case of strong centralization R&D activity is undertaken at the corporate level, with a single top manager in charge of the organization. In the case of decentralization R&D gives the opportunity to easily identify market opportunities and threats to efficiently adapt new products and processes to requirements of the various businesses in which the organization operates. This solution also simplifies the transfer of the outcomes of R&D activities to manufacturing and marketing. In table 3 we tried to compare differences between enhancing innovation among people in the case of strong decentralization of R&D activities.

Table 3.
Strong decentralization of R&D activities

Advantages	Disadvantages
Possibility of scouting and identifying market needs, opportunities and threats	Risk of under-investment in developing core technological competences and bounded innovation
Possibility of adapting new products and processes to specific business requirements	Risk of losing the capability to synthesis and integrate knowledge from different sources and technical domains
Simple transfer from R to D	Risk of delaying investments into promising technologies not yet exploited or exploitable at the business level
Simple transfer from R&D to manufacturing and marketing	Problems in supporting radical innovation programs within certain and delayed outputs
Possibility of measuring R&D performance more simply	Problems in building a long-term vision in technology strategy
Great emphasis on development time, costs and quality	Difficulties in leveraging a common technology basis across different business

Source: (Ortt, Verburg, 2008).

4. Conclusion

The publication concentrate on problems connected with various aspects of individual innovations. In the paper we presented the analysis of differences between terms – innovation, reform and change and its impact on industrial management. Also we analyzed in detailed way the main trends in management in the context on their impact on individual innovations. We analyzed the activities organization should use to boast the innovativeness level in the enterprise. The innovativeness can be done in centralized or decentralized way. This is an important factor influencing the results of innovations activity. We try to analyze the situation of strong centralization of R&D activities in a company with an analysis of its advantages and disadvantages. We think that the decentralization of R&D give the company possibility to easy identify market opportunities and treats and because of that it can easy adapt new product and processes to the customer requirements.

References

1. Åmo, B.W. (2005). *Employee innovation behavior*. Thesis for the Degree of Doctor Oeconomia, Bodø, June.
2. Avvisati, F., Jacotin, G., Vincent-Lancrin, S. (2013). Educating higher education students for innovative economies: What international data tell us. *Tuning Journal for Higher Education*, 1, 223-240.

3. Czerwińska-Lubszczyk, A., Grebski, M.E., Grebski, W., Krawczyk, D., Kuzior, A., Wolniak, R. (2022). *Creativity and innovativeness in psychology and management*. Toruń: Dom Organizatora.
4. Drozd, R., Wolniak, R. (2021). Metrisable assessment of the course of stream-systemic processes in vector form in industry 4.0. *Quality and Quantity*, 1-16, DOI: 10.1007/s11135-021-01106-w.
5. Drozd, R., Wolniak, R. (2021). Systematic assessment of product quality. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(4), 1-12.
6. European Ambassadors for Creativity and Innovation. (2009). Manifesto, European Union, www.create2009.europa.eu/fileadmin/Content/Downloads/PDF/Manifesto/manifesto.en.pdf, 5.01.2022.
7. Gajdzik, B., Grebski, M., Grebski, W., Wolniak, R. (2022). *Human factor activity in lean management and quality management*. Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa. Dom Organizatora.
8. Gajdzik, B., Wolniak, R. (2021). Digitalisation and innovation in the steel industry in Poland - selected tools of ICT in an analysis of statistical data and a case study. *Energies*, 14(11), 1-25.
9. Gajdzik, B., Wolniak, R. (2021). Influence of the COVID-19 crisis on steel production in Poland compared to the financial crisis of 2009 and to boom periods in the market. *Resources*, 10(1), 1-17.
10. Gajdzik, B., Wolniak, R. (2021). Transitioning of steel producers to the steelworks 4.0 - literature review with case studies. *Energies*, 14(14), 1-22.
11. Gajdzik, B., Wolniak, R. (2022). Framework for R&D&I Activities in the Steel Industry in Popularizing the Idea of Industry 4.0. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(3), 133.
12. Gajdzik, B., Wolniak, R. (2022). Influence of Industry 4.0 Projects on Business Operations: literature and empirical pilot studies based on case studies in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 1-20.
13. Gajdzik, B., Wolniak, R. (2022). Smart Production Workers in Terms of Creativity and Innovation: The Implication for Open Innovation. *Journal of Open Innovations: Technology, Market and Complexity*, 8(1), 68.
14. Gajdzik, B., Wolniak, R., Grebski, W.W. (2022). An econometric model of the operation of the steel industry in Poland in the context of process heat and energy consumption. *Energies*, 15(21), 1-26, 7909.
15. Gębczyńska, A., Wolniak, R. (2018). *Process management level in local government*. Philadelphia: CreativeSpace.
16. Grabowska, S., Grebski, M., Grebski, W., Saniuk, S., Wolniak, R. (2021). *Inżynier w gospodarce 4.0*, Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa – Stowarzyszenie Wyższej Użyteczności "Dom Organizatora".

17. Grabowska, S., Grebski, M., Grebski, W., Wolniak, R. (2019). *Introduction to engineering concepts from a creativity and innovativeness perspective*. New York: KDP Publishing.
18. Grabowska, S., Grebski, M., Grebski, W., Wolniak, R. (2020). *Inżynier – zawód przyszłości. Umiejętności i kompetencje inżynierskie w erze Przemysłu 4.0*. Warszawa: CeDeWu.
19. Hąbek, P., Wolniak, R. (2013). Analysis of approaches to CSR reporting in selected European Union countries. *International Journal of Economics and Research*, 4(6), 79-95.
20. Hąbek, P., Wolniak, R. (2016). Assessing the quality of corporate social responsibility reports: the case of reporting practices in selected European Union member states. *Quality & Quantity*, 50(1), 339-420.
21. Hąbek, P., Wolniak, R. (2016). Factors influencing the development of CSR reporting practices: experts' versus preparers' points of view. *Engineering Economy*, 26(5), 560-570.
22. Hąbek, P., Wolniak, R. (2016). Relationship between management practices and quality of CSR reports. *Procedia – Social and Behavioral Sciences*, 220, 115-123.
23. Hero, L.M., Lindfords, E., Taatila, V. (2017). Individual Innovation Competence: A Systematic Review and Future Research Agenda. *International Journal of Higher Education*, 6(5), 1041-121.
24. Hys, K., Wolniak, R. (2018). Praktyki przedsiębiorstw przemysłu chemicznego w Polsce w zakresie CSR. *Przemysł Chemiczny*, 9, 1000-1002.
25. Jonek-Kowalska, I., Wolniak, R. (2021). Economic opportunities for creating smart cities in Poland. Does wealth matter? *Cities*, 114, 1-6.
26. Jonek-Kowalska, I., Wolniak, R. (2021). The influence of local economic conditions on start-ups and local open innovation system. *Journal of Open Innovations: Technology, Market and Complexity*, 7(2), 1-19.
27. Jonek-Kowalska, I., Wolniak, R. (2022). Sharing economies' initiatives in municipal authorities' perspective: research evidence from Poland in the context of smart cities' development. *Sustainability*, 14(4), 1-23.
28. Jonek-Kowalska, I., Wolniak, R., Marinina, O.A., Ponomarenko, T.V. (2022). *Stakeholders, Sustainable Development Policies and the Coal Mining Industry. Perspectives from Europe and the Commonwealth of Independent States*. London: Routledge.
29. Jones, G., Teegen, H. (2002). Factors Affecting Foreign R&D Location Decisions: Management and Host Policy Implications. *International Journal of Technology Management*, 25(8), 791-813.

30. Kordel, P., Wolniak, R. (2021). Technology entrepreneurship and the performance of enterprises in the conditions of Covid-19 pandemic: the fuzzy set analysis of waste to energy enterprises in Poland. *Energies*, 14(13), 1-22.
31. Kwiotkowska, A., Gajdzik, B., Wolniak, R., Vveinhardt, J., Gębczyńska, M. (2021). Leadership competencies in making Industry 4.0 effective: the case of Polish heat and power industry. *Energies*, 14(14), 1-22.
32. Kwiotkowska, A., Wolniak, R., Gajdzik, B., Gębczyńska, M. (2022). Configurational paths of leadership competency shortages and 4.0 leadership effectiveness: an fs/QCA study. *Sustainability*, 14(5), 1-21.
33. Montonen, T., Eriksson, P. (2013). Teaching and learning innovation practice: a case study from Finland. *International Journal Human Resource Development and Management*, 2/3, 107-118.
34. Mulder, M. (2012). Competence-based education and training. *The Journal of Agricultural Education and Extension*, 18(3), 305-314, <https://doi.org/10.1080/1389224X.2012.670048>.
35. Nedkovski, V. Guerci, M. (2015). *Innovative behaviour in organizations: A social network perspective*, https://www.researchgate.net/publication/279534751_Innovative_behaviour_in_organizations_A_social_network_perspective, 29.11.2022.
36. Olkiewicz, M., Olkiewicz, A., Wolniak, R., Wyszomirski, A. (2021). Effects of pro-ecological investments on an example of the heating industry - case study. *Energies*, 14(18), 1-24, 5959.
37. Ortt, J.R., Smits, R. (2006). Innovation Management: Different Approaches to Cope with the Same Trend. *International Journal of Technology Management*, 34(3/4), 296-318.
38. Ortt, R., Verburg, R. (2008). *Determinants of Innovative Behaviour A Firm's Internal Practices and its External Environment*. London: Palgrave Macmillan.
39. Orzeł, B., Wolniak, R. (2021). Clusters of elements for quality assurance of health worker protection measures in times of COVID-19 pandemic. *Administrative Science*, 11(2), 1-14, 46.
40. Orzeł, B., Wolniak, R. (2022). Digitization in the design and construction industry - remote work in the context of sustainability: a study from Poland. *Sustainability*, 14(3), 1-25.
41. Oslo, Manual (2005). Guidelines for Collecting and Interpreting Technological Innovation Data. Paris: OECD/Eurostat.
42. Peschl, M.F., Bottaro, G., Hartner-Tiefenthaler, M., Rötzer, K. (2014). Learning how to innovate as a socio-epistemological process of co-creation. *Towards a constructivist teaching strategy for innovation. Constructivist Foundations*, 9(3), 421-433.
43. Ponomarenko, T.V., Wolniak, R., Marinina, O.A. (2016). Corporate Social responsibility in coal industry (Practices of russian and european companies). *Journal of Mining Institute*, 222, 882-891.

44. Purc, E., Lagun, M. (2019). Personal Values and Innovative Behavior of Employees. *Frontiers Psychology, 10*, 865. doi: 10.3389/fpsyg.2019.00865.
45. Schwartz, S.H. (1992). Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. In: M.P. Zanna (ed.), *Advances in experimental social psychology, Vol. 25* (pp. 1-65). San Diego, CA, US: Academic Press.
46. Sousa, C.M.P., Coelho, F. (2013). Exploring the relationship between individual values and the customer orientation of front-line employees. *Journal Marketing Management, 29*, 1653-1679. doi: 10.1080/0267257X.2013.798674.
47. Srobl, A., Matzer, K., Nketia, B.A., Veider, V. (2020). Individual innovation behaviour and firm- level exploration and exploitation: how family firms make the most of their managers. *Review of Managerial Science, 14*, 809-844.
48. Standing, C., Jackson, D., Larsen, A.-C., Suseno, Y., Fulford, R., Gengatharen, D. (2016). Enhancing individual innovation in organisations: A review of the literature. *International Journal of Innovation and Learning, 19(1)*, 44-62, <https://doi.org/10.1504/IJIL.2016.073288>.
49. Stawiarska, E., Szwajca, D., Matuszek, M., Wolniak, R. (2020). *Wdrażanie rozwiązań przemysłu 4.0 w wybranych funkcjonalnych obszarach zarządzania przedsiębiorstw branży motoryzacyjnej: próba diagnozy*. Warszawa: CeDeWu.
50. Stawiarska, E., Szwajca, D., Matuszek, M., Wolniak, R. (2021). Diagnosis of the maturity level of implementing Industry 4.0 solutions in selected functional areas of management of automotive companies in Poland. *Sustainability, 13(9)*, 1-38.
51. Stecuła, K., Wolniak, R. (2022). Advantages and Disadvantages of E-Learning Innovations during COVID-19 Pandemic in Higher Education in Poland. *Journal of Open Innovation: Technology, Market, and Complexity, 8(3)*, 159.
52. Stecuła, K., Wolniak, R. (2022). Influence of COVID-19 Pandemic on Dissemination of Innovative E-Learning Tools in Higher Education in Poland. *Journal of Open Innovations: Technology, Market and Complexity, 8(1)*, 89.
53. Sturing, L., Biemans, H.J.A., Mulder, M., De Bruijn, E. (2011). The nature of study programmes in vocational education: Evaluation of the model for comprehensive competence-based vocational education in the Netherlands. *Vocations and Learning, 4(3)*, 191-210, <https://doi.org/10.1007/s12186-011-9059-4>.
54. Sułkowski, M., Wolniak, R. (2016). Przegląd stosowanych metod oceny skuteczności i efektywności organizacji zorientowanych na ciągłe doskonalenie. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie, 67*, 63-74.
55. Sułkowski, M., Wolniak, R. (2018). *Poziom wdrożenia instrumentów zarządzania jakością w przedsiębiorstwach branży obróbki metali*. Częstochowa: Oficyna Wydawnicza Stowarzyszenia Menedżerów Produkcji i Jakości.
56. Wolniak, R., Skotnicka-Zasadzień, B. (2014). The use of value stream mapping to introduction of organizational innovation in industry. *Metalurgija, 53(4)*, 709-713.

