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# 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, Czech Republic and Ukraine. The number consists of 44 papers.

The papers presented in the number concentrate on many topics connected with organization and management. There are in the number papers about: leadership; marketing; production management; consumer satisfaction; Smart City; Industry 4.0; impact of COVID-19 pandemic on management; financial management; logistics; management in healthcare; environmental management; quality management; sustainability; safety management; conflict management; human resource management; Corporate Social Responsibility; project management; organizational culture and e-government.

*Radosław Wolniak*

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ORGANIZATION AND MANAGEMENT SERIES NO. 160

# TRIAL OF DISTRIBUTED LEADERSHIP IN INSTITUTIONAL MANAGEMENT

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**Purpose:** The paper investigates challenges associated with institutional leadership engagement of main staff to fill inner vacancies.
**Design/methodology/approach:** The study rates merit, experience, rank, competencies, long service, in-depth knowledge, and deeper consultation as key requirements for appointment in some selected academic institutions. The survey collects data through questionnaires and semi-structured interviews. The SPSS and descriptive statistics were used for the analysis of data presented in percentages, tables, and graphs.
**Findings:** The results show that over 80% of respondents said that the prerogative of leaders in second-cycle institutions to share leadership needs a reassessment. As it undermines specific parameters and subsequently creates emotions among staff and unsatisfactory students' behaviours at school. The study found social and external factors as the basis for some nominations that weaken institutional unity and performance.
**Recommendation/limitations:** The legislative instrument should be amended to suit the current management environment. Besides, ethical leadership and emotional intelligence should be encouraged at schools for effective management and harmony.
**Practical implications:** Organizational failures across economies to a large extent are results of stimulus variables.
**Originality/value:** The paper demonstrates how institutional leaders are often torn between stimulus and prospective variables resulting in self-interest to the detriment of institutional vision.

**Keywords:** education, leadership, second-cycle institution.

**Category of the paper:** Research paper.

## 1. Introduction

Education at the High School level has a diversified curriculum that enables students to identify and achieve different aptitudes, abilities, interests, and skills that would provide them with further educational training and occupational opportunities. The teacher plays a vital role in any educational setting. Teachers go through training to attain knowledge and that gives them a professional status to impart knowledge and skill to students. The employer and management actions influence the teacher's mode of delivery, competencies, confidence, and love for the job. Institutional leadership is central to every educational reform programme as leadership functions have consequences on the entire process.

The Ghana Education Bill 2015 for instance, amends the legal framework for the pre-tertiary regulatory bodies for education in the Education Act 2008 (Act 778) and provides a decentralized pre-tertiary education system (Adu-Gyamfi et al., 2016). The Regional Department, in consultation with the Regional Co-ordinating Council, shall establish Boards of Governors for the human, material, and financial management of every second-cycle school in the region (Sekyere, 2016). The Regional Director of Education makes appointments, promotions and transfers, and recommends discipline and awards for staff at the second cycle institutions in the region on behalf of the Head of the Local Government Service (Ghana Education Service, 2010).

The head of schools allows distributed leadership in offices deemed suitable, but holders of these offices, substantive or acting, must have the professional qualifications that the position requires (Sekyere, 2016). The organizational leaders have three sources of power at their disposal to get things done. The legitimate power that the subordinates must accept is the administrative authority of the head and the coercive power where subordinates are punished by withholding some of their privileges and other entitlements (Sekyere, 2016). Again, the rewarding power to award subordinates either for hard work or to motivate them to work harder to achieve institutional goals (Sekyere, 2016). The institutional leader must act in ways that stimulate a positive response from the subordinates to achieve academic and moral superiority (Lonyian & Kuranchie, 2018).

However, High School Education under the Ghana Education Service (G.E.S.) supervision has been hard hit by rampant student unrest, destroying school properties and disrupting the academic calendar, and has been a problematic for the government, stakeholders, and students. A series of research has been conducted on the education sector, and still ongoing regarding educational leadership (Appiah & Amfo-Antiri, 2019), and educational policies (Adu-Gyamfi et al., 2016), but with little emphasis on distributed leadership within the second-cycle institutions in Ghana. The procedure involved and the consequences of distributed leadership in 21st-century second-cycle institutions are too open to discussion. Therefore, investigating to what extent the distributed leadership challenges fill the void. Academic institution leadership

needs current information concerning internal engagement for efficient management and high academic performance in Ghana and beyond. The study identifies trials of distributed leadership and highlights appropriate conditions that would allow institutions to arrive at harmony and transparency among the workforce for academic excellence.

## 2. Leadership

### 2.1. Institutional Leadership

Each day, we learn a new concept or a skill that adds value to our being. These things that we gain knowledge of during our daily activities and interactions are either structured or unstructured, though they school us in many ways. Education is the act of imparting knowledge, customs, and values to generations. Education is generally accepted as it serves as a foundation for economic growth and development (Lonyian & Kuranchie, 2018). Second-cycle education is a turning point in the life of a teenager because it is the level at which the individual decides on a career path. Therefore, leadership at this level is complicated as students are in transition, the adolescence age, a move from childhood to adulthood which comes with various behaviours and needs a system that everyone is happily put on board to enable successful management.

Leadership goes beyond just influencing behaviour and directing change in organizations. A leader's behaviour is shaped by culture and values, and these variables determine one's leadership when applied in the workplace (Akpamah et al., 2021). Wright and Taylor (1994) state that leadership is when the organizational head controls subordinates' behaviours and beliefs to achieve set objectives. Leadership is a skill that manipulates the entire organization's resources to align with the socially accepted norm and protects the organization's culture and its core values (Matkó, 2013). Leadership is devoid of behaviour enticement, a behaviour put up to avoid punishment (Appiah & Amfo-Antiri, 2019). Instead, the leader generates traits, nurtures attitude, and persuades others to behave in the desired direction (Politis, 2001).

Institutional leadership is an extensive consultation to achieve the institutional goal (Akpamah et al., 2021). The kind of management provided by heads of second-cycle institutions is crucial for developed and developing countries (Bush & Jackson, 2003). The leaders in the academic institution must not take actions that will undermine its essence (Zame et al., 2008). Nations' educational systems are constantly changing to meet the current occurrences in society that require a certain level of innovation and talent to perform professional and administrative duties (Lonyian & Kuranchie, 2018). The heads of schools are responsible for creating and maintaining quality and standards in their institutions. They owe it a duty to choose leaders to effectively manage various departments and units in their institutions (Esia-Donkoh, 2014). The heads or principals need an efficient delegation system with a trustworthy team for support,

since the heads are held responsible for the choice they made to accomplish organizational goals (Casper, 2002). In leadership, employee mobilization defines a leader's behaviour that builds internal commitment of staff for extra-institutional achievements (Mbah, 2016), a leader whose behaviour destabilises workforce mobilization and efficiency invariably creates discomfort amid the labour force.

A leader who encourages subordinates' intellectual stimulation to enhance their knowledge, creativity, and thinking deeply about problems of the institution (Tian-Syung et al., 2019) is respected and trusted for self-confidence, attitude, ideology, and emotional intelligence. The institutional leaders focus on fixing the rules and standards that are no longer on track and addressing issues of subordinates' emotions, reactions regarding negative comments and decisions previously made (Tian-Syung et al., 2019). They ensure subordinates of leadership's unbiased attitude, favourable responses, inspiring speeches, and compliments, these make the employee happy and very interactive (Tian-Syung et al., 2019). The management of an academic institution depends on one's ability not just to direct or order, but to motivate, work collaboratively with, and offer broad intellectual leadership to a diverse set of academic staff who might have attained little professional training (Rudenstine, 2002). The teachers function best when they can fulfil their institutional roles to make utmost use of their creative talents as scholars and educators (Rudenstine, 2002).

Teachers appointed to leadership positions in the western world are offered training to sufficiently prepare them for their responsibilities. It is, however, the opposite in most developing countries (Bush & Oduro, 2006). Moreover, orientation is rare for those allowed by the appointing authority to occupy certain internal positions in second-cycle institutions, subsequently, appointees take their appointment letters and could immediately move to the supposed office to start work (Bush & Oduro, 2006; Lonyian & Kuranchie, 2018). When an organization's workforce is allowed to become conscious of their interests, it reduces workplace anxiety and helps employees focus on achieving organizational goals (Sadeghi & Pihie, 2012). But leadership in deprived regions still practices centralization of authority where the leader controls management power and does not share with subordinates. Consequently, their terminologies and thoughts will not be made known to subordinates, and even if they did, they want to remain in authority and have control (Tian-Syung et al., 2019). The preparation for leadership positions in an academic institution is appreciated when it is based on experience, professional qualification, rank, and recognition of how work is defined and structured (Mulford, 2003). Leaders in educational institutions play a significant role in harmonizing relationships within their schools and beyond by mobilizing and deploying various resources (Chen, 2002). The heads of second-cycle institutions are responsible for protecting the peace and ensuring the smooth running of these institutions as they share leadership with significant offices (Lonyian & Kuranchie, 2018).