57. Wolniak, R. (2011). *Parametryzacja kryteriów oceny poziomu dojrzałości systemu zarządzania jakością*. Gliwice: Wydawnictwo Politechniki Śląskiej.
58. Wolniak, R. (2013a). A typology of organizational cultures in terms of improvement of the quality management. *Manager*, 17(1), 7-21.
59. Wolniak, R. (2013b). Projakościowa typologia kultur organizacyjnych. *Przegląd Organizacji*, 3, 13-17.
60. Wolniak, R. (2014). Korzyści doskonalenia systemów zarządzania jakością opartych o wymagania normy ISO 9001:2009. *Problemy Jakości*, 3, 20-25.
61. Wolniak, R. (2016a). Kulturowe aspekty zarządzania jakością. *Etyka biznesu i zrównoważony rozwój. Interdyscyplinarne studia teoretyczno-empiryczne*, 1, 109-122.
62. Wolniak, R. (2016b). *Metoda QFD w zarządzaniu jakością. Teoria i praktyka*. Gliwice: Wydawnictwo Politechniki Śląskiej.
63. Wolniak, R. (2016c). Relations between corporate social responsibility reporting and the concept of greenwashing. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 87, 443-453.
64. Wolniak, R. (2016d). The role of QFD method in creating innovation. *Systemy Wspomagania Inżynierii Produkcji*, 3, 127-134.
65. Wolniak, R. (2017a). Analiza relacji pomiędzy wskaźnikiem innowacyjności a nasyceniem kraju certyfikatami ISO 9001, ISO 14001 oraz ISO/TS 16949. *Kwartalnik Organizacja i Kierowanie*, 2, 139-150.
66. Wolniak, R. (2017b). Analiza wskaźników nasycenia certyfikatami ISO 9001, ISO 14001 oraz ISO/TS 16949 oraz zależności pomiędzy nimi. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 108, 421-430.
67. Wolniak, R. (2017c). The Corporate Social Responsibility practices in mining sector in Spain and in Poland – similarities and differences. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 111, 111-120.
68. Wolniak, R. (2017d). The Design Thinking method and its stages. *Systemy Wspomagania Inżynierii Produkcji*, 6, 247-255.
69. Wolniak, R. (2017e). The use of constraint theory to improve organization of work. 4th International Multidisciplinary Scientific Conference on Social Sciences and Arts. SGEM 2017, 24-30 August 2017, Albena, Bulgaria. Conference proceedings. Book 1. *Modern science. Vol. 5, Business and management*. Sofia: STEF92 Technology, 1093-1100.
70. Wolniak, R. (2018a). Functioning of social welfare on the example of the city of Łazy. *Zeszyty Naukowe Wyższej Szkoły, Humanitas. Zarządzanie*, 3, 159-176.
71. Wolniak, R. (2018b). Methods of recruitment and selection of employees on the example of the automotive industry. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 128, 475-483.

72. Wolniak, R. (2019a). Context of the organization in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 133, 121-136.
73. Wolniak, R. (2019b). Downtime in the automotive industry production process - cause analysis. *Quality, Innovation, Prosperity*, 2, 101-118.
74. Wolniak, R. (2019c). Leadership in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 133, 137-150.
75. Wolniak, R. (2019d). Support in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 137, 247-261.
76. Wolniak, R. (2019e). The level of maturity of quality management systems in Poland - results of empirical research. *Sustainability*, 15, 1-17.
77. Wolniak, R. (2020a). Design in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 148, 769-781.
78. Wolniak, R. (2020b). Operations in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 148, 783-794.
79. Wolniak, R. (2020c). Quantitative relations between the implementation of industry management systems in European Union countries. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 142, 33-44.
80. Wolniak, R. (2021a). Internal audit and management review in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 151, 724-608.
81. Wolniak, R. (2021b). Performance evaluation in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 151, 725-734.
82. Wolniak, R. (2022a). Engineering ethics – main principles. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 155, 579-594.
83. Wolniak, R. (2022b). Management of engineering teams. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 157, 667-674.
84. Wolniak, R. (2022c). Project management in engineering. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 157, 685-698.
85. Wolniak, R. (2022d). The role of the engineering profession in developing and implementing sustainable development principles. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 155, 595-608.
86. Wolniak, R. Sułkowski, M. (2015). Rozpowszechnienie stosowania Systemów Zarządzania Jakością w Europie na świecie – lata 2010-2012. *Problemy Jakości*, 5, 29-34.
87. Wolniak, R., Grebski, M.E. (2018a). Innovativeness and creativity as factors in workforce development – perspective of psychology. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 203-214.
88. Wolniak, R., Grebski, M.E. (2018b). Innovativeness and creativity as nature and nurture. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 215-226.

89. Wolniak, R., Grebski, M.E. (2018c). Innovativeness and Creativity of the Workforce as Factors Stimulating Economic Growth in Modern Economies. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 227-240.
90. Wolniak, R., Grebski, M.E., Skotnicka-Zasadzień, B. (2019). Comparative analysis of the level of satisfaction with the services received at the business incubators (Hazleton, PA, USA and Gliwice, Poland). *Sustainability*, 10, 1-22.
91. Wolniak, R., Hąbek, P. (2015). Quality management and corporate social responsibility. *Systemy Wspomagania w Inżynierii Produkcji*, 1, 139-149.
92. Wolniak, R., Hąbek, P. (2016). Quality assessment of CSR reports – factor analysis. *Procedia – Social and Behavioral Sciences*, 220, 541-547.
93. Wolniak, R., Jonek-Kowalska, I. (2021a). The level of the quality of life in the city and its monitoring. *Innovation (Abingdon)*, 34(3), 376-398.
94. Wolniak, R., Jonek-Kowalska, I. (2021b). The quality of service to residents by public administration on the example of municipal offices in Poland. *Administration Management Public*, 37, 132-150.
95. Wolniak, R., Jonek-Kowalska, I. (2022). The creative services sector in Polish cities. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 1-23.
96. Wolniak, R., Saniuk, S., Grabowska, S., Gajdzik, B. (2020). Identification of energy efficiency trends in the context of the development of industry 4.0 using the Polish steel sector as an example. *Energies*, 13(11), 1-16.
97. Wolniak, R., Skotnicka, B. (2011).: *Metody i narzędzia zarządzania jakością – Teoria i praktyka, cz. 1*. Gliwice: Wydawnictwo Naukowe Politechniki Śląskiej.
98. Wolniak, R., Skotnicka-Zasadzień, B. (2008). *Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach*. Gliwice: Wydawnictwo Politechniki Śląskiej.
99. Wolniak, R., Skotnicka-Zasadzień, B. (2010). *Zarządzanie jakością dla inżynierów*. Gliwice: Wydawnictwo Politechniki Śląskiej.
100. Wolniak, R., Skotnicka-Zasadzień, B. (2018). Developing a model of factors influencing the quality of service for disabled customers in the conditions of sustainable development, illustrated by an example of the Silesian Voivodeship public administration. *Sustainability*, 7, 1-17.
101. Wolniak, R., Skotnicka-Zasadzień, B. (2022). Development of photovoltaic energy in EU countries as an alternative to fossil fuels. *Energies*, 15(2), 1-23.
102. Wolniak, R., Skotnicka-Zasadzień, B., Zasadzień, M. (2019). Problems of the functioning of e-administration in the Silesian region of Poland from the perspective of a person with disabilities. *Transylvanian Review of Public Administration*, 57E, 137-155.
103. Wolniak, R., Sułkowski, M. (2015). Motywy wdrażanie certyfikowanych Systemów Zarządzania Jakością. *Problemy Jakości*, 9, 4-9.

104. Wolniak, R., Sułkowski, M. (2016). The reasons for the implementation of quality management systems in organizations. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 92, 443-455.
105. Wolniak, R., Wyszomirski, A., Olkiewicz, M., Olkiewicz, A. (2021). Environmental corporate social responsibility activities in heating industry - case study. *Energies*, 14(7), 1-19, 1930.
106. Yuan, F., Woodman, R.W. (2010). Innovative behaviour in the workplace: the role of performance and image outcome expectations. *Academy of Management Journal*, 53, 323-342.

TRAITS OF HIGHLY INNOVATIVE PEOPLE

Radosław WOLNIAK

Politechnika Śląska, Wydział Organizacji i Zarządzania, Instytut Ekonomii i Informatyki; rwolniak@polsl.pl,
ORCID: 0000-0003-0317-9811

Purpose: The aim of the paper is to analyze the most important traits of highly innovative people.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The publication concentrate on problems connected with various aspects of traits of highly inventive people. In the paper there is an analysis of the very important role of cognition in innovativeness. In the paper there is an analysis of various aspects of the role of cognition like: general intelligence, genius, cognitive abilities and observer judgments of intelligence. On the basis of the analysis following main traits of highly innovative peoples can be distinguished: sensitive, not motivated by money, sense of destiny, adaptable, tolerant of ambiguity, observant, perceive world differently, see possibilities, question asker, ability to synthesize, able to fantasize, flexible, fluent, imaginative, intuitive, original, ingenious, energetic, sense of humor, self-actualizing, self-disciplined, self-knowledgeable, specific interests, divergent thinker, curious, open-ended, independent, severely critical, non-conforming, confident, risk taker.

Originality/value: Detailed analysis of all subjects related to the problems connected traits of highly innovative people.

Keywords: Industry 4.0; innovation, industrial enterprise, innovative traits, highly innovative people.

Category of the paper: literature review.

1. Introduction

Creative and innovative persons are often referred to as indication of creative potential in general. Proper innovation management needs highly innovative people. Organization which wants to be innovative should find those people and manage them properly. In times of Industry 4.0 implementation in industry there is important to analyze traits of the highly innovative people which can increase the potential of organization.

The aim of the paper is to analyze the most important traits of highly innovative people.

2. Cognition in innovations

The very important problem is also to identify what traits very innovative people have (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021). According to some research, personality, intelligence, knowledge, thinking style, motivation and environment are examples of important factors associated with creativity (Costa et al., 2015; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018; Grabowska et al., 2019, 2020, 2021). Many researchers have found relations between innovation potential and intelligence. We can divide this concept into five categories described in table 1.

Table 1.

The role of cognition in innovativeness.

Attribute	Characteristic
General intelligence	Early research claimed that creativity was equivalent to high intelligence. The best known researcher in this field is Guilford. In his theory of the Structure of Intellect (SI) published in the 1950s, he claimed that creative thinking was a mental ability, involving divergent production as ‘thinking that goes off in different directions’. Other investigations have tested the possibility of a curvilinear relationship between intelligence and innovation where intelligence would potentially become less influential as the level of intelligence increases beyond a certain point.
Genius	Some researchers have suggested that genius, as the most obvious manifestation of high intelligence, is closely tied to the propensity for innovation. However, there has been a substantial lack of evidence to support a direct relationship between innovation and intelligence. Many, including Eysenck himself, have concluded that intelligence is a necessary, but not a sufficient, condition for innovation. Recent studies conclude that intelligence and innovation potential are moderately related, but once IQ scores go over 115 the relationship is near zero. This finding has been described as ‘threshold theory’.
Cognitive abilities	Ward and Smith suggested that in order to understand the role of cognitive abilities in idea generation, we must draw upon current models in cognitive psychology, and use experimentally based observations of the processes that underlie generative tasks. The model proposes that many creative activities can be described in terms of an initial generation of ideas or solutions followed by an extensive exploration of those ideas. Initial ideas are referred to as ‘pre-inventive’, in the sense that they are incomplete solutions, but offer promise in terms of originality and utility. The model assumes that one would alternate between generative and exploratory phases, refining the structures according to the demands or constraints of the specific task. This ‘creative cognition’ approach emphasizes that generative capacity is a property of normative human cognition.
Observer judgments of intelligence	Innovative individuals are often perceived and rated by others as more intelligent than less innovative individuals. For example, in MacKinnon’s studies of architects in the 1960’s, supervisors rated innovative architects as more ‘intelligent’ than less innovative individuals. MacKinnon described the innovative architects to have high ‘effective intelligence’, and argued that traditional measures of intelligence (e.g. IQ) do not fully explain this ‘real-world’ intelligence.

Source: On basis: (Patterson et al., 2021; Guilford, 1967; MacKinnon, 1978; Lysenck, 1994; Jauk et al., 2019; Gaur, 2016).

3. Personality in innovations

The next very important set of factors connected with innovativeness is knowledge. Almost all researchers conducted analysis about innovativeness have assumed that knowledge is a very important variable in both innovativeness and creativity. Immersion in domain specific knowledge is very important to boost innovativeness. Domain-relevant knowledge reflects how much an individual knows about a given area. An individual who wants to make an innovative contribution must not only work within a system, but must also reproduce that system in his or her mind. Personal mastery and an accurate sense of domain are necessary factors for innovations (Patterson et al., 2021; Habek, Wolniak, 2013, 2016; Hys, Wolniak, 2018).

Next important factor boasting innovativeness is motivation. High levels of motivation are required for innovation and innovative people are viewed as displaying devotion and very bug absorption in their work (Harrison et al., 2006). While intrinsic motivation is clearly a prerequisite for innovation, the very role of extrinsic motivation is less clear (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021). The evidence suggests that constructive evaluation in an organization can enhance innovation. Some researchers suggest that intrinsic and extrinsic motivation might serve different functions; whilst intrinsic motivation might be linked to work on a task, extrinsic motivation might affect choice of task, field or implementation strategy (Mumford et al., 2002; Kwiotkowska et al., 2021, 2022; Orzeł, Wolniak, 2021, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021). Sagerman and Cohen have found that intrinsic and extrinsic motivation affected both individual effort and the overall quality of the innovative endeavors. They have found that extrinsic rewards, such as pay, were not as important as certain aspects of intrinsic motivation such as the desire for individual change in the process of enhancing motivation (Sauremann, Cohen, 2008).