### 2.2. Distributed Leadership

Distributed leadership explains a leadership model in the twenty-first century distinct from positional authority (Tang, 2019). The leadership engages internal staff with a certain degree of expertise to fill vacancies as and when they exist in the organization (Harris, 2004). Distributed leadership is best practised in schools as it is significantly associated with retention and students' academic performance (Hallinger & Heck, 2010; Ghamrawi, 2011). Distributed leadership appears as a team with professional backing to achieve the organizational goal (Bennett et al., 2003). It describes a leadership position where organizations fill vacancies using their employees within the organization (Muhereza, 2019). Organizational leaders in charge of an internal appointment may avoid holding back when they can detect and re-evaluate factors that positively activate the employees' emotional life (Alina, 2009). Though, emotion at the personal level or subjective suggests an individual's self-control capacity and the ability to direct the positive and negative emotions to achieve emotional intelligence whereas a feeling at the interpersonal or social level is the settlement of emotional variance between the workforce and leadership. Alina (2009) states that divergence views governing internal commitment result in subjective sentiment while the organization experiences emotional behaviours such as anxiety, frustration, intolerance, shrunk self-esteem, and undue stress on the postholders leading to a drastic decline in output.

Emotions are made up of various components and usually not directed at a specific event. The physiological and behavioural responses such as facial expression and appraisal are some reactions of emotions (Totterdell & Niven, 2014). According to the affective events theory by Weiss and Cropanzano (1996), behaviour is either affect-driven or judgment-driven with a direct response to an emotional experience and an indirect response mediated by a worker's attitude respectively. Both affect-driven and judgment-driven behaviours are reasons for counterproductive behaviours at work (Ashkanasy & Humphrey, 2011). Besides, some characteristics of the leader promote events that could result in bitter sentiment and do not influence the positive feelings of the subordinate in which the workplace is occasioned by the presumption against tender feelings (Dahlum & Wig, 2019; Miner & Glomb, 2010). However, distributed leadership has challenges when implemented in organizations noted for bureaucracy because bureaucratic leaders will not let go of power and will only share leadership with those that they could control (Hartley, 2010). The interactions with others at work can result in momentary feelings, but leaders' actions are the most salient source of emotions in the workplace (Dimotakis et al., 2011). Lawrence (2008) argues that people's sentimentality arose at work when they profess that there is injustice in the system.

In addition, people express bad feelings when they compare themselves with others, they perceive them to be better off at work than they are. At the same time, they feel positive when making the comparison that shows others are worse off than them (Spence et al., 2011). The unwarranted management behaviour at the workplace can produce intense and longer-

lasting emotions in any organization (Rozin & Royzman, 2001). The actions of one or a group at the workplace may cause others social emotion as it perceives as unjust, frustrates one's goal attainment, and encourages interpersonal conflict (Gibson & Callister, 2010). In distributed leadership, injustice has been identified as the most severe cause of emotions in the workplace (Domagalski & Steelman, 2005), while the event that often leads to unfairness at work is discernment (Fitness, 2000).

The public worker in the developing country is never satisfied with the job concerning the conditions of service, as illustrated in Figure 1. In Ghana, a professional graduate teacher in a public school has a net salary of less than USD 500 at the study time, coupled with no rent allowance and a poor work environment. The teacher has no control over all of those, and already lost confidence in the work. Hence, a decision that places the teacher at a disadvantage irritates him the more, and the results become a pattern of bad leadership.

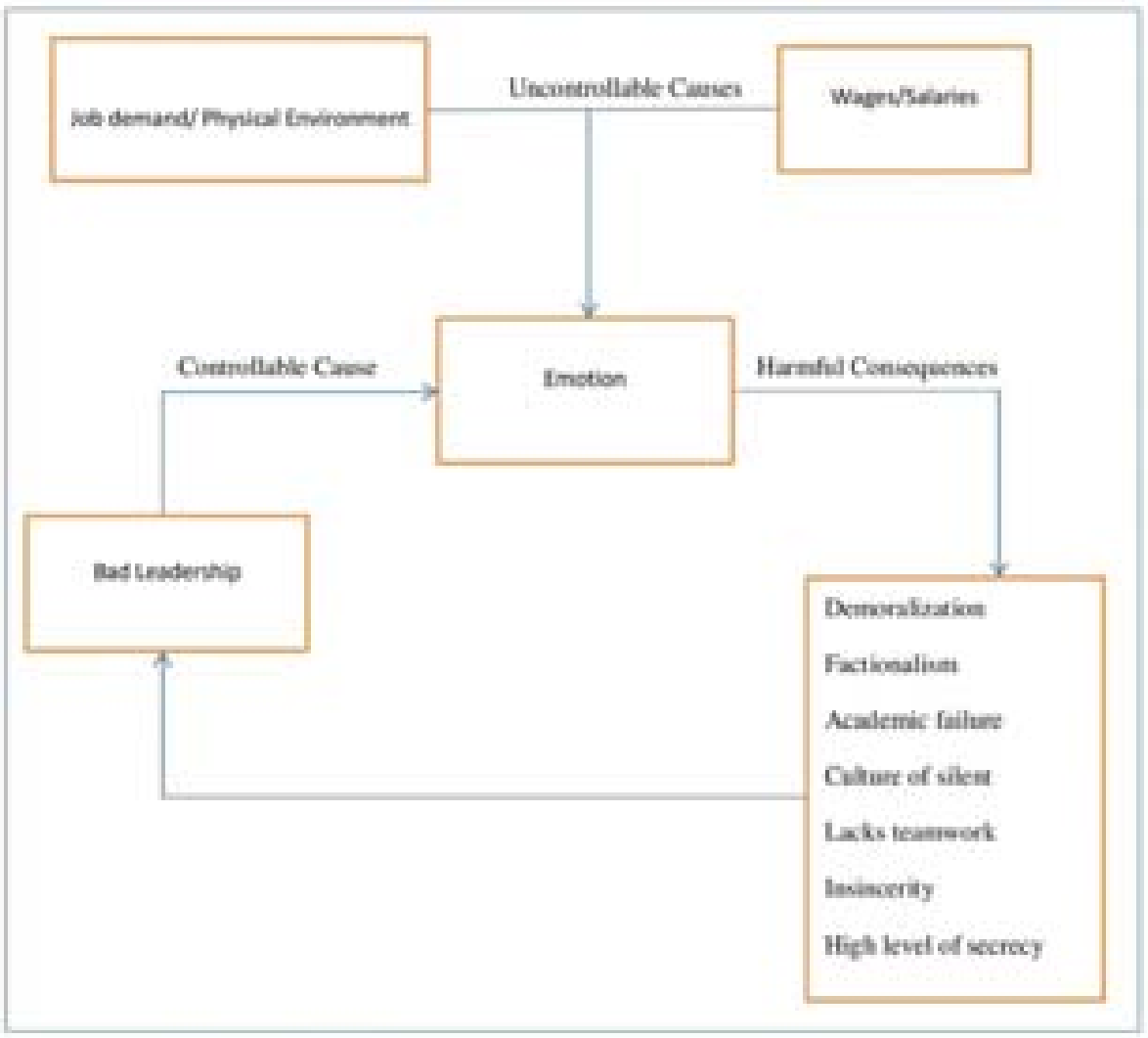


**Figure 1.** Theoretical Framework. Source: Authors' source.

## 3. Approach and Methodology

The study gathers data through extensive desk research from the library to various published relevant materials and worldwide web search. A piece of current knowledge about the topic was pulled together from one hundred and fifteen (115) research participants. Structured questionnaires and semi-structured interviews were used to solicit first-hand information from the staff of the selected public institutions alongside observation in Northern Ghana. The instrument was made anonymous, voluntary, and self-administered. The study had a sample of one hundred and twenty (120). The study uses purposive sampling of schools that experienced strikes not less than three times within six years (2015-2021) in Northern Ghana. Random sampling was applied to select respondents in the sample. Though, a quota was applied to select at least three (3) members from management in each school. After a thorough check of collected data, the questionnaires were coded and entered software version 22.0 of the Statistical Package for Social Sciences (SPSS) for analysis with a broad description of the findings presented in percentages, tables, and graphs.

## 4. Results and Discussions

A total of one hundred and twenty (120) questionnaires were administered to the respondents, and one hundred and fifteen (115) questionnaires were retrieved representing 95.8% of responses which was considered satisfactory. The analyses were made based on the responses to the returned questionnaires, interviews and observations made during the administration of questionnaires, and casual discussions with the research participants demonstrated in tables and graphs.

The results in Figure 2 show that about 94% of respondents agreed that workers were not allowed positions in distributed leadership based on the number of years they might have served the organization closely, followed by professional rank representing 91.3% of the respondents who agreed that grades in academic institutions were not a guarantee for receiving shared leadership. The results substantiated the Esia-Donkoh (2014) survey, which states that the head chooses leaders for effective management of various departments at the school. The findings also agreed with Casper (2002) argument that the head of institutions needed to determine a trustworthy delegation team to accomplish organizational goals. The results suggest that merit is a major factor that antagonized management in distributed leadership among staff as confirmed by 90.4% of respondents.

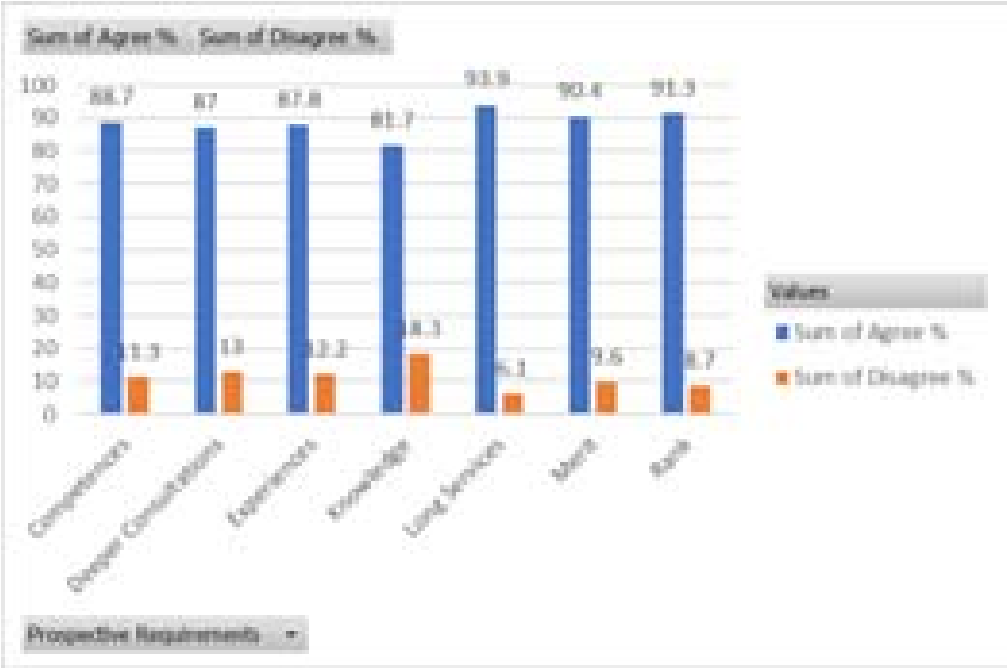


**Figure 2.** Required Prospective. Source: Authors' Fieldwork.

Besides, management was confronted with issues concerning competencies, and experiences in the distributed leadership within the organizations, about 88.7% and 87.8% of research participants confirmed that organizations often do not recognize and consider these as critical requirements in distributed leadership respectively, but only allowed 13% for consultation as demonstrated in Figure 2. The results disagreed with Akpamah et al. (2021) that institutional leadership is an extensive consultation that allows full participation in the decision-making process to achieve institutional goals.

The results establish that challenges regarding shared leadership based on requirements were not hidden, as a zero percentage of respondents represents no knowledge about appointments at the time of the study. Though, on average, 6.1% of the respondents could not explain how distributed leadership is allowed among staff at their institutions. Management tacked with favouritism was validated by respondents representing 91.3%, followed by external influence of 81.7 % of respondents, as shown in Table 1.

**Table 1.**
*Stimulus Variables*

| Close Associates/conviction | Agree % | Disagree % | No Idea % |
|---|---|---|---|
| Relations | 64.3 | 34 | 1.7 |
| Friendship | 62.6 | 36.5 | 0.9 |
| Secret/Furtive keeper | 41.7 | 40.9 | 17.4 |
| Favouritism | 91.3 | 7.9 | 0.8 |
| Appeasement | 41.7 | 41.8 | 16.5 |
| Settlement of Internal Issues | 73 | 25.2 | 1.8 |
| External Influence | 81.7 | 14.7 | 3.6 |

Source: Fieldwork.

The study authenticates Domagalski and Steelman (2005) and Fitness (2000) assertion that injustice is a serious cause of emotions in distributed leadership whereas the unfairness at work is as a result of discernment. However, only 0.1% spilt the respondents on distributed leadership for appeasement, while 40.9% opposed the statement that leadership is shared with people that will not disclose information either within or outside the organization. Institutional leaders nominating their close associates for internal positions stood at 62.6% for friends and 64.3% for relations. The results conflicted with Tian-Syung et al. (2019) postulation that effective leadership ensures subordinates leaders' unbiased attitude, favourable responses, inspiring speeches, and compliments to make the employee happy and very interactive.

In Figure 3, the diagram concludes that distributed leadership is the sole responsibility of management. Hence, advertising positions and vetting applicants would not be necessary as represented by 99.1 % and 98.2% of respondents respectively. The results contradict Lonyian and Kuranchie (2018) survey, which revealed that nations' educational systems are constantly changing to meet the current trials in society and require a certain level of innovation and talent to perform professional and administrative duties. Also, the authority responsible for distributed leadership had confidence in whosesoever they intended to share power with. Therefore, orientation was regarded as on-the-job training supported by 99.1% of respondents, whereas 0.9% represented those against the statement that management often does not consider organizing orientation for newly appointed staff to a higher office. The respondents' view partially agreed with the previous findings that the heads of schools are responsible for creating and maintaining quality and standards in their institutions, and give power to the selected few per their convictions (Lonyian & Kuranchie, 2018). An average of 0.9% represents the respondents' neutrality and disagreement with the process of distributed leadership, and that is a manifestation of organizational fracture.

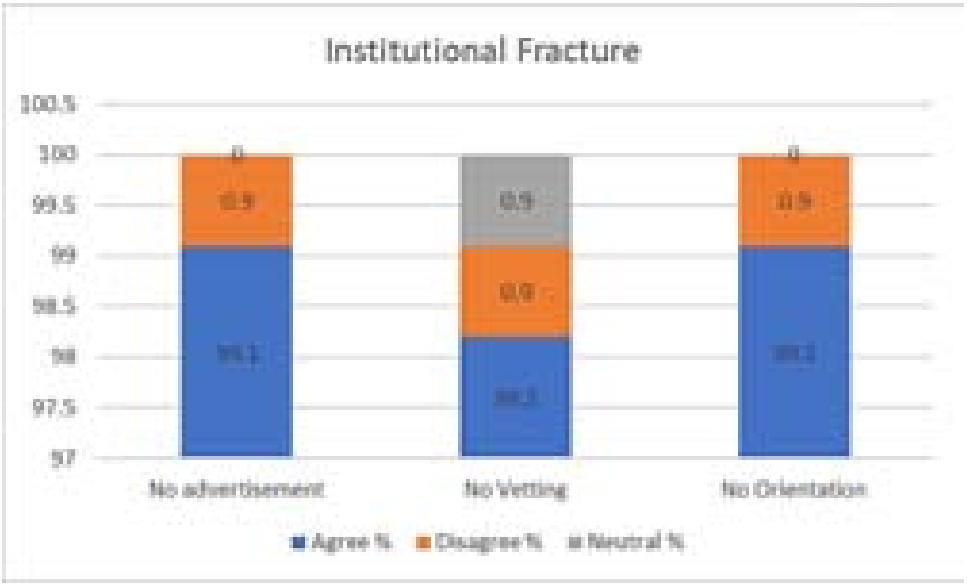


**Figure 3.** Institutional Fracture. Source: Fieldwork.

## 5. Interviews and Observation

Observation reveals the discontent of some staff in their responses to questions about why they are not in leadership positions. Resentment is a demonstration of social emotion as the actions that speed up bitterness are a direct deed of someone else (Totterdell & Niven, 2014). The atmosphere had shown evidence of no apparent balance between most subordinates and management in some of those institutions. The leadership had not shown conduct entirely transparent and acceptable to every staff member. The results were a direct opposite of Lonyian and Kuranchie (2018) findings that institutional leaders must act in ways that stimulate a positive response from their subordinates to achieve academic and moral excellence. Management somehow ignored employees' feelings which translated into a rejection of common agreement for any organization per participants' responses. The 4-V model, Value, Vision, Voice, and Virtue (Appiah & Amfo-Antiri, 2019), got lost in some academic institutions. Leadership had disregarded the 4-V model in management, which could integrate the inner beliefs and values with the peripheral behaviours and recommended actions for the accomplishment of the institutional objectives.

The staff common rooms purposely meant for teachers to have a rest and probably mark students' exercises and assignments were virtually empty in some schools. Some teachers preferred any other available space, even an inconvenient place to the staff common room, for personal reasons. Besides, some other teachers never stayed on campus for a second after their periods were over. They did not want to do anything with the school outside their obligations, and that speaks volumes about the atmosphere in some academic institutions. The behaviours of the teachers confirmed a lack of unity. The attitude of some staff members conflicts with the Tian-Syung et al. (2019) study that institutional leaders focus on fixing the rules and standards that were no longer on track. They emphasized addressing issues of a subordinate's emotions and reactions to certain behaviours of leadership especially unfair attitude and favouritism.

Some staff members in the distributed leadership position were not ready for the task. They suggested advertising inner leadership vacancies for those interested in taking up such places during the interview. However, the teachers were punctual in class, and management was delighted with the teachers' performance and anticipated excellent results, mainly from the final year students. The question remains whether the teachers were mindful of students' attendance and general behaviour in class. Again, whether they were happily teaching or just protecting their meagre salaries to survive, as majority expressed dissatisfaction with their condition of service and management approach to getting staff members in shared leadership positions.