Many researchers have found relations between innovation and personality and from those analyses a consistent set of characteristics has emerged. The Five Factor personality model (openness to experience, agreeableness, conscientiousness, extroversion, neuroticism) was used to analyze relations between innovativeness and personality. Those relations are described in table 2.

Table 2.
The role of personality in innovativeness

Attribute	Characteristic
Openness to Experience	<p>There is good empirical evidence of a positive association between various characteristics associated with innovation and those used to depict openness (e.g. imaginative, original, flexible, unconventional).</p> <p>Research suggests that openness enhances an individual's intrinsic motivation towards novelty and therefore works in a multiplicative way to produce innovation. Although there are some inconsistencies in the findings - with recent findings suggesting that the relationship may be moderated by contextual factors - openness is perhaps the most important personality dimensions to predict the propensity for innovation.</p>
Agreeableness	<p>Several studies have demonstrated a negative association between agreeableness and Innovation. In other words, being more disagreeable is linked to innovation.</p> <p>Empirical studies have confirmed the negative association between innovation and agreeableness by showing that innovators have high social rule independence. These findings are consistent with Eysenck's emphasis on the potentially negative dispositional characteristics of innovators, where innovators are often outspoken, uninhibited, quarrelsome, and sometimes asocial. Related to these findings are results showing that agreeableness is negatively associated with creative achievement but not with creative thinking. Thus, agreeableness is likely to be important in the implementation process of innovation but not for idea generation. This affords intuitive sense in that the implementation of new ideas is likely to be a group effort which involves social processes and activities. Such findings have important repercussions for the selection and management of employees.</p>
Conscientiousness	<p>The vast majority of research has demonstrated that lack of conscientiousness is associated with innovation. Defined by terms such as fastidious, ordered, neat and methodical, the evidence shows that individuals high on conscientiousness are more resistant to changes at work, and are more likely to comply with current organizational norms. A recent study reported that the negative association between conscientiousness and creativity is likely to be moderated by contextual factors, such as lack of autonomy and support.</p>
Extroversion	<p>With regard to the relationship between Extroversion and innovation, findings are not clear cut. Introversion is positively associated with innovation. Similarly, many have argued that isolation and withdrawal are necessary conditions for generating new ideas. However, there is little evidence from organizational contexts and more recent research indicates that extroversion is a positive predictor of innovation.</p> <p>In meta-analytic studies of occupational work performance in general, extroversion has been shown to be a positive predictor for many occupations. This is particularly the case in large organizations where interpersonal factors are likely to be important for effective job performance (e.g. sales, managers and other professional occupations). The association between extraversion and innovation seems to be context dependent. Introversion is likely to be related to real-life artistic endeavor whereas extraversion seems to predict performance measures of creativity and innovation.</p>
Neuroticism	<p>King and colleagues found no association between neuroticism and creative thinking or innovation. Conversely, other research literature suggests a positive relationship between neuroticism and innovation. One explanation for these inconsistencies is likely to be that the association between neuroticism and innovation is domain-dependent.</p> <p>A more thorough investigation in this area is necessary, particularly in organizational settings with a broader range of occupations. Some suggest a curvilinear association between emotional stability and performance, (where too much or too little anxiety is detrimental to innovation) and moderate levels of anxiety, for example, can enhance innovative potential.</p>

Source: On basis: (Patterson et al., 2021; Harrison et al., 2006; Baer, Oldham, 2006; Wolfradt, Pretz, 2001; George, Zhou, 2001; Furnham, Bachtiar, 2008; Mg, Yeung, 2013; Raviv, 2008).

4. Main innovative traits

We can distinguish many important factors we should expect from creative people (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022). The most important of them we have described in table 3. There are extensive characteristics of those traits encouraging creativity.

Table 3.
Traits encouraging creativity

Trait	Characteristic
Recognition and appreciation	Because the results of creative work are often postponed for a long time (many geniuses in history received no recognition in their lifetimes), creative people stand in special need of encouragement and appreciation. The recognition of the value or worth of their contribution is especially important to them, particularly if it comes from those whose opinions they respect.
Freedom to work in areas of greatest interest	While the predominantly analytical person concentrates and focuses down, the creative person wanders in every possible or feasible direction. Freedom to move is the necessary condition of creative work. A creative person tends to be most effective if allowed to choose the area of work, and the problems or opportunities within that area, which arouses deep interest. Clearly within an innovative organization this freedom has to be bounded by its definition of general purpose and by the consequent parameters of its broad strategies.
Contacts with stimulating colleagues	Creative people need conversation with colleagues in order to think, not merely for social intercourse. In the social sense they may be inclined to be ‘loners’, but they cannot intellectually be ‘loners’ all the time. Organizational structure should facilitate these formal and informal interactions. Buildings, especially the position and character of rooms where people congregate for coffee, tea or meals, play an important part. Random meetings with colleagues and visitors in such meeting places may spark off new ideas or suggest new avenues of thought.
Encouragement to take risks	Innovation is a gamble. If you have never worked on the edge of failure, you will not have worked on the edge of real success. Creative people respond well to an organization which encourages them to take calculated risks.
A willingness to accept risk	The potential downside of freedom given to a colleague or team, as we have seen, includes mistakes, failures or financial loss. As delegation should not mean abdication, you as the leader may well have been a party to the risk. You may at least have understood the consequences of things not going as intended or planned. You have to be willing to accept an element of risk, for without freedom there would be no mistakes. But to eliminate freedom is the biggest mistake of all: freedom alone breeds innovation and entrepreneurial success. Mistakes are a by-product of progress.
An ability to work with half-baked ideas	Ideas seldom leap into the world fully-formed and ready to go. They are more like newborn babies, struggling and gasping for life. They hesitate before dismissing an ill-formed idea or an imperfect proposal, for it may contain the germ of something really useful. It follows that team creativity in groups and organizations calls for listening leaders.
A willingness to bend rules	Rules and systems have their place, but they can obstruct the process of innovation dreadfully. A leader, as a member of the management team, should respect rules and procedures but he or she should not think like a bureaucrat. Sometimes creative dyslexia – the inability to read rules – is a strength rather than a weakness. Rules can sometimes be stretched where they cannot be broken. Without this you end up being bogged down in organizational treacle.

Cont. table 3.

An ability to respond quickly	The innovative organization must have leaders who are able to commit resources and not have to defer everything to committees or upwards to Higher Authority. To be able to allocate or obtain small resources now may be far better than being able to summon mighty resources in a year's time when it is too late.
Personal enthusiasm	Only leaders who are highly motivated themselves will motivate others. Enthusiasm is contagious. Moreover, enthusiastic leaders and colleagues tend to be intellectually stimulating ones.

Source: On basis: (Adair, 2021).

Another conception of highly creative people's traits gives us more information of their potential characteristics (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011). We put those traits into the table 4 with brew characteristics of them. We should remember that creative characteristics can vary according to tasks within the domain (Wolniak, Jonek-Kowalska, 2021; 2022). But there can be distinguished typical creative traits that can be useful in the case of almost every type of creative activities.

Table 4.

Traits of highly creative people

Trait	Characteristic
Sensitive	Being sensitive helps creativeness in many ways: a. it helps with awareness of problems, known & unknown b. it helps people sense things easier c. it helps to cause people to care and commit themselves to challenges or causes
Not motivated by money	As important as money is in most societies or economies it is not a driving force for a creative person. Generally, they have an intuitive sense of the amount of money they basically need and once that need is fulfilled then money stops affecting or driving them.
Sense of destiny	Intuitively creative people know that they have a purpose, a destiny or they realize that they can choose or create one to drive them to reach greater heights of skill, ability, or talent.
Adaptable	Without the ability to adapt people could not become creative. But rather than adapt to something they choose to adapt things to suit them, their needs or the goals they are striving towards
Tolerant of ambiguity	Two or more things or ideas being right at the same time challenges the thinking of a creative person. They love to be ambiguous to challenge other people and ideas. Ambiguity helps them see things from many different perspectives all at the same time.
Observant	Creative people constantly are using their senses: consciously, sub-consciously and unconsciously, even non-consciously.
Perceive world differently	Thoreau talked about people drumming to a different drum beat. Creative people thrive on multiple ways of perceiving: seeing, hearing, touching, smelling, tasting, sensing things. These different perspectives open up their minds to unlimited possibilities.
See possibilities	Average people, people who don't believe they are creative, people who are fearful or resistant to creativeness or creative thinking prefer to work within limits with limited possibilities. Creative people love to see many, even infinite possibilities in most situations or challenges
Question asker	Creative people, especially highly creative people, probably came out of their mothers' wombs asking questions. It's in their nature to question. Question yes, not actually criticize. Their questioning nature often mistakenly appears as criticism when it is simply questioning, exploring, examining, playing with things as they are or might be.
Can synthesize correctly often intuitively	This is the ability to see the whole picture, see patterns, grasp solutions with only a few pieces, even with major pieces missing. Creative people trust their intuition, even if it isn't right 100% of the time.

Cont. table 4.

Able to fantasize	Highly creative people love to wander through their own imaginary worlds.
Flexible	Creative People are very flexible when they are playing with ideas. They love to look at things from multiple points of view and to produce piles of answers, maybe, almost, when other people are content with the or an answer or solution.
Fluent	It could be a door stop, a boat anchor, a weapon, a prop, a weight for holding down papers, etc., etc., etc. This is what a creative person would say about the possible uses of a brick.
Imaginative	Creative people love to use their imagination to play to make it seem real to experiment.
Intuitive	The more creative a person is, the more they tap their intuition skills; the ability to see answers with minimum facts, to sense problems even when they aren't happening.
Original	Being original is a driving force for creative people. They thrive on it.
Ingenious	Doing the unusual. Solving unsolvable problems. Thinking what has never been thought of before. These are all traits of a creative person that make them be ingenious at times.
Energetic	Challenges, problems, and new ideas once committed by a creative person truly excite them and provide them with seemingly unlimited amounts of energy; such as Sherlock Holmes once he grasps a sense of the mystery.
Sense of humor	Laughter and creativity truly go together. Many experts believe that creativity can occur without a touch of humor believing that seriousness tends to squelch creativeness or creative thinking.
Self-actualizing	The psychologist Abraham Maslow created this term in the 1960s representing the ultimate motivator of people: the need or desire to be all you can be, to be what you were meant to be.
Self-disciplined	This is one trait that appears to be ambiguous in highly creative people. They can appear disorganized, chaotic at times while at the same time they are highly self-disciplined. At the same time, they greatly resist the discipline of other people who do not have a creative mind.
Self-knowledgeable	One of the few things highly creative people had in common is that they all kept some form of journal and were constantly striving to better understand themselves.
Specific interests	This is still another ambiguous trait of creative people. They appear on the surface to be interested in everything, while at the same time they have very specific interests that they commit their true energies and efforts to. By being willing to be exposed to seemingly unlimited interests they discover more about their particular specific interests.
Divergent thinker	Creative people love to diverge from the norm, to look at things from multiple positions, to challenge anything that exists. Because of this they are seen at times to be off-key, deviant, atypical, irregular, or uncharacteristic.
Curious	Creative people are continuously curious, often child-like.
Open-ended	In order to explore many possibilities creative people, tend to stay open-ended about answers or solutions until many have been produced.
Independent	Creative people crave and require a high degree of independence, resist dependence but often can thrive on beneficial inter-dependence.
Severely critical	Creative people challenge most every-thing, every idea, every rule. They challenge, challenge, and challenge some more to the point that most other people see their challenging as severe criticism.
Non-conforming	Conforming is the antithesis, the opposite of creativeness and in order to be creative, creative people must be non-conforming and go against the norm, swim upstream.
Confident	This is another ambiguous trait in creative people. When they are at their most creative they are extremely confident. When they are in a stage of frustration when nothing seems to be working they often lack confidence. After much positive experience they begin to trust themselves and know that they will become depressed, frustrated, nearly devastated but their internal subconscious confidence keeps them moving or at least floating until they experience or discover an aha! (a breakthrough idea or piece of information).
Risk taker	This trait is a general misunderstanding of many non-creative people or people who fear the creativeness of creative people. Highly creative people are not really risk-takers because they do not see what they are doing as a risk. They simply see it as a possible solution or path towards a solution. They have other possible solutions, often many others in their head or their notes to use if a particular idea or solution does work.
Persistent	Creative people do not give up on things that mean a lot to them.

Source: On basis: (Alan, 2021).

5. Conclusion

The publication concentrate on problems connected with various aspects of traits of highly inventive people. In the paper there is an analysis of the very important role of cognition in innovativeness. In the paper there is an analysis of various aspects of the role of cognition like: general intelligence, genius, cognitive abilities and observer judgments of intelligence. On the basis of the analysis following main traits of highly innovative peoples can be distinguished: sensitive, not motivated by money, sense of destiny, adaptable, tolerant of ambiguity, observant, perceive world differently, see possibilities, question asker, ability to synthesize, able to fantasize, flexible, fluent, imaginative, intuitive, original, ingenious, energetic, sense of humor, self-actualizing, self-disciplined, self-knowledgeable, specific interests, divergent thinker, curious, open-ended, independent, severely critical, non-conforming, confident, risk taker.