## 6. Conclusion

Over the years, the educational system in Africa has gone through a series of changes to meet the changing environment of today's educational system. The transformation has always been associated with educational reforms and policies. In Ghana, the latest reforms and a noticeable policy were the Middle School changed to Junior Secondary School (J.S.S.) in 1987, and now, the Junior High School, Secondary School were replaced by Senior Secondary School (S.S.S.) in 1991, renamed Senior High School, and the recent implementation of the Free Senior High School (FSHS) Policy. Nonetheless, little emphasis is given to the teacher's condition of service. As a result, the teachers have not been pleased with their poor condition of service. Moreover, the activities of institutional leaders frequently generate emotions among staff, students rioting against certain decisions taken by management, general blatant disregard for directives from leadership, meagre input of personnel resulting in unsatisfactory academic performance and surrounded by unhealthy human relations within second-cycle institutions in less developed countries.

Also, the nomination of persons to leadership positions with no regard for best procedures such as vacancy declaration, proceeding ranks, and professional qualifications made the privilege of the authority responsible for getting individuals to fill organizations' internal vacancies outlived its usefulness. An upright dismissal of one's emotional distress expressed negatively influences professional performance and threatens the path of effective management. The inability of the authority mandated to share leadership at the second-cycle institutions to recognize differences between authentic and simulated staff emotions increases behavioural diversity in the organization's environment, associated with labour turnover and low productivity. The developments leading to shared leadership appear shrouded in secrecy. If distributed leadership is not open to interested applicants, the issue of free, fair, and transparent arises. The recruitment to certain leadership positions solely made by the head of institutions will always remain in the minds of staff and the public that their favourites were chosen and considered for the posts. Appointments in secret trigger emotions among the employees. The organizations that performed well and remained in business for so long never gave up assessing individuals' feelings and actions at the workplace. The Ghana Education Service should not be an exception to studying the worker's emotions to minimize the unwarranted students' agitations and needless factionalisms among staff in our academic institutions.

Though, in the Ghana Education Service constitution, the head of second-cycle institutions has the mandate to choose leaders from the core staff to manage various departments. Ironically, external influence has currently taken centre stage in these appointments in schools. The heads in some instances were compelled to accept unqualified individuals forced on them by the politicians just to protect their livelihood. In the same vein, the head choosing their close

associates for positions based on convictions often creates emotions among staff and dishonesty on the part of the appointing committee. The principle of ethical leadership is still not rooted in the management of most organizations in Africa, especially the second-cycle institutions. According to the Oxford Dictionary, Ethics is moral principles that govern a person's behaviour or conduct. Ethics is both good and bad deeds; a person's ability to distinguish between factual and erroneous defines one's leadership credentials and aptitude. Leadership led by ethics makes observable conduct that is suitable and acceptable to the organization. The leaders highlight ethical standards and promote peace and harmony within the organization and its environs to facilitate the accomplishment of organizational goals. Ethical leaders apply ethics to every aspect of management by noticing the wrong and the right in decision-making. They set up strategies that could bring about a sustainable peaceful co-existence in their organizations.

The inability of an organization's leader to accept and implement ethical leadership creates no opportunities for emotional bonding among staff and between management and the workforce. Leaders must forge positive emotional bonds within organizations because their behaviours are significant in transforming one's life and are meant to impact the attitudes of others within the organization. An appointment as an incentive is a fundamental human drive as employees may want to have a bond, form a network, and be part of mutually reinforcing relationships. Therefore, the sole right of heads of the second-cycle institutions to share leadership positions must be revised to suit the current management environment. Besides, leaders should be inspired to apply ethical leadership and emotional intelligence at school for unity and effective management. Future researchers are encouraged to research ethical leadership and emotional intelligence in managing academic institutions in Africa and beyond.

## References


1. Adu-Gyamfi, S., Donkoh, W.J., and Addo, A.A. (2016). Educational Reforms in Ghana: Past and Present. *Journal of Education and Human Development September 2016, Vol. 5, No. 3, pp. 158-172 ISSN: 2334-296X*
2. Akpamah, P., Ivan-Sarfo, E., and Matkó, A. (2021). organizational culture and organizational strategy. A Review Article. *Cross-Cultural Management Journal, Vol. XXIII, Iss. 1.*
3. Alina, M.A. (2009). Emotions Management within Organizations. *The Annals of "Dunarea de Jos", University of Galati Fascicle I. Economics and Applied Informatics.*
4. Appiah, S.O., and Amfo-Antiri, D. (2019). *Leadership and Emotional Intelligence.* Ghana: University of Cape Coast, College of Distance Education, University of Cape Coast Code Publications.

5. Ashkanasy, N.M., and Humphrey, R.H. (2011). Current emotion research in organizational behaviour. *Emotion Review, 3,* 214-224.
6. Bennett, N., Harvey, J., Wise, C., and Woods, P. (2003). *Distributed leadership: A desk study*. Nottingham, UK: NCSL.
7. Bush, T., and Jackson, D. (2003). A preparation for school leadership: International perspectives. *Educational Leadership and Administration, 30(4),* 417-429.
8. Bush, T., and Oduro, G.K.T. (2006). New principals in Africa: preparation, induction and practice. *Journal of Educational Administration*, 44(4), 359-375
9. Casper, G. (2002). *Four essential qualities of the successful research-intensive university*. Proceedings of Chinese-Foreign University Presidents Forum Beijing, China: Higher Education Press, pp. 102-123. Retrieved from http://www.edu.cn/20040806/ 3112120.shtml, 26.01.2022.
10. Chen, Z. (2002). *Speech at the opening ceremony of Chinese-Foreign University presidents' forum.* Proceedings of Chinese-Foreign University Presidents Forum. Beijing, China: Higher Education Press, pp. 7-10. Retrieved from http://www.edu.cn/20040806/ 3112120.shtml, 26.01.2022.
11. Dahlum, S., and Wig, T. (2019). Educating Demonstrators: Education and Mass Protest in Africa. *Journal of Conflict Resolution, Vol. 63(1),* 3-30. DOI: 10.1177/0022002717721394 journals.sagepub.com/home/jcr.
12. Dimotakis, N., Scott, B.A., and Joopman, J. (2011). *An experience sampling investigation of workplace interactions, affective states, and employee wellbeing*.
13. Domagalski, T.A., and Steelman, L.A. (2005). The impact of work events and disposition on the experience and expression of employee anger. *Organizational Analysis, 13,* 31-52.
14. Esia-Donkoh, K. (2014). Attaining school and educational goals: Duties of head teachers at public basic schools in Ghana. *Journal of Education and Practice, 5(1),* 64-72.
15. Fitness, J. (2000). Anger in the workplace: An emotion script approach to anger episodes between workers and their superiors, co-workers, and subordinates. *Journal of Organizational Behaviour, 21,* 147-162.
16. Ghamrawi, N. (2011). Trust me: Your school can be better—A message from teachers to principals. *Educational Management, Administration and Leadership, 39*(3), 333-348.
17. Ghana Education Service (2010). *Head teachers' handbook*. Ghana, Accra: Ministry of Education.
18. Gibson, D.E., and Callister, R.R. (2010). Anger in organizations: Review and integration. *Journal of Management, 36,* 66-93.
19. Hallinger, P., & Heck, R. (2010). Leadership for learning: Does distributed leadership make a difference in student learning? *Educational Management, Administration, and Leadership, 38*(6), 654-678.
20. Harris, A. (2004). Distributed leadership and school improvement: Leading or misleading? *Educational Management, Administration and Leadership, 32*(1), 11-24.

21. Hartley, D. (2010). Paradigms: How far does research in distributed leadership "stretch"? *Educational Management, Administration and Leadership, 38*(3), 271-285.
22. Lawrence, S. (2008). The case for emotion-induced toxicity: Making sense of toxic emotions in the workplace. In: N.M. Ashkanasy & C.L. Cooper (Eds.), *Research companion to emotion in organizations* (pp. 73-89). Cheltenham, UK: Edward Elgar.
23. Lonyian, S.P., and Kuranchie, A. (2018). Head Teachers' Professional Management Needs and Concerns: Evidence from an Educational District in Ghana. *European Journal of Training and Development Studies, Vol. 5, No. 2.* UK: European Centre for Research Training and Development, pp. 33-47.
24. Matkó, E.M. (2013). *The Role of Organizational Culture and Leader Characteristics in Regional Competitiveness at the Municipalities of the North Great Plan Region. Doctoral (PhD) Dissertation.* Hungary: KarolyIhrig Doctoral School of Management and Business. University of Debrecen.
25. Mbah, F.J.A. (2016). *Leadership Style and Performance of Small and Medium Size Enterprises in Cameroon.* Faculty of Economics and Management, University of Yaounde II.
26. Miner, A.G., and Glomb, T.M. (2010). State mood, task performance, and behaviour at work: A within-persons approach. *Organizational Behaviour and Human Decision Processes, 112,* 43-57.
27. Muhereza, J.I. (2019). *Internal Recruitment and Employee Performance in Security Forces; a Case of Uganda Police.* Mbarara District.
28. Mulford, B. (2003). *Leadership for learning research group.* Tasmania: University of Tasmania.
29. Politis, J.D. (2001). The relationship of various leadership styles to knowledge management. *Leadership & Organization Development Journal, 22(8),* 354-364.
30. Rozin, P., and Royzman, E.B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review, 5,* 296-320.
31. Rudenstine, N.L. (2002). *Distinguished features of a national leading university and elements for successful leadership and management: Harvard experiences*. Proceedings of Chinese-Foreign University Presidents Forum. Beijing, China: Higher Education Press, pp. 1-31. Retrieved from http://www.edu.cn/20040806/3112120.shtml, 29.01.2021.
32. Sadeghi, A. and Pihie, Z.A.L. (2012). Transformational leadership and its predictive effects on leadership effectiveness. *Int. J. Bus. Soc. Sci., 3,* 186-197.
33. Sekyere, E.A. (2016). *Teacher's Guide on topical issues for promotion and selection. Interviews for teachers, teacher trainee, non-teaching staff and general professional update.* Ghana: Afosek Education consult-Kumasi.
34. Spence, J.R., Ferris, D.L., Brown, D.J., and Heller, D. (2011). Understanding daily citizenship behaviours: A social comparison perspective. *Journal of Organizational Behaviour, 32,* 547-571.