References

1. Adair, J. (2007). *Leadership for innovation. How to organize team creativity and harvest ideas*. London and Philadelphia: Kogan Page.
2. Alan, R. (2021). *32 traits of Highly creative People*, <http://www.cre8ng.com/materials/wp-content/uploads/2010/08/32-traits-w-crayons.pdf>, 29.12.2021.
3. Baer, M., Oldham, R. (2006). The Curvilinear Relation Between Experienced Creative Time Pressure and Creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology*, 91, 963-970.
4. Costa, S., Paez, D., Sanchez, F., Garaigordobil, M., Gondim, S. (2015). Personal factors of creativity: A second order meta-analysis. *Journal of Work and Organizational Psychology*, 31, 165-173.
5. Drozd, R., Wolniak, R. (2021). Metrisable assessment of the course of stream-systemic processes in vector form in industry 4.0. *Quality and Quantity*, 1-16, DOI: 10.1007/s11135-021-01106-w.
6. Drozd, R., Wolniak, R. (2021). Systematic assessment of product quality. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(4), 1-12.
7. Eysenck, H.J. (1994). *The measurement of creativity*. In: M. Boden (Ed.), *Dimensions of Creativity*. Cambridge, MA: MIT Press.
8. Furnham, A., Bachtiar, V. (2008). Personality and intelligence as predictors of creativity. *Personality and Individual Differences*, 45(7), 613-617.

9. Gajdzik, B., Grebski, M., Grebski, W., Wolniak, R. (2022). *Human factor activity in lean management and quality management*. Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa; Dom Organizatora.
10. Gajdzik, B., Wolniak, R. (2021). Digitalisation and innovation in the steel industry in Poland - selected tools of ICT in an analysis of statistical data and a case study. *Energies*, 14(11), 1-25.
11. Gajdzik, B., Wolniak, R. (2021). Influence of the COVID-19 crisis on steel production in Poland compared to the financial crisis of 2009 and to boom periods in the market. *Resources*, 10(1), 1-17.
12. Gajdzik, B., Wolniak, R. (2021). Transitioning of steel producers to the steelworks 4.0 - literature review with case studies. *Energies*, 14(14), 1-22.
13. Gajdzik, B., Wolniak, R. (2022). Framework for R&D&I Activities in the Steel Industry in Popularizing the Idea of Industry 4.0. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(3), 133.
14. Gajdzik, B., Wolniak, R. (2022). Influence of Industry 4.0 Projects on Business Operations: literature and empirical pilot studies based on case studies in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 1-20.
15. Gajdzik, B., Wolniak, R. (2022). Smart Production Workers in Terms of Creativity and Innovation: The Implication for Open Innovation. *Journal of Open Innovations: Technology, Market and Complexity*, 8(1), 68.
16. Gajdzik, B., Wolniak, R., Grebski, W.W. (2022). An econometric model of the operation of the steel industry in Poland in the context of process heat and energy consumption, *Energies*, 15(21), 7909, 1-26,
17. Gaur, S.P. (2016). Kindling the Creative Potential. *Vision*, 20(4), 290-299.
18. Gębczyńska, A., Wolniak, R. (2018). *Process management level in local government*. Philadelphia: CreativeSpace.
19. George, J.M., Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behaviour: An interactional approach. *Journal of Applied Psychology*, 86, 513-524.
20. Grabowska, S., Grebski, M., Grebski, W., Saniuk, S., Wolniak, R. (2021). *Inżynier w gospodarce 4.0*. Toruń: Towarzystwo Naukowe Organizacji i Kierownictwa – Stowarzyszenie Wyższej Użyteczności "Dom Organizatora".
21. Grabowska, S., Grebski, M., Grebski, W., Wolniak, R. (2019). *Introduction to engineering concepts from a creativity and innovativeness perspective*. New York: KDP Publishing.
22. Grabowska, S., Grebski, M., Grebski, W., Wolniak, R. (2020). *Inżynier – zawód przyszłości. Umiejętności i kompetencje inżynierskie w erze Przemysłu 4.0*. Warszawa: CeDeWu.
23. Guilford, J.P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.

24. Hąbek, P., Wolniak, R. (2013). Analysis of approaches to CSR reporting in selected European Union countries. *International Journal of Economics and Research*, 4(6), 79-95.
25. Hąbek, P., Wolniak, R. (2016). Assessing the quality of corporate social responsibility reports: the case of reporting practices in selected European Union member states. *Quality & Quantity*, 50(1), 339-420.
26. Hąbek, P., Wolniak, R. (2016). Factors influencing the development of CSR reporting practices: experts' versus preparers' points of view. *Engineering Economy*, 26(5), 560-570.
27. Hąbek, P., Wolniak, R. (2016). Relationship between management practices and quality of CSR reports. *Procedia – Social and Behavioral Sciences*, 220, 115-123.
28. Harrison, M.M., Neff, N.L., Schwall A.R., Zhao, X. (2006). A Meta-analytic *Investigation of Individual Creativity and Innovation*. Paper presented at the 21st Annual Conference for the Society for Industrial and Organizational Psychology, Dallas, Texas.
29. Hu, W., Zheng, D. ((2021). *Research on the influence of team i-deals level on team innovation-from the perspective of collective thriving*. E3S Web of Conferences, 251, 03087.
30. Hys, K., Wolniak, R. (2018). Praktyki przedsiębiorstw przemysłu chemicznego w Polsce w zakresie CSR. *Przemysł Chemiczny*, 9, 1000-1002.
31. Jauk, E., Eberhardt, L., Koschmieder, C., Diedrich, J., Pretsch, J., Benedek, M., Neubauer, A.C. (2019). A New Measure for the Assessment of Appreciation for Creative Personality. *Creativity Research Journal*, 31(2), 149-163.
32. Jonek-Kowalska, I., Wolniak, R. (2021). Economic opportunities for creating smart cities in Poland. Does wealth matter? *Cities*, 114, 1-6.
33. Jonek-Kowalska, I., Wolniak, R. (2021). The influence of local economic conditions on start-ups and local open innovation system. *Journal of Open Innovations: Technology, Market and Complexity*, 7(2), 1-19.
34. Jonek-Kowalska, I., Wolniak, R. (2022). Sharing economies' initiatives in municipal authorities' perspective: research evidence from Poland in the context of smart cities' development. *Sustainability*, 14(4), 1-23.
35. Jonek-Kowalska, I., Wolniak, R., Marinina, O.A., Ponomarenko, T.V. (2022). *Stakeholders, Sustainable Development Policies and the Coal Mining Industry. Perspectives from Europe and the Commonwealth of Independent States*. London: Routledge.
36. Kordel, P., Wolniak, R. (2021). Technology entrepreneurship and the performance of enterprises in the conditions of Covid-19 pandemic: the fuzzy set analysis of waste to energy enterprises in Poland. *Energies*, 14(13), 1-22.

37. Kwiotkowska, A., Gajdzik, B., Wolniak, R., Vveinhardt, J., Gębczyńska, M. (2021). Leadership competencies in making Industry 4.0 effective: the case of Polish heat and power industry. *Energies*, 14(14), 1-22.
38. Kwiotkowska, A., Wolniak, R., Gajdzik, B., Gębczyńska, M. (2022). Configurational paths of leadership competency shortages and 4.0 leadership effectiveness: an fs/QCA study. *Sustainability*, 14(5), 1-21.
39. MacKinnon, D.W. (1978). *In search of human effectiveness*. New York: Creative Education Foundation.
40. Mumford, M.D., Scott, G.M., Gaddis, B.H. Strange, J.M. (2002). Leading creative people: Orchestrating expertise and relationships. *Leadership Quarterly*, 13, 705-750.
41. Ng, R.Y.-K., Yeung, S.S.-M. (2013). *Stage-gate model in action: Regulating creativity and business imperatives in creative industries*. Proceedings of the International Conference on Engineering Design, ICED, 7 DS75-07, 567-573.
42. Olkiewicz, M., Olkiewicz, A., Wolniak, R., Wyszomirski, A. (2021). Effects of pro-ecological investments on an example of the heating industry - case study. *Energies*, 14(18), 5959, 1-24.
43. Orzeł, B., Wolniak, R. (2021). Clusters of elements for quality assurance of health worker protection measures in times of COVID-19 pandemic. *Administrative Science*, 11(2), 1-14, 46.
44. Orzeł, B., Wolniak, R. (2022). Digitization in the design and construction industry - remote work in the context of sustainability: a study from Poland. *Sustainability*, 14(3), 1-25.
45. Patterson, F., Kerrin, M., Gatto-Roissard, G. (2021). *Characteristics & Behaviours of Innovative People in Organisations*. Literature Review, https://www.researchgate.net/publication/242102530_Characteristics_Behaviours_of_Innovative_People_in_Organisations, 29.11.2022.
46. Ponomarenko, T.V., Wolniak, R., Marinina, O.A. (2016). Corporate Social responsibility in coal industry (Practices of russian and european companies). *Journal of Mining Institute*, 222, 882-891.
47. Raviv, D. (2008). *Innovative thinking: Desired skills and related activities*. Conference Proceedings. ASEE Annual Conference and Exposition.
48. Sauermann, H., Cohen, W.M. (2008). What makes them tick? Employee motives and firm innovation. *NBER Working Paper*, N.14443.
49. Seon-Young, L., Jiyeon, M. (2016). The Profiles of Creative Potential and Personality Characteristics of Adult Professionals. *Creativity Research Journal*, 28(3), 298-309.
50. Stawiarska, E., Sz wajca, D., Matusek, M., Wolniak, R. (2020). *Wdrażanie rozwiązań przemysłu 4.0 w wybranych funkcjonalnych obszarach zarządzania przedsiębiorstw branży motoryzacyjnej: próba diagnozy*. Warszawa: CeDeWu.

51. Stawiarska, E., Szwajca, D., Matuszek, M., Wolniak, R. (2021). Diagnosis of the maturity level of implementing Industry 4.0 solutions in selected functional areas of management of automotive companies in Poland. *Sustainability*, 13(9), 1-38.
52. Stecuła, K., Wolniak, R. (2022). Advantages and Disadvantages of E-Learning Innovations during COVID-19 Pandemic in Higher Education in Poland. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(3), 159.
53. Stecuła, K., Wolniak, R. (2022). Influence of COVID-19 Pandemic on Dissemination of Innovative E-Learning Tools in Higher Education in Poland. *Journal of Open Innovations: Technology, Market and Complexity*, 8(1), 89.
54. Sułkowski, M., Wolniak, R. (2016). Przegląd stosowanych metod oceny skuteczności i efektywności organizacji zorientowanych na ciągłe doskonalenie. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 67, 63-74.
55. Sułkowski, M., Wolniak, R. (2018). *Poziom wdrożenia instrumentów zarządzania jakością w przedsiębiorstwach branży obróbki metali*. Częstochowa: Oficyna Wydawnicza Stowarzyszenia Menedżerów Produkcji i Jakości.
56. Wolfradt, U., Pretz, J.E. (2001). Individual differences in creativity: Personality, story writing and hobbies. *European Journal of Personality*, 15(4), 297-310.
57. Wolniak, R., Skotnicka-Zasadzień, B. (2014). The use of value stream mapping to introduction of organizational innovation in industry. *Metalurgija*, 53(4), 709-713.
58. Wolniak, R. (2011). *Parametryzacja kryteriów oceny poziomu dojrzałości systemu zarządzania jakością*. Gliwice: Wydawnictwo Politechniki Śląskiej.
59. Wolniak, R. (2013). A typology of organizational cultures in terms of improvement of the quality management. *Manager*, 17(1), 7-21.
60. Wolniak, R. (2013). Projakościowa typologia kultur organizacyjnych. *Przegląd Organizacji*, 3, 13-17.
61. Wolniak, R. (2014). Korzyści doskonalenia systemów zarządzania jakością opartych o wymagania normy ISO 9001:2009. *Problemy Jakości*, 3, 20-25.
62. Wolniak, R. (2016). Kulturowe aspekty zarządzania jakością. *Etyka biznesu i zrównoważony rozwój. Interdyscyplinarne studia teoretyczno-empiryczne*, 1, 109-122.
63. Wolniak, R. (2016). *Metoda QFD w zarządzaniu jakością. Teoria i praktyka*. Gliwice: Wydawnictwo Politechniki Śląskiej.
64. Wolniak, R. (2016). Relations between corporate social responsibility reporting and the concept of greenwashing. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 87, 443-453.
65. Wolniak, R. (2016). The role of QFD method in creating innovation. *Systemy Wspomagania Inżynierii Produkcji*, 3, 127-134.
66. Wolniak, R. (2017). Analiza relacji pomiędzy wskaźnikiem innowacyjności a nasyceniem kraju certyfikatami ISO 9001, ISO 14001 oraz ISO/TS 16949. *Kwartalnik Organizacja i Kierowanie*, 2, 139-150.

67. Wolniak, R. (2017). Analiza wskaźników nasycenia certyfikatami ISO 9001, ISO 14001 oraz ISO/TS 16949 oraz zależności pomiędzy nimi. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 108, 421-430.
68. Wolniak, R. (2017). The Corporate Social Responsibility practices in mining sector in Spain and in Poland – similarities and differences. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 111, 111-120.
69. Wolniak, R. (2017). The Design Thinking method and its stages. *Systemy Wspomagania Inżynierii Produkcji*, 6, 247-255.
70. Wolniak, R. (2017). *The use of constraint theory to improve organization of work*. 4th International Multidisciplinary Scientific Conference on Social Sciences and Arts. SGEM 2017, 24-30 August 2017, Albena, Bulgaria. Conference proceedings. Book 1, *Modern science. Vol. 5, Business and management*. Sofia: STEF92 Technology, 1093-1100.
71. Wolniak, R. (2018). Functioning of social welfare on the example of the city of Łazy. *Zeszyty Naukowe Wyższej Szkoły, Humanitas. Zarządzanie*, 3, 159-176.
72. Wolniak, R. (2018). Methods of recruitment and selection of employees on the example of the automotive industry. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 128, 475-483.
73. Wolniak, R. (2019). Context of the organization in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 133, 121-136.
74. Wolniak, R. (2019). Downtime in the automotive industry production process - cause analysis. *Quality, Innovation, Prosperity*, 2, 101-118.
75. Wolniak, R. (2019). Leadership in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 133, 137-150.
76. Wolniak, R. (2019). Support in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 137, 247-261.
77. Wolniak, R. (2019). The level of maturity of quality management systems in Poland - results of empirical research. *Sustainability*, 15, 1-17.
78. Wolniak, R. (2020). Design in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 148, 769-781.
79. Wolniak, R. (2020). Operations in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 148, 783-794.
80. Wolniak, R. (2020). Quantitative relations between the implementation of industry management systems in European Union countries. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 142, 33-44.
81. Wolniak, R. (2021). Internal audit and management review in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 151, 724-608.