35. Tang, K.N. (2019). *Leadership and Change Management*. Springer Briefs in Business, Springer Nature Singapore Pte Ltd. https://doi.org/10.1007/978-981-13-8902-3_2.
36. Tian-Syung, L., I-Hsiung, C., Tsz-Ching, M., Lie-Ping, Z., and Kai-Chi, C. (2019). Influences of Transformational Leadership, Transactional Leadership, and Patriarchal Leadership on Job Satisfaction of Cram School Faculty Members. *Sustainability, 11,* 3465. Doi: 10.3390/su11123465 www.mdpi.com/journal/sustainability.
37. Totterdell, P., and Niven, K. (2014). *Workplace moods and emotions: A review of research.* Charleston, SC: Createspace Independent Publishing.
38. Weiss, H.M., and Cropanzano, R. (1996). Affective events theory: A theoretical discussion of the structure, causes and consequences of affective experiences at work. *Research in Organizational Behaviour, 18,* 1-74, 128.
39. Wright, P.L., and Taylor, D.S. (1994). *Improving leadership performance: interpersonal skills for effective leadership.* USA: Prentice Hall.
40. Zame, M.Y., Warren, C.H., and Trimetia, R. (2008). Educational reform in Ghana: The leadership challenge. *International Journal of Educational Management, 22(2),* 115.

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# IDENTIFICATION OF AREAS FOR OPTIMISING MARKETING COMMUNICATIONS VIA AI SYSTEMS

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**Purpose:** The main objective of this article is to identify areas for optimizing marketing communication via artificial intelligence solutions.
**Design/methodology/approach**: In order to realise the assumptions made, an analysis and evaluation of exemplary implementations of AI systems in marketing communications was carried out. For the purpose of achieving the research objective, it was decided to choose the case study method. As part of the discussion, the considerations on the use of AI undertaken in world literature were analysed, as well as the analysis of three different practical projects.
**Findings:** AI can contribute to the optimisation and personalisation of communication with the customer. Its application generates multifaceted benefits for both sides of the market exchange. Achieving them, however, requires a good understanding of this technology and the precise setting of objectives for its implementation.
**Research limitations/implications**: The article contains a preliminary study. In the future it is planned to conduct additional quantitative and qualitative research.
**Practical implications:** The conclusions of the study can serve to better understand the benefits of using artificial intelligence in communication with the consumer. The results of the research can be used both in market practice and also serve as an inspiration for further studies of this topic.
**Originality/value:** The article reveals the specifics of artificial intelligence in relation to business activities and, in particular, communication with the buyer. The research used examples from business practice.

**Keywords:** Artificial Intelligence, Marketing Communication, Machine Learning, Big Data, New Technologies

**Category of the paper:** Technical paper, Conceptual paper.

## 1. Introduction

The dynamic development of information and communication technologies (ICTs) is having a significant impact on the functioning of modern businesses. The transformation, which takes place through digital systems, in its main intentions is to result in increasing the efficiency of processes and enhancing productivity, resulting in raising the standard of living of society (Ebert, Duarte, 2020; Vial 2021). The multidimensionality of the changes taking place in the enterprise under the influence of the spread of solutions such as artificial intelligence, the internet of things, or virtual reality is an important research subject (see: Dornberger, 2018; Bajak, 2021; Naqvi, 2021). In fact, progressive digitalisation affects almost all dimensions and aspects of the functioning of market institutions. Indeed, modern technologies improve, for example, production, logistics, marketing, management, or financial processes (eg. Liu et al., 2019; Tadapaneni, 2019; Żabińska, 2020; Raisch, Krakowski, 2021; Bajak, 2022). At the same time, the development of systems, that can be described as SMART, reinforces integration of a horizontal and vertical nature between different company departments (Patel, Ali, Sheth, 2018; Miśkiewicz, 2019; Yang, Gu, 2021), which enables, in effect, the creation of increasingly efficient, safe, cost-effective and environmentally friendly solutions. These are predominantly based on using data extracted from the environment to generate value from it (Nguyen, Zhou, Spiegler, Ieromonachou, Lin, 2018; Romaniuk, 2020). In this area, the fundamental challenge is therefore to create systems that automate data processing and, on this basis, monitor, control and optimise company processes.

The main objective of this article is to identify areas for optimizing marketing communication via artificial intelligence solutions. In order to realise the assumptions made, an analysis and evaluation of exemplary implementations of AI systems in marketing communications was carried out. As part of the discussion, the considerations on the use of AI undertaken in world literature were analysed, as well as the analysis of three different practical projects. For the purpose of achieving the research objective, it was decided to choose the case study method.

## 2. The use of artificial intelligence in the enterprise

The term 'artificial intelligence' was first introduced by John McCarthy at Dartmouth University in 1955 during a meeting with fellow scientists (Warszycki, 2019). He described it as the process "that of making a machine behave in ways that would be called intelligent if humans were so behaving" (McCarthy et al., 1955). The development of such systems and their components like data, computing power, algorithms can lead to a variety of benefits, including

economic ones (Zhang, Cui, Zhu, 2020). AI can thus be defined as a multidisciplinary technology that uses mechanisms for data analysis, integration of cognitive functions and emotion recognition, human-computer interaction, machine learning and decision-making (Lu, 2019). It assumes particular importance in industries where big data analysis is important [such as healthcare, commerce, finance or automotive], which is not without its influence on the main development directions of such systems (Zhang, Lu, 2021).

The subject of artificial intelligence has been gaining in popularity in recent years. As many as 377,529 papers in the Web of Science database have been devoted to it, while 434,754 articles in this area have been classified in Scopus. The most common fields are Computer Science (39.1%), Engineering (16.4%) and Mathematics (15.5%). It is worth noting that the rapid development observed in the aforementioned areas of science further contributes to the growing importance of artificial intelligence. At the same time, machines and programmes using AI mechanisms help to create and discover new relationships between data, which is why AI is being implemented in various areas beyond the sciences and technology, such as economics, medicine or management.

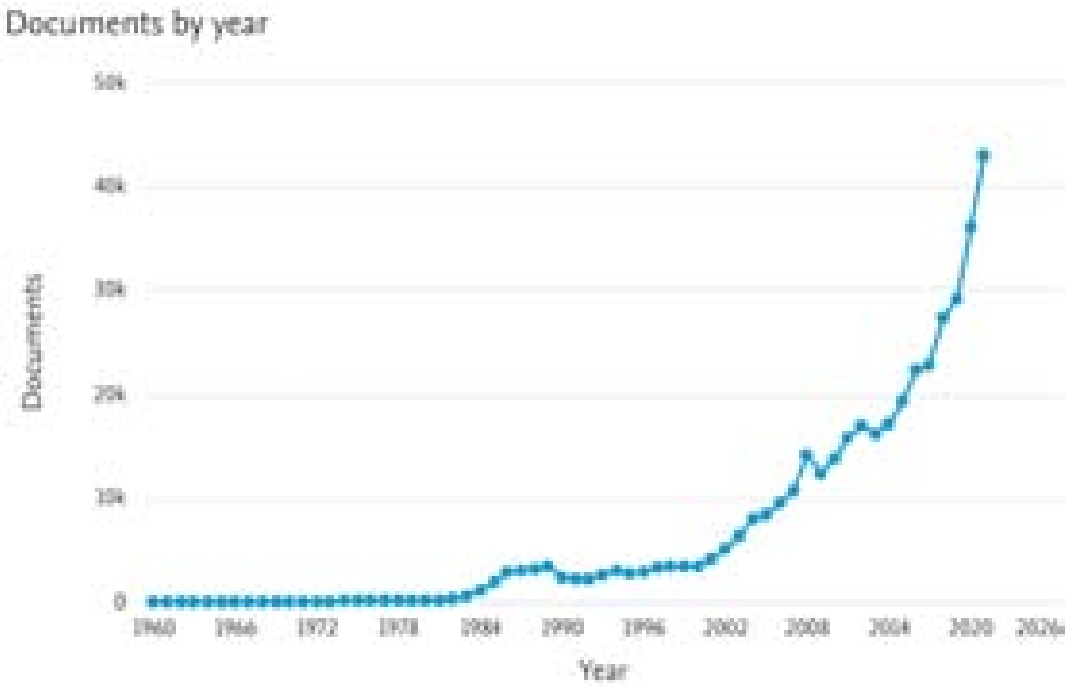


**Figure 1.** Increase in number of AI related articles in Scopus database. Source: (Scopus, 2022).

The interest in AI shown by a variety of industries has led global leaders in the field of high-tech to take an interest in its application, such as Apple, Amazon, Google, IBM, Facebook and Baidu (McKinsey & Company, Forbes, 2017). Enterprises using AI solutions also include companies from the automotive industry [BMW, Toyota, Tesla] and broader industry (Bosh, ABB, Siemens, General Electric). Their investments have contributed to the dynamic development of AI, which has made the technology increasingly relevant (Bielinska-Dusza, 2020) and finding more and more applications in business (Eriksson et al., 2020). This is a factor in building competitive advantage and can be seen as a kind of catalyst for digital

transformation (Bielinska-Dusza, 2022), which is reshaping existing ways of operating businesses (Cusumano et al., 2020). The following can be identified as the main factors encouraging investment in this area (Wodecki, 2018):

- economic incentives – increased revenues as a result of a wider market and reduced failure rates, as well as lower operating costs,
- new sources of revenue – innovative payment models, as well as new services and products,
- technological advantage – increased predictability of processes, ensuring stability, more efficient use of resources, decreased cost of errors because of their efficient detection,
- regulatory changes – introduction of data protection regulations such as RODO as well as new security standards and requirements, changing economic objectives, implementation of modernisation and development grants,
- industry (market) pressure – rising resource costs, pressure from regulators and aggressive competitive strategies,
- customer pressure – expectation of new solutions and product optimisation by consumers.