82. Wolniak, R. (2021). Performance evaluation in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 151, 725-734.
83. Wolniak, R. (2022). Engineering ethics – main principles. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 155, 579-594.
84. Wolniak, R. (2022). Management of engineering teams. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 157, 667-674.
85. Wolniak, R. (2022). Project management in engineering. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 157, 685-698.
86. Wolniak, R. (2022). The role of the engineering profession in developing and implementing sustainable development principles. *Silesian University of Technology Scientific Papers. Organization and Management Series*, 155, 595-608.
87. Wolniak, R., Sułkowski, M. (2015). Rozpowszechnienie stosowania Systemów Zarządzania Jakością w Europie na świecie – lata 2010-2012. *Problemy Jakości*, 5, 29-34.
88. Wolniak, R., Grebski, M.E. (2018). Innovativeness and creativity as factors in workforce development – perspective of psychology. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 203-214.
89. Wolniak, R., Grebski, M.E. (2018). Innovativeness and creativity as nature and nurture. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 215-226.
90. Wolniak, R., Grebski, M.E. (2018). Innovativeness and Creativity of the Workforce as Factors Stimulating Economic Growth in Modern Economies. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarządzanie*, 116, 227-240.
91. Wolniak, R., Grebski, M.E., Skotnicka-Zasadziń, B. (2019). Comparative analysis of the level of satisfaction with the services received at the business incubators (Hazleton, PA, USA and Gliwice, Poland). *Sustainability*, 10, 1-22.
92. Wolniak, R., Hąbek, P. (2015). Quality management and corporate social responsibility. *Systemy Wspomagania w Inżynierii Produkcji*, 1, 139-149.
93. Wolniak, R., Hąbek, P. (2016). Quality assessment of CSR reports – factor analysis. *Procedia – Social and Behavioral Sciences*, 220, 541-547.
94. Wolniak, R., Jonek-Kowalska, I. (2021). The level of the quality of life in the city and its monitoring. *Innovation (Abingdon)*, 34(3), 376-398.
95. Wolniak, R., Jonek-Kowalska, I. (2021). The quality of service to residents by public administration on the example of municipal offices in Poland. *Administration Management Public*, 37, 132-150.
96. Wolniak, R., Jonek-Kowalska, I. (2022). The creative services sector in Polish cities. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 1-23.
97. Wolniak, R., Saniuk, S., Grabowska, S., Gajdzik, B. (2020). Identification of energy efficiency trends in the context of the development of industry 4.0 using the Polish steel sector as an example. *Energies*, 13(11), 1-16.

98. Wolniak, R., Skotnicka, B. (2011).: *Metody i narzędzia zarządzania jakością – Teoria i praktyka, cz. I*. Gliwice: Wydawnictwo Naukowe Politechniki Śląskiej.
99. Wolniak, R., Skotnicka-Zasadzień, B. (2008). *Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach*. Gliwice: Wydawnictwo Politechniki Śląskiej.
100. Wolniak, R., Skotnicka-Zasadzień, B. (2010). *Zarządzanie jakością dla inżynierów*. Gliwice: Wydawnictwo Politechniki Śląskiej.
101. Wolniak, R., Skotnicka-Zasadzień, B. (2018). Developing a model of factors influencing the quality of service for disabled customers in the conditions of sustainable development, illustrated by an example of the Silesian Voivodeship public administration. *Sustainability*, 7, 1-17.
102. Wolniak, R., Skotnicka-Zasadzień, B. (2022). Development of photovoltaic energy in EU countries as an alternative to fossil fuels. *Energies*, 15(2), 1-23.
103. Wolniak, R., Skotnicka-Zasadzień, B., Zasadzień, M. (2019). Problems of the functioning of e-administration in the Silesian region of Poland from the perspective of a person with disabilities. *Transylvanian Review of Public Administration*, 57E, 137-155.
104. Wolniak, R., Sułkowski, M. (2015). Motywy wdrażanie certyfikowanych Systemów Zarządzania Jakością. *Problemy Jakości*, 9, 4-9.
105. Wolniak, R., Sułkowski, M. (2016). The reasons for the implementation of quality management systems in organizations. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, 92, 443-455.
106. Wolniak, R., Wyszomirski, A., Olkiewicz, M., Olkiewicz, A. (2021). Environmental corporate social responsibility activities in heating industry - case study. *Energies*, 14(7), 1930, 1-19,
107. Ziegert, J.C., Dust, S.B. (2021). Integrating Formal and Shared Leadership: the Moderating Influence of Role Ambiguity on Innovation. *Journal of Business and Psychology*, 36(6), 969-984.8.12.

SELECTED SOURCES OF PROPERTY INFORMATION FUNDAMENTAL TO PROPERTY INVESTMENT

Aneta ZAREMBA^{1*}, Małgorzata BLASZKE²

¹ West Pomeranian University of Technology, Szczecin; AZaremba@zut.edu.pl, ORCID: 0000-0002-7806-6710

² West Pomeranian University of Technology, Szczecin; MBlaszke@zut.edu.pl, ORCID: 0000-0001-7806-6710

* Correspondence author

Purpose: The aim of the publication was to present selected sources of information on real estate. Selected planning documents were presented, which are not only necessary when planning new developments in communes, but also help to estimate the value of real estate.

Design/methodology/approach: An analysis of the legislation governing the meaning and use of planning documents was carried out. A literature analysis on the subject was also carried out.

Findings: The range of data used for the real estate market should include the use of multiple sources of information, both mandatory and optional. Deficiencies in the use of real estate information, or the acquisition of poor quality information, may lead to inappropriate investment decisions by real estate market participants. Therefore, basic sources of information on real estate should be taken into account when making any decisions concerning the broadly understood management of real estate; in the case of investments, planning studies such as the local spatial development plan or the study of the conditions and directions of spatial development of a municipality should be taken into account in particular.

Research limitations/implications: Planning documents are extremely important when planning new developments. These documents are not only an excellent source of information on existing land or built-up land, but also help to plan the development of vacant land on the urban fringe, among other things.

Practical implications: The analysis of the planning documentation presented helps to understand the relevance of local spatial plans and development studies of municipalities for planned construction projects or land use change.

Originality/value: To date, there has been very little analysis of planning documents as an important source of information in property management.

Keywords: planning documents, real estate market, real estate information.

Category of the paper: Review article.

1. Introduction

In a market economy, information on real estate is a fundamental component of the issue of activities aimed at investing or developing optimal principles for the management, administration and marketing of real estate owned by private, state or municipal entities.

Investment is a fundamental factor in economic development. However, it should be borne in mind that real estate is a special object of investment. An important benefit of investing in real estate is the security of capital. The investment of capital in real estate not only secures it, but also protects it against inflation in the long term. In a market economy, there are many forms of investment with varying levels of risk, but one of the basic directions is real estate investment. Every investor, when embarking on an investment process, verifies his or her intentions on the basis of an expert opinion, based on an in-depth market analysis and a detailed assessment of the investment's effectiveness. The information that characterises the various types of real estate is often incomplete and scattered in various source collections, as no existing professional collection covers the full range of real estate information. In the Real Estate Management Act (the Act of 21 August 1997), art. 155 states that for the purposes of real estate appraisal, all necessary and available data on real estate, contained in particular in:

- 1) land and mortgage registers,
- 2) real estate cadastre,
- 3) register of land development networks,
 - a) register of real estate serial numbers,
 - b) registers of historical monuments,
- 4) taxation tables and taxation maps,
- 5) local plans, studies of land development conditions and directions of spatial development of a municipality or decisions on land development conditions and building permits,
- 6) lists maintained by tax offices,
 - a) documents held by agencies entrusted by the State Treasury, by means of laws, with the exercise of ownership rights and other rights in rem in its favour,
 - b) in notarial deeds held by housing cooperatives concerning the disposal of cooperative rights to premises,
- 7) contracts, rulings, decisions and other documents constituting the basis for entry in land and mortgage registers, registers forming part of the cadastre, as well as in extracts from appraisal reports submitted to the real estate cadastre.

Critical work on real estate activity and the financialisation of urban development encountered in the literature has mainly focused on investor-developer-government interactions to highlight how the values, expectations and goals of real estate and investors are enacted through regulatory and tax reforms, which in turn affect the way cities are built (Robin, 2018; Bakhareva 2019).

2. Planning documentation as a source of property information

Taking into account the above mentioned sources of information on real estate, all but the very important ones regarding future possible uses, development and zoning of real estate include planning and design studies, including the study of conditions and directions for spatial development of the municipality and the local zoning plan.

Spatial planning, which involves creating a framework for the location of development and infrastructure, is a key driver of many change processes, such as land use (Oliveira, Leuthard, Tobias, 2019).

It is worth emphasising that the current state and effects of planning and spatial development date back to 1989, when the system transformation took place. Its effect with regard to planning development was the transfer of planning freedom to all local government units at the municipal level. Of course, the regime change itself is not directly responsible for the costly and often irreversible changes in space (Tulumello, Cotella, Othengrafen, 2020), the responsibility must necessarily be seen and characterised in a broader perspective that includes in its span various interest groups (residents, developers, government officials and all those for whom a particular area represents a measurable value, not necessarily expressed by a means of payment) (Hołuj, 2012).

Pursuant to the Act on Spatial Planning and Development (the Act of 27 March 2003), the shaping and conducting of spatial policy in the territory of the municipality, including the adoption of the study of spatial development conditions and directions and the local spatial development plan, is one of the municipality's own tasks.

The study of spatial development conditions and directions (suikzp) defines the directions for the economic development of the municipality, both in terms of priorities and permissible directions, as well as location suggestions for the distribution of various forms of business activity in the municipal space. It is in this document that the decision is made as to the desired directions of municipal development and whether, in addition to the desired directions, other forms of economic activity may also be developed in the municipal space and under what conditions. The study not only shows the distribution of individual spatial functions against the background of the existing conditions, it also shows social, demographic and ecological conditions, geological resources and the possibilities of their exploitation, and finally cultural assets, including the distribution of archaeological monuments. It is practically the only document showing at the same time the totality of the existing conditions and the practical prospects for the development of the municipality accepted by all its inhabitants. The study is not a local legal act.

The Suikzpl takes into account conditions resulting in particular from:

- previous land use, development and infrastructure,
- state of spatial order and requirements of its protection,
- the state of the environment, including the condition of agricultural and forestry production space, size and quality of water resources and the requirements of environmental, nature and cultural landscape protection,
- condition of cultural heritage and historical monuments as well as contemporary culture assets,
- conditions and quality of life of residents, including protection of their health,
- threats to the safety of the population and its property,
- needs and possibilities for development of the municipality,
- the legal status of the land,
- occurrence of objects and areas protected under separate regulations,
- existence of areas of natural geological threats
- existence of documented mineral deposits and groundwater resources,
- existence of mining areas designated on the basis of separate provisions,
- state of the communication and technical infrastructure systems, including the degree of orderliness of water and sewage management, power supply and waste management,
- tasks serving the realisation of translocal public objectives.

In particular, it defines:

- directions of changes in the spatial structure of the municipality and land use,
- directions and indicators for land development and use, including areas excluded from development (Stanek, 2011),
- areas and principles of protection of the environment and its resources, protection of nature, cultural landscape and spas,
- areas and principles of protection of cultural heritage and monuments as well as contemporary culture goods,
- directions of the development of communication and technical infrastructure systems,
- areas where public purpose investments of local importance will be located,
- areas where public purpose investments of supra-local importance will be located, as specified in the voivodeship spatial development plan and special programmes,
- areas for which it is obligatory to prepare a local spatial development plan pursuant to separate provisions, including areas requiring real estate consolidation and division, as well as areas for the arrangement of commercial facilities with retail space exceeding 2000 m, and areas of public space,
- areas for which the municipality intends to prepare a local spatial development plan, including areas requiring a change of the designation of agricultural and forest land for non-agricultural and non-forest purposes,

- directions and principles of shaping the agricultural and forest production space,
- areas exposed to the danger of flooding and landslides,
- objects or areas for which a protective pillar in the mineral deposit is marked,
- areas of holocaust memorials and their protection zones, as well as restrictions on conducting economic activity in these areas, in accordance with the provisions of the Act of 7 May 1999 on the protection of the areas of former Nazi extermination camps,
- areas requiring transformation, rehabilitation or reclamation,
- boundaries of closed areas and their protection zones,
- other problem areas, depending on the conditions and development needs existing in the municipality.

The municipality's zoning plan is a document which contains a very broad set of information on the municipality, its community, economy, which, ordered and then systematically updated and enriched, will be the basis for the construction of a municipal spatial information system, necessary for the management of the municipality in a market economy (...).

A very important source of information and, at the same time, an act of local law is the local spatial development plan (mpzp), which is drawn up in order to determine the purpose of land and specify the ways in which it may be developed and built upon (Zwirowicz, 2012).