Another stimulant that is increasing interest in AI is the cooperation between industry, research and education directed toward the development of this technology. Therefore, this is resulting in growing investment and increased innovation dynamics in this area (Stanford Human-Centered Artificial Intelligence HAI, 2019).

## 3. Determinants of the implementation of AI systems in a company

Constructing the right business case is often a critical determinant of a company's success in implementing AI. These solutions ultimately aim to streamline decision-making processes and improve communication as a result of information analysis (Rutkowski, 2020). The fundamental element that enables AI mechanisms to achieve the assumptions made is data. This is because they make it possible to understand market phenomena, draw conclusions from them and make decisions (Warszycki, 2019). The results obtained can be used to create new products, services and conquer new markets (Sujata, Aniket, Mahasingh, 2019; Chen, Siau, 2020). Therefore, the implementation of artificial intelligence in a company requires the precise establishment of business objectives, as well as access to data and appropriate tools, together with techniques for their analysis. Equally important is the adaptability of the results obtained and a favourable organisational culture (McKinsey & Company, 2017; Ransbotham et al. 2017). Although these types of systems are costly, their legitimate use has a number of benefits for the organisation, which ultimately contributes to growth. This is because the overriding concern is to increase: revenue, profit, or market share, rather than to reduce expenditure per se

(Wodecki, 2018). However, it is important to keep in mind that the purchase and implementation of artificial intelligence solutions does not guarantee that value will be derived from the venture. Therefore, it is significant to adapt algorithms for one's own range of processes and data, which requires structured data ecosystems and supervision and control of the training (learning) processes of the algorithms. In this area, it is essential to understand the specifics of artificial intelligence mechanisms and controllers (Kietzmann, Paschen, Treen, 2018; Zhang, Lu, 2021):

- Big Data – multidimensional and powerful data sets whose analysis requires the speed and accuracy provided by AI. As a result, they enable comprehensive information and serve to optimise processes and facilitate decision-making.
- Problem Solving and Reasoning – computer algorithms that enable the detection of patterns based on data analysis and thus contribute to problem solving and improve the ability to predict future behaviour.
- Machine Learning – empirical learning based on experience in data analysis. Used to optimise algorithms based on previously memorised data and practices.
- Vision Computing – image recognition as well as object identification, tracking and measurement. Processing the surrounding world into data for understanding by computers.
- Speech Recognition – speech analysis, including both, understanding the meaning of words and the timbre of the voice, as well as the interaction between human and machine language.
- Hardware Platform – the physical devices that provide the material basis for the operation of computer software.

From a business perspective, it is particularly important to practically reference and use these processes for decision-making (eg. Duan, Edwards, Dwivedi, 2019; Ghasemaghaei, 2019; Arnott, 2020), knowledge and skills management (eg. Božič, Dimovski, 2019; Lei, Wang, 2020; Yiu, Yeung, Jong, 2020) and information analytics in a broad sense (eg. Nalchigar, Yu, 2017; Chen, Siau, 2020; Wamba-Taguimdje et al., 2020). At the same time, these mechanisms can be used to optimise communication with the buyer and improve their shopping experience. This responds to the growing need to personalise the dialogue with the customer and contributes to achieving multifaceted benefits for each side of the market exchange. A better understanding of the specific role of AI in consumer communication can be provided by analysing practical implementations of such systems.

## 4. Methodology

The main objective of this article is to identify areas for optimizing marketing communication via artificial intelligence solutions. In order to realise the assumptions made, exemplary implementations of AI systems in marketing communication were examined. As part of the discussion undertaken, reflections on the application of AI undertaken in the literature were reviewed, as well as an analysis of three different practical projects. This made it possible, in effect, to analyse and evaluate exemplary implementations of AI systems in a variety of business areas. In order to realise the research objective, it was decided to choose the case study method. It is based on a detailed study of the empirical material, which is carried out using secondary or primary data. It is done in order to understand the processes of the discussed phenomenon and to indicate their context (Rashid et al., 2019). Due to the extensive and interdisciplinary nature of the topic under study, it was decided to juxtapose three separate examples with varying specificities. This allowed for the identification of similarities as well as differences between the cases. In the work presented here, the interdependencies between the cases studied were used to identify the main benefits for the company and the consumer resulting from the use of AI solutions in the company.

Due to the dynamic development of technologies in the field of artificial intelligence and their numerous implementations in business, a purposeful selection of the projects examined was made. Prior to the selection, information on outstanding projects was searched for, among other things, on company websites and in trade journals. The following criteria were adopted:

- possibility of dissemination of the solutions used by other institutions,
- innovativeness of the AI mechanisms used,
- prospects for further improvement of the system presented.

## 5. Practical examples of using AI systems in marketing communication

Three different systems using artificial intelligence (AI) mechanisms were analysed as part of the considerations (Table 1). The general specificity of the projects is shown in the table, which is a common practice when applying this method (Miles et al., 2014). This serves to deepen insights and establish relationships between the cases studied (Halkias, Neubert, 2020). The systems studied have a variety of functions, which nevertheless remain within the field of marketing communications. However, their distinct characteristics result in different benefits for the organisations using them, which provides a broader picture of the specificity of AI.

**Table 1.**
*Overview of the cases studied*

| System | Organisation | Area of appliacation | Main objectives of implementation |
|---|---|---|---|
| **Watson Assistant** | Humana | Customer service | Shortening the time of customer service, obtaining customer's data (customer verification and authorization), relieving employees from routine activities, increasing the efficiency of the team |
| **Seventh Sense** | Natera | Email marketing | Optimising email messages, automating the time of sending messages, increasing the open rate and click-through rate |
| **shopDisney** | Walt Disney Company | E-commerce | Improving purchase recommendations, increasing sales revenues |

Source: own study.

### 5.1. Humana: Watson Assistant

In the United States, Humana is the leading provider of health insurance. It serves more than 13 million customers nationwide. In order to maintain their high position, companies in this sector are forced to innovate, including constantly improving customer service. When consumers make a phone call, they expect fast and accurate answers to their questions, without taking their circumstances into account. In order to meet customer demands, Humana began looking for call centre automation solutions. To this end, the company began working with global technology giant IBM, which offers numerous AI-based tools. The Watson Assistant tool implemented was tailored to Humana's needs, automating customer service. The solution uses one method of artificial intelligence in the form of a voice assistant, equipped with the ability to convert speech into text. Until now, the calls received by physical consultants were 60% about routine, specific pre-service questions, with definable answers. The artificial intelligence system implemented provides a faster, consistent and more user-friendly way to obtain information, particularly regarding medical qualifications; verification and authorisation without having to speak to a physical agent. The solution has significantly increased the efficiency of customer service staff, relieving them of repetitive and routine activities. Through Humana's extended collaboration with IBM, a joint IBM Data and AI Expert Labs & Learning (DAELL) effort was launched. This resulted in improvements to the Watson system, using customised training and models focused on medical terminology in a lower bandwidth call centre environment. This solution allowed Humana to answer more than 7,000 voice calls per day, significantly increasing the capacity of its existing customer service department (IBM, 2022).