Prior to the adoption of a resolution to draw up a local plan, the head of the local authority, mayor or president performs analyses of the justification for the plan and the degree of compliance of the envisaged solutions with the provisions of the Study, prepares surveying and cartographic materials and the necessary scope of work, and prepares a draft local plan containing text and graphics, also compliant with the provisions of the Study and separate regulations pertaining to the area covered by the plan. The Local Plan is an act of local law (Stelmach-Fita, 2017).

The local spatial development plan shall mandatorily specify (Zbierska, 2013):

- land use and lines demarcating areas with different use or different development principles,
- principles of protection and shaping of the spatial order,
- principles of protection of the environment, nature and cultural landscape,
- principles of protection of cultural heritage and monuments as well as contemporary culture assets,
- requirements resulting from the needs of shaping public spaces,
- parameters and indicators of shaping the development and land development, including the building lines, dabbits of the objects and building intensity indicators,
- boundaries and ways of using protected areas or objects, including mining areas, as well as areas exposed to the danger of flooding and endangered by landslides,
- detailed principles and conditions of merging and dividing the properties included in the local plan,

- specific terms and conditions of land development, including the prohibition of development,
- principles of modernisation, development and construction of communication and technical infrastructure systems,
- manners and terms of temporary development, arrangement and use of land,
- percentage rates on the basis of which the fee is determined.

And as required (Kowalczyk, 2011):

- boundaries of areas requiring real estate consolidation and division,
- boundaries of areas of rehabilitation of existing buildings and technical infrastructure, boundaries of areas requiring transformation or reclamation,
- boundaries of areas for construction of certain large commercial facilities,
- boundaries of recreation and leisure areas and areas for organising mass events,
- boundaries of Holocaust memorials and their protection zones.

The contents of the Local Plan, are (Mroziak 2015):

1. the plan document comprising:
 - text (a set of findings constituting provisions regulating the use and conditions of development and construction of land, which are binding on the municipal authorities and on natural and legal persons),
 - drawing or drawings of the plan as an appendix to the resolution (the drawing of the plan is made on an up-to-date situation and altitude map, including the land ownership boundaries, at a scale resulting from the substantive premises and corresponding to the subject matter of the plan's findings; the drawing of the plan should be made in a technique ensuring the possibility of publication and making copies).
2. formal and legal documentation (collection of materials gathered and created as a result of the work on the plan):
 - substantive documentation of the plan (collection of materials including studies and analyses collected and/or performed in the planning process and concerning the justification for the plan's preparation and the degree of compliance of the envisaged solutions with the study's findings),
 - documentation of the planning process (materials documenting the maintenance of planning processes required by law),
 - forecast of the effects of the plan's findings on the environment.

The LSDP contains a lot of valuable information which should be taken into account by valuers (Czekiel-Świtalska, 2005), real estate agents or property managers, but among the most important is the information concerning:

- the function of the site and the location of the function in relation to other functions,
- the location of the function in relation to spatial form elements,
- limitations resulting from the principles of shaping spatial forms, e.g. the type of development,
- arrangements concerning the anticipated scope of development and equipping the area with technical and social infrastructure facilities,
- restrictions on the use of individual areas.

The local plan, which is an act of local law, is the basis for formulating the conditions for development and land use in administrative decisions. It grants or withdraws the right to develop land and determines the principles on which this right may be exercised (Radzimski, 2011). It is also a reference for other decisions and opinions, conditional on compliance with its determinations. The plan's findings, together with other provisions of law, shape the content and use of the property right. This makes the plan the basic normative act shaping the content of the property ownership right and it must comply with the requirements of the competence acts. Local planning is therefore an important factor in the process of shaping spatial order and protecting values that largely determine the attractiveness of a city.

3. Summary

In summary, it should be stated that the range of data used for real estate market purposes should include the use of numerous sources of both obligatory and optional information.

Obligatory information sources (which have legal regulations governing their functioning) include:

- land registers,
- real estate cadaster,
- geodetic register of land development networks,
- local spatial development plan,
- state geodetic and cartographic resource,
- taxation tables and maps.

Optional sources of information (created as a result of processing data collected in obligatory sources after adding thematic data) include:

- branch information systems on utility networks and buildings,
- technical and project documentation,
- inventories maintained by tax offices,
- databases on property prices and values,

- databases created by companies and insurance companies,
- statistical studies, collections of construction unit price indices, catalogues of material expenditures.

Information has many meanings, e.g. to inform about something, to communicate something, to instruct. In real estate management, it is one of the basic elements for making effective investment decisions. Lack of information or poor quality information can lead to inappropriate investment decisions by real estate market participants. Therefore, the basic sources of information about real estate should be taken into account when making any decisions concerning the broadly understood real estate management; in the case of investments, planning studies such as the local zoning plan or the study of the conditions and directions of the municipality's spatial development should be particularly taken into account.

References

1. Bakhareva, O. (2019). Strategic planning of infrastructure development: BIM and intelligent building. *J. Advanced Res. L. & Econ.*, Vol. 10, 2262.
2. Czekięł-Świtalska, E. (2005). Miejskowy plan zagospodarowania przestrzennego a skutki ekonomiczne jego uchwalenia. *Przestrzeń i forma*, 1, pp. 87-92.
3. Hołuj, A. (2012). Perspektywy rozwoju regionalnego Polski w okresie programowania po 2013 r. In: A. Harańczyk (Ed.), *Problemy i dylematy planowania przestrzennego w różnych typach jednostek terytorialnych*. Warszawa: KPZK PAN.
4. Hołuj, D. (2014). Wizje planistów a oczekiwania użytkowników przestrzeni miejskiej. Konfliktogenność procesu uchwalania planów miejscowych w wybranych obszarach polskich metropolii. *Biuletyn KPZK*, 253.
5. Kowalczyk, M. (2011). Dokumenty strategiczne i planistyczne w gospodarowaniu przestrzenią Wrocławia. *Studia i Materiały*, 127.
6. Małkowska, A. (2005). Systemy informacji o nieruchomościach. *Zeszyty Naukowe Akademii Ekonomicznej w Krakowie*, Vol. 687, pp. 115-130.
7. Mrozięk, K. (2015). Miejskowe plany zagospodarowania przestrzennego jako element monitoringu rozwoju lokalnego. *Studia i Prace WNEiZ US*, Vol. 42, pp. 149-160.
8. Oliveira, E., Leuthard, J., Tobias, S. (2019). Spatial planning instruments for cropland protection in Western European countries. *Land Use Policy*, Vol. 87, 104031.
9. Radzimski, A. (2011). Rola planowania przestrzennego na przykładzie budownictwa mieszkaniowego w Poznaniu. In: T. Markowski, P. Źuber (Eds.), *System planowania przestrzennego i jego rola w strategicznym zarządzaniu rozwojem kraju*. Warszawa: Studia KPZK PAN, t. CXXXIV.

10. Ratcliffe, J., Stubbs, M., Keeping, M. (2021). *Urban planning and real estate development*. London: Routledge.
11. Robin, E. (2018). Performing real estate value(s): Real estate developers, systems of expertise and the production of space. *Geoforum*.
12. Stanek, L. (2011). Ekonomiczno-społeczne znaczenie prognoz skutków finansowych uchwalenia miejscowych planów zagospodarowania przestrzennego. *Inżynieria Ekologiczna*, pp. 191-201.
13. Stelmach-Fita, B. (2017). Europejskie źródła danych w zakresie zagospodarowania przestrzennego: potrzeby i ograniczenia. *Studies of the Industrial Geography Commission of the Polish Geographical Society*, 31(3), pp. 185-203.
14. Tulumello, S., Cotella, G., Othengrafen, F. (2020). Spatial planning and territorial governance in Southern Europe between economic crisis and austerity policies. *International planning studies*, Vol. 25(1), pp. 72-87.
15. Ustawa z dnia 21 sierpnia 1997 roku o gospodarce nieruchomościami, Dz.U. z 2021 r. poz. 1899.
16. Ustawa z dnia 23 marca 2003 r. o planowaniu i zagospodarowaniu przestrzennym, Dz.U. z 2022 r., poz. 503.
17. Zbierska, A. (2013). Obszary chronione w lokalnych systemach informacji przestrzennej na potrzeby planowania przestrzennego. In: M. Kunz, A. Nienartowicz (eds.), *Systemy informacji geograficznej w zarządzaniu obszarami chronionymi – od teorii do praktyki*. Tuchola-Toruń: Firma Usługowo-Wydawnicza „Daniel” Ewa Wierzchucka.
18. Zwirowicz, K. (2012). Związki katastru i geodezji z gospodarką przestrzenną. *Studia i Materiały Towarzystwa Naukowego Nieruchomości*, 20(4), pp. 41-50.

DISPROPORTIONS IN THE LEVEL OF INNOVATION IN EUROPEAN UNION COUNTRIES

Monika ZIOŁO^{1*}, Lidia LUTY²

¹ University of Agriculture in Krakow; monika.ziolo@urk.edu.pl, ORCID: 0000-0003-0884-4083

² University of Agriculture in Krakow; lidia.luty@urk.edu.pl, ORCID: 0000-0001-8250-8331

* Correspondence author

Purpose: One of the most important areas of reflection on innovation and innovativeness is regional policy and issues related to the development of the economy. The phenomena of globalisation and pressure to create a knowledge-based economy means that not only enterprises, but also countries are forced to optimise the use of their potential on a macro, meso or micro scale. For this reason, the issue of innovativeness is connected with particular economic entities and sectors of the economy, with the activity of state, regional and local authorities and the European Union. In the conditions of deepening European integration, stimulating innovation of territorial socio-economic systems is an important instrument of economic policy at the international, national and regional levels. The aim of the study is to assess the level of innovativeness of the region in spatial and dynamic terms. Multivariate Statistical Analysis will be used to determine the aggregated indicator based on data taken from Eurostat database.

Design/methodology/approach: The implementation of the objective will be achieved through the evaluation and comparison of the level of innovativeness of EU countries with the use of a synthetic measure, estimated by using one of the model methods of linear ordering of objects in the years 2015, 2018 and 2021. In the proposed method, the synthetic measure is determined using the distance of the examined objects from the model objects. The dynamic approach will allow to determine the directions of changes. The level of innovation of regions (EU countries) determined by a number of indicators that were adopted in four areas: human capital, finance, business activity and intellectual property protection.

Findings: The region's innovativeness is a multidimensional phenomenon, which is directly unmeasurable, hence the need to use statistical methods when measuring it. Obtained results will allow to assess the studied phenomenon, build a ranking and identify countries with a high, medium or low level of innovation. The results of the analyses confirmed that it is advisable to consider innovation by plane, because in this case there is a greater differentiation of countries. Due to the level of innovation, the highest positions in the ranking were taken by Sweden, Germany, Finland and Austria, at the end of the ranking were countries from Central and Eastern Europe, Poland, Latvia, Bulgaria and Romania. In the area of innovative activities, Estonia ranked very high being classified in the group I of the most innovative countries. The country is characterized by high employment in innovative enterprises, significant expenditure on innovation and a large share of Small and Medium Enterprises (SMEs) introducing product innovations. The fact that the countries of Central and Eastern Europe are

reducing the distance to more innovative EU countries should be assessed positively, as evidenced by lower values of the coefficients of variation in 2021 compared to 2015.

Keywords: innovation of regions, dynamics, Multivariate Statistical Analysis.

Category of the paper: research paper.

1. Introduction

Innovation is an economic category which can be examined and defined on three different levels, namely companies, regions and states (economies) (Kowalik, 2015). Innovation in regions and economies on a macroeconomic level signifies that the entities in that economy have the ability and willingness to constantly seek out and implement scientific findings, research and development results, ideas, inventions, organizational methods and techniques, and improvements in all areas of operation and knowledge (Mirkowska, 2010). It creates a competitive advantage for regions and significantly shapes regional variations of socio-economic development (Dominiak, Churski, 2012).

Emphasising the importance of innovation for regional development, at the Lisbon European Council summit in 2000 the European Research Area (ERA) was established. As one of the key elements in EU strategy on innovation and growth, it identifies the need to overcome the differences between EU countries through targeted funding and improving policies that support innovation (Chessa et al., 2013).

Pachura also notes the need to expand the role of regional innovation policy, as he argues that at the regional level it is possible to manage more effectively, adapting tools and system solutions to local needs (Pachura et al., 2014).

Seeking out countries with a high level of innovation is important, as these countries can provide a benchmark for other territories. The aim of this article is to investigate the disparities between individual countries of the European Union in terms of the level of innovation in 2015, 2018 and 2021. Taking into account the fact that there are differences between countries the level of innovation of regions (EU countries) determined by a number of indicators that were adopted in four areas: human capital, finance, business activity and intellectual property protection.

2. Literature review

In the literature on the subject, the concept of a region's innovation is largely identified with the economy's innovation (Skonieczny, Świda, 2008). Piech (2009) writes following Porter (2001) that a region's competitiveness is strictly a result of its ability to absorb innovations and is the primary source of differences in economic development between regions.