### 5.2. Natera: Seventh Sense

Natera Inc is a global clinical research leader dedicated to the development and commercialisation of non-invasive DNA analysis methods, with a particular focus on the detection of women's diseases, organs and cancer. The company's mission is to transform the diagnosis and treatment of genetic diseases. Currently, Natera offers a range of genetic testing services in its portfolio mainly in the field of obstetrics and gynaecology, as well as infertility treatment. As a global company, Natera was looking for a unique, efficient solution in the area of marketing communication due to the growing number of its customers worldwide. The company's main objective was to maintain its leadership position, which involved reaching out to new audiences for their services. A relatively traditional marketing method in the form of email marketing proved to be the optimal solution. Due to the demand for more personalised and sophisticated marketing campaigns, innovation in the form of email optimisation and automation was required. Natera, in collaboration with Prism Global Marketing Solution, decided to implement AI-based technology in this area - Seventh Sense and HubSpot. The Seventh Sense system, using artificial intelligence, analyses historical data on customer engagement on previously sent emails, builds a profile of each subscriber and then allows marketers to automatically send campaigns, according to individual customer time preferences. In other words, the system's algorithms are focused on sending emails at the time each subscriber is most likely to read the message and respond to the call to action in it. The Seventh Sense system uses 3 methods of email delivery:

- based on sending time personalisation - using historical data of successful contacts, the system determines the most optimal time to send a message to a given group of recipients within a specified hourly framework;
- based on randomisation of sending time – in the case of new customers, or customers who have not been engaged so far, the system randomly selects the time of sending the message to each of them (between 8:00 and 20:00 Eastern American time). The purpose of this is to determine the appropriate time to send the message to customers not previously engaged, the time they spend browsing their own email inboxes;
- based on sending an e-mail to a so-called control group - it is similar to a traditional batch campaign conducted at random times, but, thanks to data analysis by AI, it is carried out at moments of peak message recipient engagement.

As a result of the Seventh Sense application (mainly through personalisation and randomisation of the timing of messages), Natera generated a combined increase in open rate (OR) and click-through rate (CTR) of 5.1 and 18.1 percentage points, respectively (compared to the control group). Taking into account the personalisation method, the increase in OR was 2.5 percentage points, while CTR was 23.9%. Among new customers, these increases were much higher, as the randomisation method resulted in an open rate 110.6 percentage points higher and a click-through rate 89 percentage points above the control group. In other words,

the AI-based tool brought tangible benefits to the company in the form of significantly higher conversion rates with the customer. What's more, the Natera company increased the number of its new customers by 85% within six months of using the Seventh Sense email marketing optimisation system. In addition to attracting new service recipients, engagement with existing subscribers and customers who were active in earlier years also increased (Natera, 2022).

### 5.3. Walt Disney Company: shopDisney

The Walt Disney Company is an American media and entertainment company. The concern initially produced animated films becoming an industry leader. The corporation includes entities such as Walt Disney Studios, General Entertainment Networks (Walt Disney Television), Media and Entertainment Distribution, Sports Networks (ESPN Inc.), International Operations and Disney Parks, Experiences and Products. Disney has more than 200 retail shops in the US, as well as shops in Europe, Japan and China. The company also has an online shop, shopDisney. It offers a number of product categories, including household items, toys, collectibles and clothing.

The online shop shopDisney has so far used product metadata (including names and descriptions) to display product recommendations to shop users that are related to the items they are currently browsing. This method is commonly used in e-commerce, mainly to increase the likelihood of a consumer buying another product. Due to the rather limited possibilities associated with the use of metadata, this solution often contributes to many misguided purchase suggestions. For example, a customer looking for a sleep mask would come across recommendations for costume masks, which are a separate product category. In order to improve the way products are recommended to customers, the Walt Disney Company decided to implement an artificial intelligence tool. To this end, a collaboration was undertaken with Google, which has solutions based on AI methods. Such a tool is Recommendations AI, which uses machine learning to analyse data and optimise processes. The adapted artificial intelligence system began collecting data and analysing it, which translated directly into the generation of relevant product suggestions in the online shop. As a result of the implementation, shopDisney has recorded increased customer engagement in the sales process, leading to higher sales figures and, in turn, increased revenue for the company. Thanks to the AI system's analysis of consumers' previous interactions in the online shop, the management decided to extend the recommendation functionality also at the stage when customers add items to the shopping cart. The AI system detected that often products displayed by customers are grouped together and purchased by them. Using this relationship, Recommendations AI intelligently displays product suggestions based on consumers' previous purchasing decisions. In both cases, the machine learning tool showed greater efficiency than standard metadata-based mechanisms (Vignesh, 2019).

## 6. Summary

The research conducted suggests that the application of artificial intelligence in marketing communications generates multifaceted benefits for both the company and the consumer (Figure 2). Its use mainly revolves around the automation, control and optimisation of processes provided by AI. On the brand side, its effect is primarily to better identify the needs of the buyer and to be able to tailor the communication provided to them more effectively. This creates a greater sense of connection with the brand for the consumer, fostering his trust and engagement.

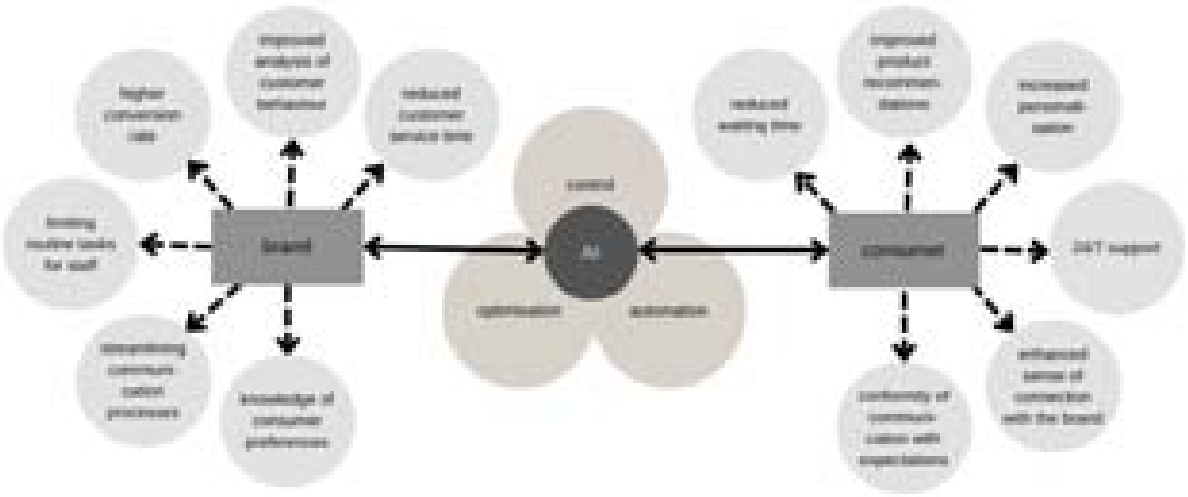

**Figure 2.** Areas for optimising marketing communications via AI systems. Source: own study.

Undoubtedly, the use of artificial intelligence is significantly changing business operations. However, in order for its implementations to be successful, it is essential to know the detailed specifics of this type of IT solution and to understand the needs of the brand and its audience. It should therefore be preceded by practices such as:

- recognising the benefits of AI,
- conducting an analysis of the company's needs and expectations regarding the implementation of the technology,
- examining the requirements of consumers, the implementation of which can be facilitated by the automation of marketing communications using artificial intelligence,
- becoming familiar with solutions from this area applied in other market institutions,
- setting specific business objectives resulting from the implementation of AI,
- carefully selecting a project contractor who specialises in systems from the area of artificial intelligence,
- ensuring that the solution is intuitive to use (e.g., by limiting useless functionalities),
- providing access to good quality databases,
- securing the system against hacking attacks,
- testing the solution before releasing it in order to eliminate possible errors.

In turn, after implementation, the operation of the system should be regularly tested, both for correctness and its further development as a result of machine learning. At the same time, it is worth following the trends emerging in technology and, if necessary, considering the development of applied AI solutions. Progressive digitalisation, in a way, imposes an obligation on companies to observe trends and respond to them if they want to remain leaders in the area of modern marketing communication that meets the needs of the contemporary consumer.

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## References

1. Arnott, D. (2010). Senior executive information behaviors and decision support. *Journal of Decision Systems, 19(4)*, pp. 465-480. doi: 10.3166/jds.19.165-480.
2. Bajak, M. (2021). *Wykorzystanie beaconów w komunikacji marketingowej*. Warszawa: PWE.
3. Bajak, M. (2022). Beacons as the Touchpoints on the Customer Journey. *Scientific Papers of Silesian University of Technology. Organization and Management Series, 155*, pp. 17-29. doi: 10.29119/1641-3466.2022.155.2.
4. Božič, K., Dimovski, V. (2019). Business intelligence and analytics use, innovation ambidexterity, and firm performance: A dynamic capabilities perspective. *The Journal of Strategic Information Systems, 28(4)*, pp. 101578. doi: 10.1016/j.jsis.2019.101578.
5. Chen, X., Siau, K. (2020). Business analytics/business intelligence and IT infrastructure: Impact on organizational agility. *Journal of Organizational and End User Computing, 32(4)*, pp. 138-161. doi: 10.4018/JOEUC.2020100107.
6. Cusumano, M.A., Yoffie, D.B., Gawer, A. (2020). The Future of Platforms. *MIT Sloan Management Review, 61(3)*, pp. 46–54.
7. Dornberger, R. (2018). *Business Information Systems and Technology 4.0: New Trends in the Age of Digital Change*. Cham: Springer.
8. Duan, Y., Edwards, J.S., Dwivedi, Y.K. (2019). Artificial intelligence for decision making in the era of Big Data–evolution, challenges and research agenda. *International Journal of Information Management, 48*, 63-71. doi: 10.1016/j.ijinfomgt.2019.01.021.