Innovatory capacity is a critical factor for the European Union's economic growth, especially if we take into consideration that an important part of productive growth in advanced nations - as measured in terms of Gross Domestic Product - corresponds to innovation (Freeman, 1994), so we may consider it to be one of the key factors determining competitiveness, business survival, growth and employment. Thus, it is especially important to find out which components of an Research & Development (R&D) system are most decisive as engines of innovation and what are the factors determining systems' innovatory capacity. Among authors seeking out the factors which determine innovations, one can point to the research carried out by Buesa, Hejis and Baumert (2010). In the opinion of these authors, policies aimed at promoting innovation will have to focus mainly on innovations by companies. It is necessary to create an environment conducive to initiatives and investments, as well as to stimulate R&D and design by companies, bearing in mind that these constitute a decisive factor driving the launch of new products and processes on the market. Agrawal notes that the chances for the development of an economically weaker country or region depends partly on its ability to innovate (Agrawal et al., 2011). Szopik-Depczyńska (Szopik-Depczyńska et al., 2018) point out that a region's innovation level is an important factor affecting both economic growth and growth in employment. The work of such authors as Christopher Freeman (1994), Freeman and Soete (2009), and Crescenzi, Rodriguez-Pose, Storper (2007) point to the need to incorporate knowledge and innovation in shaping the diversification of economic development within regions. Lundvall (1994) emphasizes the importance of knowledge in the process of implementing innovation, stating that "knowledge is the greatest strategic resource, and learning (acquiring knowledge) is the most important process". Studies conducted by Sleuwaegen and Boiardi (2014) recognize the unique importance of employees in the process of implementing innovations. The view that innovation is a key driver for sustainability is widely accepted among scholars, industry professionals and government representatives. This is due to the fact that sustainable development is a pressing issue that requires immediate action and changes from governments, industry, and society as whole (Silvestrea, Țîrcăb, 2019).

3. Materials and methods

In economic research, we generally deal with the analysis of complex phenomena, i.e. phenomena that cannot be expressed with a single feature and cannot be measured directly. An example of such a phenomenon is the level of innovativeness of regions (EU countries) determined by a number of indicators, which are usually considered in four areas (Table 1): human capital, finance, activity of enterprises and protection of intellectual property.

Table 1.
Selected variables for the analysis

Area	Variable	Item
Human capital	Employed ICT specialists [% share]	W_1
	Employment in knowledge-intensive activities [% share]	W_2
	Employment in innovative enterprises [% share]	W_3
Finance	R&D expenditure in the public sector [% GDP]	W_4
	R&D expenditure in the business sector [% GDP]	W_5
	Direct and indirect government support of business R&D [% GDP]	W_6
	Non-R&D innovation expenditure [% turnover]	W_7
	Innovation expenditures per person employed [thousands euro]	W_8
Business activity	SMEs introducing product innovations [% SMEs]	W_9
	SMEs introducing business process innovations [% SMEs]	W_{10}
	Exports of medium and high technology products [% share]	W_{11}
	Knowledge-intensive services exports [% share]	W_{12}
	Sales of new-to-market and new-to-firm innovations [% of turnover]	W_{13}
Intellectual property protection	PCT patent applications [per billion GDP (in PPS)]	W_{14}
	Trademark applications [per billion GDP (in PPS)]	W_{15}
	Design applications [per billion GDP (in PPS)]	W_{16}

Source: Own study based on Eurostat.

The selection of indicators was preceded by a literature review (Greunz, 2004, Fritsch, Slavtchev, 2006) and a statistical analysis (Table 2). All variables in the studied group of objects meet the basic criterion for selecting variables to describe a complex phenomenon, i.e. they are not quasi-constant variables (Kukuła, Luty, 2015). The recent and current literature on the innovation systems approach, has demonstrated that not all the indicators are adequate for measuring innovativeness (Edquist, Zabala-Iturriagoitia et al., 2015). Great importance was paid to the quality of data due to their usefulness, topicality, accuracy and elimination of information noise (Nermend, 2017).

Table 2.*Numerical characteristics of the indicators in years 2015, 2018, 2021*

Item	2015				2018				2021			
	<i>max</i>	<i>min</i>	<i>Me</i>	<i>CV</i>	<i>max</i>	<i>min</i>	<i>Me</i>	<i>CV</i>	<i>max</i>	<i>min</i>	<i>Me</i>	<i>CV</i>
W_1	6.80	1.60	3.30	0.19	6.80	1.90	3.60	0.18	7.00	2.10	3.90	0.18
W_2	22.90	6.60	13.50	0.16	22.70	7.20	13.70	0.16	25.70	7.60	14.30	0.14
W_3	72.03	23.44	57.05	0.17	72.03	14.44	55.58	0.20	79.87	15.39	56.15	0.19
W_4	1.08	0.25	0.60	0.22	1.07	0.20	0.55	0.23	1.07	0.20	0.57	0.23
W_5	2.26	0.09	0.82	0.31	2.26	0.11	0.68	0.29	2.44	0.17	0.83	0.27
W_6	0.37	0.00	0.08	0.29	0.41	0.00	0.07	0.27	0.40	0.00	0.07	0.25
W_7	1.55	0.14	0.60	0.24	2.01	0.13	0.58	0.21	2.36	0.10	0.56	0.20
W_8	11.46	0.63	3.68	0.23	12.52	0.74	3.76	0.23	11.95	0.83	4.36	0.27
W_9	34.55	2.84	22.81	0.25	34.24	3.20	23.30	0.26	48.87	9.35	30.40	0.21
W_{10}	49.64	16.40	34.73	0.18	49.18	10.11	34.96	0.22	65.62	7.57	39.44	0.22
W_{11}	67.56	19.41	48.72	0.18	68.65	21.18	49.72	0.17	69.52	29.16	51.26	0.15
W_{12}	92.98	17.94	47.90	0.22	94.02	19.97	49.74	0.21	93.46	20.10	51.44	0.21
W_{13}	69.76	3.69	10.98	0.17	19.12	4.12	9.27	0.22	23.81	1.42	11.47	0.18
W_{14}	9.34	0.21	1.61	0.29	9.36	0.29	1.36	0.27	8.92	0.19	1.28	0.27
W_{15}	36.16	1.74	6.07	0.21	35.89	2.22	6.64	0.20	40.44	2.52	7.27	0.19
W_{16}	17.93	0.45	3.52	0.24	12.09	0.82	3.97	0.21	7.77	0.65	2.55	0.24

Me: Median; *CV*: Coefficient of Variation.

Source: own study.

In the analysed period, changes in most of the selected indicators were slight and the median values for 10 indicators increased compared to 2015. The most active in introducing innovations were the owners of small and medium-sized enterprises, hence noticeable changes can be observed on the business activity level in the case of indicators W_9 , W_{10} , W_{11} and W_{12} . Among the selected features, the most favourable changes took place in the case of introducing product innovation in small and medium-sized enterprises (W_9). In the analysed countries, the SMEs sector saw an average increase by 8% in the number of entities introducing a new product to the market. The most active in introducing product innovations (W_9) were Estonia, Cyprus, Germany, Slovenia, Finland, Sweden and Bosnia and Herzegovina, where about 40% of entities from the SMEs sector made decisions about introducing a new product.

In the case of the W_{11} index showing the share of SMEs introducing business process innovations, the median value increased from 48.7% in 2015 to 51.3%.

In 2021, compared to 2015, the differentiation of the countries presented also slightly decreased, which is indicated by the level of the coefficients of variation, which may indicate the levelling of differences between more and less innovative countries.

The statistical data on the basis of which the analysis was carried out in one year form the matrix:

$$[w_{ij}] = \begin{bmatrix} w_{11} & w_{12} & \dots & w_{1k} \\ w_{21} & w_{22} & \dots & w_{2k} \\ \dots & \dots & \dots & \dots \\ w_{n1} & w_{n2} & \dots & w_{nk} \end{bmatrix} \quad (1)$$

where w_{ij} - indicator value W_j for i country.

A synthetic measure, which is the tool of Multidimensional Statistical Analysis, was used to assess the level of innovativeness of the EU countries in the analysed areas. Its design was based on a model-free method of aggregating variables:

$$Q_i = \frac{1}{j} \sum_j z_{ij}, \quad (2)$$

where:

Q_i - level of innovation in the country and in a given area,

z_{ij} - normalized values of the actual realisation of indicators, determined according to the formula (Walesiak, 2014; Kukuła, Luty, 2015):

$$z_{ij} = \frac{w_{ij} - \min_i w_{ij}}{\max_i w_{ij} - \min_i w_{ij}}, \quad (3)$$

z_{ij} - standardized values of the actual realisation of indicators, such that: $z_{ij} \in [0, 1]$.

The values of the synthetic variable obtained in the above-described manner are a proposal of a measure describing the assessment of the country's innovation level in the area of human capital, finance, business activity and intellectual property protection in spatial and dynamic terms.

Thanks to the application of the discussed method, the analysed regions were ranked according to the values Q_i in four areas and in total. Within the ordered sets, a topological classification of similar objects was carried out, as follows:

- I group (high level): $Q_i \in \left(\frac{1}{3} \left(\min_i Q_i + 2 \max_i Q_i \right), \max_i Q_i \right]$ (4)

- II group (medium level): $Q_i \in \left(\frac{1}{3} \left(\min_i Q_i + \max_i Q_i \right), \frac{1}{3} \left(\min_i Q_i + 2 \max_i Q_i \right) \right]$ (5)

- III group (low level): $Q_i \in \left[\min_i Q_i, \frac{1}{3} \left(\min_i Q_i + \max_i Q_i \right) \right]$ (6)

4. Results

Taking into account all the analysed indicators collectively, in 2015, compared to 2018 and 2021, the changes are small. On the planes, in turn, the differentiation of countries is visible. Hence the decision to leave the analysis for 2021 and to assess the differentiation of countries in the indicated planes (Figure 1).

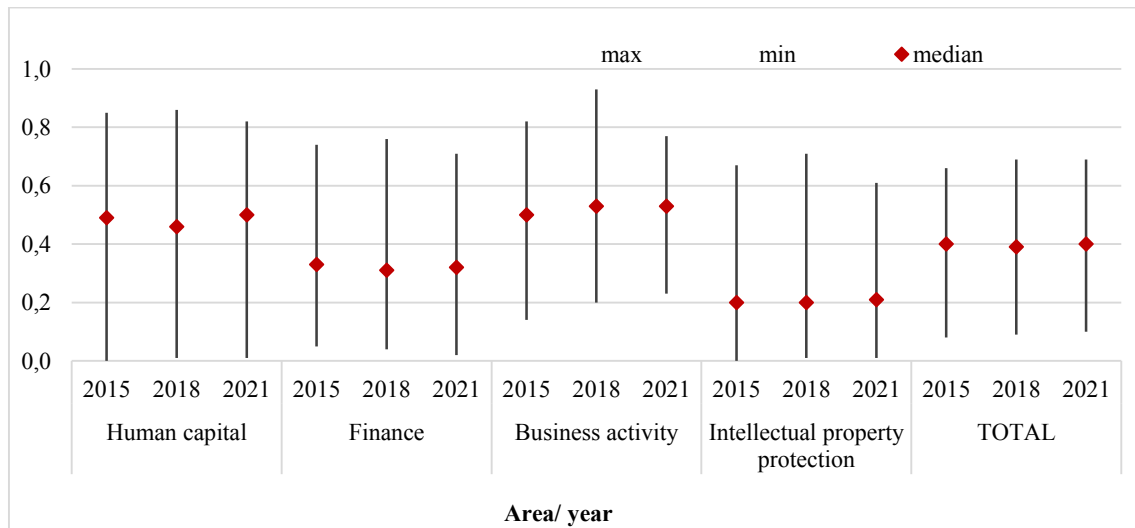


Figure 1. Numerical characteristics of the synthetic variable describing the level of innovativeness in total and in the area of: human capital, finance, business activity and intellectual property protection in the years.

Due to the level of innovation, the highest positions in the ranking were taken by Sweden, Germany, Finland and Austria, at the end of the ranking were countries from Central and Eastern Europe Poland, Latvia, Bulgaria and Romania (Figure 2). In the area of human capital the leaders were Germany, Belgium, Sweden and Austria, the lowest results were observed in Bulgaria, Poland and Romania. In terms of finance, the largest funds for innovation were allocated by Germany, Belgium, Sweden and Austria and the lowest by Latvia, Bulgaria and Romania. The innovativeness of the SMEs sector was the highest in Germany, Sweden and Belgium and the lowest in Latvia, Poland and Bulgaria. Denmark, Sweden and Finland have the highest number of registered innovative patents.

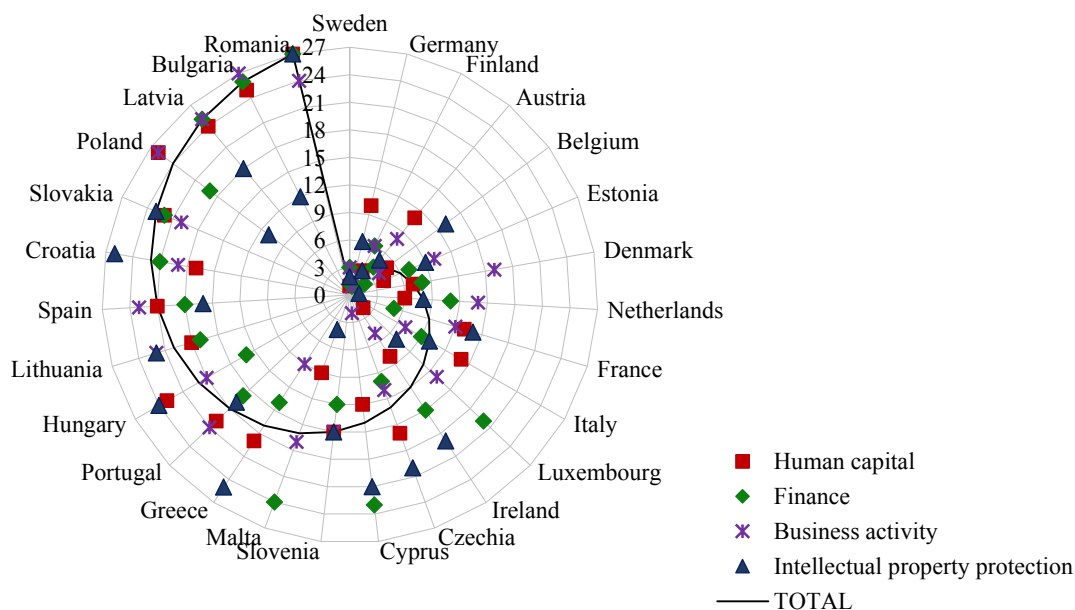


Figure 2. Rankings of EU countries in terms of innovation performance in 2021 overall and in the areas of: human capital, finance, business activity and intellectual property protection.

When assessing the differentiation of indicators between the three groups of countries, the greatest distance can be observed in terms of patent applications (Table 4).

Table 4.

Numerical characteristics of indicators in groups of EU countries similar in terms of innovation performance in 2021

Item	high level				medium level				low level			
	max	min	Me	CV	max	min	Me	CV	max	min	Me	CV
W_1	7.00	4.00	5.40	0.14	6.10	2.10	3.90	0.17	3.70	2.30	3.10	0.11
W_2	19.00	14.20	15.95	0.08	25.70	11.10	14.60	0.16	12.30	7.60	11.00	0.11
W_3	79.87	56.15	68.93	0.09	71.53	34.58	54.66	0.14	59.77	15.39	38.93	0.22
W_4	1.07	0.70	0.95	0.11	0.74	0.22	0.52	0.24	0.57	0.20	0.48	0.23
W_5	2.44	0.86	1.94	0.19	1.51	0.26	0.74	0.27	0.83	0.17	0.50	0.24
W_6	0.26	0.03	0.10	0.31	0.40	0.00	0.15	0.28	0.12	0.01	0.02	0.32
W_7	2.36	0.16	0.55	0.29	1.01	0.14	0.49	0.31	1.48	0.10	0.62	0.27
W_8	11.95	2.94	7.50	0.26	9.87	2.16	4.36	0.23	4.49	0.83	2.52	0.28
W_8	48.87	26.76	34.10	0.14	48.23	19.54	30.40	0.16	37.77	9.35	15.30	0.24
W_{10}	56.82	39.44	49.87	0.09	65.62	19.00	39.04	0.18	45.33	7.57	21.99	0.27
W_{11}	67.50	41.36	51.33	0.11	69.52	29.16	55.55	0.16	69.03	33.66	43.40	0.16
W_{12}	80.02	45.67	74.38	0.15	93.46	32.80	51.44	0.22	52.81	20.10	41.51	0.22
W_{13}	15.65	1.42	13.98	0.29	23.81	6.35	11.57	0.19	16.11	6.34	9.14	0.18
W_{14}	8.92	1.56	5.31	0.25	3.54	0.53	1.23	0.25	1.28	0.19	0.51	0.24
W_{15}	18.94	6.35	8.80	0.19	40.44	3.07	5.03	0.27	8.01	2.52	5.91	0.26
W_{16}	7.77	2.55	4.60	0.19	5.84	0.76	2.33	0.26	5.16	0.65	1.68	0.30

Me: Median; CV: Coefficient of Variation.

Source: own study.

While the best country in group one, Sweden, reported 8.92 patents per billion GDP (in PPS), the most active country in group III (Spain) reported 1.28 patents per billion GDP (in PPS). A large distance between groups I and III can be observed due to the W5 and W8 indexes. The median R&D expenditure in the business sector (W5) is 1.44pp higher in group I compared to group III. The significance of the differences between the groups of countries can also be observed due to the index (W6), the highest values were obtained in this case by the countries from group II. Due to direct and indirect government support of business R&D (W6), the French government is the most active. The countries from the second group are characterized by the highest value of the W11 index. Exports of medium and high technology products prevailed in Hungary. The countries from group I showed greater differences in terms of 12 variables compared to the countries from group III, which was indicated by higher values of the coefficients of variation.

Table 5.

Innovation levels of EU countries overall and in the areas of: human capital, finance, business activity and intellectual property protection in 2021

Country	Total	Area			
		Human capital	Finance	Business activity	Intellectual property protection
Sweden					
Germany					
Finland					
Austria					
Belgium					
Estonia					
Denmark					
Netherlands					
France					
Italy					
Luxembourg					
Ireland					
Czechia					
Cyprus					
Slovenia					
Malta					
Greece					
Portugal					
Hungary					
Lithuania					
Spain					
Croatia					
Slovakia					
Poland					
Latvia					
Bulgaria					
Romania					

Legend: high level medium level low level

Source: own study.

When analysing the innovativeness of countries in terms of 4 planes and in three groups, it is important to emphasize their great diversity. Sweden, Germany, Finland and Austria are among the most innovative countries. Group I countries are characterized by high values of indicators, especially in terms of human capital and business activity. Estonia was ranked high and placed in the 1st group. It stood out in terms of Employment in innovative enterprises (W_3), Non-R&D innovation expenditure (W_7), SMEs introducing product innovations (W_9). In the group with the lowest level of innovation in terms of 4 levels, there are mainly Central and Eastern European countries. The lowest values of 11 out of 16 selected indicators characterize Romania, hence its low position in the third group.

5. Conclusion

The use of a synthetic variable when comparing the innovativeness of countries is fully justified due to the different order of magnitude of the features and different titles in which the indicators are expressed. The inclusion of four planes in the analyses made it possible to present a more detailed differentiation of countries. The division into three groups allowed to distinguish countries with a low, medium and high level of innovation. Sweden, Germany, Finland and Austria can be considered the most innovative. Group I also includes Estonia, which has the highest percentage of people employed in innovative enterprises among the analysed countries, the highest expenditure on innovation, and the highest percentage of enterprises introducing product innovations. The countries of Central and Eastern Europe are the least innovative. Romania was ranked lowest in the rankings. The narrowing of the distance between more and less innovative countries should be assessed positively, although this process is very slow, as indicated by the minimal changes in the coefficients of variation for the selected features in 2021 compared to 2015.

References

1. Agrawala, A., Kapurb, D., McHalec, J., Oetld, A. (2011). Brain drain or brain bank? The impact of skilled emigration on poor-country innovation. *Journal of Urban Economics*, Vol. 69, Iss. 1, pp. 43-55, <https://doi.org/10.1016/j.jue.2010.06.003>.
2. Brenner T., Broekel T. (2009) *Methodological Issues in Measuring Innovation Performance of Spatial Units, Industry and Innovation*, DOI: 10.1080/13662716.2010.528927.

3. Bruno, S., Silvestre Țircă, D.M. (2019). Innovations for sustainable development: Moving toward a sustainable future. *Journal of Cleaner Production*, Vol. 208, pp. 325-332, <https://doi.org/10.1016/j.jclepro.2018.09.244>.
4. Buesa, M., Heijs, J., Baumert, T. (2010). The determinants of regional innovation in Europe: A combined factorial and regression knowledge production function approach. *Research Policy*, Vol. 39, Iss. 6. Elsevier, pp. 722-735, <https://doi.org/10.1016/j.respol.2010.02.016>.
5. Chessa, A., Morescalchi, F., Pammolli, O., Penner, A.M., Petersen, M., Riccaboni (2013). Is Europe Evolving Toward an Integrated Research Area? *Science*, Vol. 339, Iss. 6120, pp. 650-651, DOI: 10.1126/science.1227970.
6. Crescenzi, R., Rodriguez-Pose, A., Storper, M. (2007). On the geographical determinants of innovation in Europe and the United States. *Journal of Economic Geography, Policy F*, Vol. 7, Iss. 6. Oxford University Press (OUP), pp. 673-709. hal-00973092.
7. Dominiak, J., Churski, P. (2012). Rola innowacji w kształtowaniu regionów wzrostu i stagnacji gospodarczej w Polsce. *Studia Regionalne i Lokalne*, Vol. 4, Iss. 50, pp. 57-72.
8. Edquist, Ch., Zabala-Iturriagoitia, M.J. (2015). The Innovation Union Scoreboard is flawed: The Case of Sweden – not the innovation leader of the EU – updated version. *Papers in Innovation Studies*, Vol. 27. Lund.
9. Freeman, Ch. (1994). The economics of technical change. *Cambridge Journal of Economics*, Vol. 18, pp. 463-514.
10. Freeman, Ch., Soete, L. (2009). Developing science, technology and innovation indicators: What we can learn from the past. *Research Policy*, Vol. 38, Iss. 4, pp. 583-589.
11. Fritsch, M., Slavtchev, V. (2006). Measuring the efficiency of regional innovation systems: an empirical assessment. *Freiberg working papers*, Vol. 8, <http://hdl.handle.net/10419/27102>.
12. Greunz, L. (2004). Industrial Structure and Innovation - Evidence from European Regions. *Journal of Evolutionary Economics*, Vol. 14, Iss. 5, pp. 563-592.
13. Innovation Union Scoreboard 2018. European Commission, https://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en, 20.10.2022.
14. Kowalik, J. (2015). Analiza poziomu innowacyjności państw Unii Europejskiej. *Zeszyty Naukowe Politechniki Częstochowskiej, Zarządzanie*, Vol. 19, pp. 22-37.
15. Kukuła, K., Luty, L. (2015). Propozycja procedury wspomagającej wybór metody porządkowania liniowego. *Przegląd Statystyczny*, Vol. LXII, Iss. 2, pp. 219-231.
16. Lundvall, B. (1994). The learning economy: challenges to economic theory and policy. *Journal of Industry Studies*, Vol. 1, Iss. 2, DOI: 10.1080/13662719400000002.
17. Nermend, K. (2017). *Metody analizy wielokryterialnej we wspomaganii decyzji*. Warszawa: PWN.
18. Pachura, P., Skowron-Grabowska, B., Ociepa-Kubicka, A. (2014). Ewolucja i konfiguracja regionalnych strategii innowacji (RIS) – na przykładzie krajów grupy wyszehradzkiej (v4). *Acta Universitatis Lodzianis Folia Oeconomica*, Vol. 6, Iss. 308, pp. 149-154.

19. Piech, K. (2009). *Wiedza i innowacje w rozwoju gospodarczym: w kierunku pomiaru i współczesnej roli państwa*. Warszawa: Instytut Wiedzy i Innowacji.
20. Porter, M.E. (2001). *Porter o konkurencji*. Warszawa: PWE.
21. Silvestrea, B.S., Tîrcăb, D.M. (2019). Innovations for sustainable development: Moving toward a sustainable future. *Journal of Cleaner Production, Vol. 208*, pp. 325-332, <https://doi.org/10.1016/j.jclepro.2018.09.244>.
22. Skonieczny, J.A., Świda, A. (2008). Innowacyjność jako czynnik wzrostu konkurencyjności regionu. In: M. Noga, M. Stawicka (eds.), *Problemy gospodarki światowej. Prace naukowe Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Iss. 1191*. Wrocław: Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu.
23. Sleuwaegen, L., Boiardi, P. (2014). Creativity and regional innovation: Evidence from EU regions. *Research Policy, Vol. 43, Iss. 9*, pp. 1508-1522, <https://doi.org/10.1016/j.respol.2014.03.014>.
24. Szopik-Depczyńska, K., Kędzierska-Szczepaniak, A., Szczepaniak, K., Chebda, K., Gajda, W., Ioppolof, G. (2018). Innovation in sustainable development: an investigation of the EU context using 2030 agenda indicators. *Land Use Policy, Vol. 79*, pp. 251-262, <https://doi.org/10.1016/j.landusepol.2018.08.004>.
25. Walesiak, M. (2014). Przegląd formuł normalizacji wartości zmiennych oraz ich własności w statystycznej analizie wielowymiarowej. *Przegląd Statystyczny, Iss. 4*, pp. 363-372.

REVIEWERS

Prof. **Krzysztof ANDRUSZKIEWICZ**, Bydgoszcz University of Science and Technology,
Poland

Prof. **Szymon CYFERT**, Poznan University of Economics and Business, Poland

Prof. **Anna DZIADKIEWICZ**, University of Gdańsk, Poland

Prof. **Joanna EJDYS**, Bialystok University of Technology, Poland

Prof. **Bożena GAJDZIK**, Silesian University of Technology, Poland

Prof. **Wiesław GREBSKI**, The Pennsylvania State University, USA

PhD **Michaline GREBSKI**, Northampton Community College, USA

Prof. **Magdalena KRACZLA**, WSB University in Chorzów, Poland

PhD **Judyta KABUS**, Częstochowa University of Technology, Poland

Prof. **Sebastian KOT**, Częstochowa University of Technology, Poland

Prof. **Aleksander LOTKO**, Kazimierz Pułaski University of Technology and Humanities
in Radom, Poland

Prof. **Bartosz MICKIEWICZ**, West Pomeranian University of Technology in Szczecin,
Poland

Prof. **Andrzej PACANA**, Rzeszów Technical University, Poland

Prof. **Robert ROMANOWSKI**, Poznań University of Economics and Business, Poland

Prof. **Anna SANIUK**, University of Zielona Góra, Poland

Prof. **Sebastian SANIUK**, University of Zielona Góra, Poland

Prof. **Maciej STAJNIAK**, Poznań School of Logistic, Poland

PhD **Bożena SKOTNICKA-ZASADZIEN**, Silesian University of Technology, Poland

Prof. **Anita UŚCISŁOWSKA**, Poznań University of Technology, Poland

Prof. **Radosław WOLNIAK**, Silesian University of Technology, Poland

Prof. **Dagmara ZUZEK**, Agricultural University in Krakow, Poland

Prof. **Andra ZVIRBULE**, Latvia University of Life Science and Technologies, Latvia