9. Ebert, Ch., Duarte, C.H. (2020). Digital Transformation. IEEE Software, 35(4), pp. 16-21. doi: 10.1109/MS.2018.2801537.
10. Eriksson, T., Bigi, A., Bonera, M. (2020). *Think with me, or think for me? On the future role of artificial intelligence in marketing strategy formulation*. *TQM Journal 32(4)*, pp. 795-814.
11. Ghasemaghaei, M. (2019). Does data analytics use improve firm decision making quality? The role of knowledge sharing and data analytics competency. *Decision Support Systems, 120(2),* pp. 14-24. doi: 10.1016/j.dss.2019.03.004.
12. Halkias, D., Neubert, M. (2020). Extension of theory in leadership and management studies using the multiple case study design. *International Leadership Journal, 12(2),* 48-73. doi: 10.2139/ssrn.3586256.
13. IBM (2022). *Humana*. Available online: https://www.ibm.com/watson/stories/humana.
14. Kietzmann, J., Paschen, J., Treen, E.R. (2018). Artificial Intelligence in Advertising: How Marketers Can Leverage Artificial Intelligence Along the Consumer Journey. *Journal of Advertising Research, 58(3),* pp. 263-267. doi: 10.2501/JAR-2018-035.
15. Lei, Z., Wang, L. (2020). *Construction of organisational system of enterprise knowledge management networking module based on artificial intelligence*. *Knowledge Management Research & Practice*. doi: 10.1080/14778238.2020.1831892.
16. Liu, S., Zhang, Y., Liu, Y., Wang, L., Wang, X. V. (2019). An 'Internet of Things' enabled dynamic optimization method for smart vehicles and logistics tasks. *Journal of Cleaner Production, 215*, 806-820. doi: 10.1016/j.jclepro.2018.12.254.
17. Lu, Y. (2019). Artificial intelligence: a survey on evolution, models, applications and future trends. *Journal of Management Analyticsm 6(1)*, pp. 1-29. doi: 10.1080/ 23270012.2019.1570365.
18. McCarthy, J., Minsky, M.L., Rochester, N., Shannon, C.E. (1955). *A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence.* Available online: http://www-formal.stanford.edu/jmc/history/dartmouth/dartmouth.html.
19. McKinsey & Company (2017). *Artificial Intelligence The Next Digital Frontier?* Available online: https://www.mckinsey.com/~/media/mckinsey/industries/advanced%20electronics/our%20insights/how%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/mgi-artificial-intelligence-discussion-paper.ashx.
20. McKinsey & Company, Forbes Polska (2017). *Rewolucja AI Jak sztuczna inteligencja zmieni biznes w Polsce.* Available online: https://www.mckinsey.com/pl/~/media/McKinsey/Locations/Europe%20and%20Middle%20East/Polska/Raporty/Rewolucja%20AI%20Jak%20sztuczna%20inteligencja%20zmieni%20biznes%20w%20Polsce/Raport-AI_Forbes_PL.pdf.
21. Miles, M., Huberman, A.M., & Saldana, J. (2019). *Qualitative Data Analysis: A Methods Sourcebook*. Thousand Oaks: SAGE Publications.

22. Miśkiewicz, R. (2019). Industry 4.0 in Poland – Selected Aspects of Its Implementation. *Scientific Papers of Silesian University of Technology. Organization and Management Series, 106,* pp. 403-413. doi: 10.29119/1641-3466.2019.136.31.
23. Nalchigar, S., Yu, E. (2017). *Conceptual modeling for business analytics: A framework and potential benefits.* Proceedings of the 2017 IEEE 19th Conference on Business Informatics, Thessaloniki. doi: 10.1109/CBI.2017.63.
24. Naqwi, A. (2021). *Artificial Intelligence for Asset Management and Investment: A Strategic Perspective*. Hoboken: John Wiley & Sons.
25. Natera (2022). *Case Study: Increase Email Engagement Utilizing Send Time Optimization with Seventh Sense & HubSpot.* Available online: https://cdn2.hubspot.net/hubfs/529456/Natera%20Case%20Study.pdf.
26. Nguyen, T., Zhou, L., Spiegler, V., Ieromonachou, P., Lin, Y. (2018). Big data analytics in supply chain management: A state-of-the-art literature review. *Computers & Operations Research, 98(10)*, pp. 254-264. doi: 10.1016/j.cor.2017.07.004.
27. Patel, P., Ali, M.I., Sheth, A. (2018). From Raw Data to Smart Manufacturing: AI and Semantic Web of Things for Industry 4.0. *IEEE Intelligent Systems, 33(4)*, pp. 79-86. doi: 10.1109/MIS.2018.043741325.
28. Raisch, S., Krakowski, S. (2021). Artificial Intelligence and Management: The Automation–Augmentation Paradox. *Academy of Management Review 46(1)*. doi: 10.5465/amr.2018.0072.
29. Ransbotham, S., Kiron, D., Gerbert, P., Reeves, M. (2017). *Reshaping Business with Artificial Intelligence. Closing the Gap Between Ambition and Action.* Available online: https://web-assets.bcg.com/img-src/Reshaping%20Business%20with%20Artificial%20Intelligence_tcm9-177882.pdf.
30. Rashid, Y., Rashid, A., Warraich, M.A., Sabir, S., Waseem, A. (2019). Case study method: A step-by-step guide for business researchers. *International Journal of Qualitative Methods, 18*, pp. 1-13. doi: 10.1177/1609406919862424.
31. Romaniuk, R. (2020). Systemy informatyczne jako fundament przedsiębiorstwa 4.0. In: Gregor, B., Kaczorowska-Spychalska, D., (Eds.). *Technologie cyfrowe w biznesie* (pp. 13-42). Warszawa: PWN.
32. Rutkowski, I. (2020). Inteligentne technologie w marketingu i sprzedaży — zastosowania, obszary i kierunki badań. *Marketing i Rynek 27(6)*, pp. 3-12. doi: 10.33226/1231-7853.2020.6.1.
33. Scopus (2022). *Artificial Intelligence*. Available online: https://www.scopus.com.
34. Stanford Human-Centered Artificial Intelligence HAI (2019). *Artificial Intelligence Index Report. 2019 Annual Report.* Available online: https://hai.stanford.edu/sites/default/files/ai_index_2019_report.pdf.

35. Sujata, J., Aniket, D., Mahasingh, M. (2019). Artificial intelligence tools for enhancing customer experience. *International Journal of Recent Technology and Engineering, 8(2S3),* pp. 700-706. doi: 10.35940/ijrte.B1130.0782S319.
36. Tadapaneni, N.R. (2019). Artificial Intelligence in Finance and Investments. International *Journal of Innovative Research in Science, Engineering and Technology, 9(5),* pp. 2792-2795.
37. Vial, G. (2021). Understanding digital transformation. In: A. Hinterhuber, T. Vescovi, F. Checchinato (Eds.), *Managing Digital Transformation* (pp. 13-66). London: Routledge.
38. Vignesh, M. (2019). *Artificial Intelligence Series – AI in Retail Industry with 4 Use Case Studies*. Available online: https://www.cronj.com/blog/artificial-intelligence-series-ai-in-retail-industry.
39. Wamba-Taguimdje, S.L., Wamba, S.F., Kamdjoug, J.R.K., Wanko, C.E.T. (2020). Influence of artificial intelligence (AI) on firm performance: The business value of AI-based transformation projects. *Business Process Management Journal, 26(7)*, 1893-1924. doi: 10.1108/BPMJ-10-2019-0411.
40. Warszycki, M. (2019). Wykorzystanie sztucznej inteligencji do predykcji emocji konsumentów. *Studia i Prace Kolegium Zarządzania i Finansów. Szkoła Główna Handlowa, 173*, pp. 111-121.
41. Wodecki, A. (2018). *Sztuczna inteligencja w kreowaniu wartości organizacji*. Kraków-Legionowo: edu-Libri.
42. Yang, F., Gu, S. (2021). Industry 4.0, a revolution that requires technology and national strategies. *Complex & Intelligent Systems, 7*, 1311-1325. doi: 10.1007/s40747-020-00267-9.
43. Yiu, L.D., Yeung, A.C., Jong, A.P. (2020). Business intelligence systems and operational capability: An empirical analysis of high-tech sectors. *Industrial Management and Data Systems, 120(6)*, 1195-1215. doi: 10.1108/IMDS-12-2019-0659.
44. Żabińska, I. (2020). Development opportunities for automation and robotization in Poland. *Scientific Papers of Silesian University of Technology. Organization and Management Series, 148,* pp. 861-870. doi: 10.29119/1641-3466.2020.148.63.
45. Zhang, Z., Cui, P., Zhu, W. (2020). Deep learning on graphs: a survey. *IEEE Transactions on Knowledge and Data Engineering*. doi: 10.1109/tkde.2020.2981333.
46. Zhang, C., Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration, 23*, 100224. doi: 10.1016/j.jii.2021.100224.

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# BUILDING CONSUMER ENGAGEMENT AND LOYALTY WHILE TRAVERSING THE CUSTOMER JOURNEY IN THE ONLINE SPACE

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**Purpose:** The overriding goal of the considerations is to recognize the phenomena occurring when the buyer traverses the customer journey in the online space and their importance in building his commitment and loyalty.
**Design/methodology/approach**: Dynamic technological progress significantly influences the course of consumer's decision-making processes. Brands are looking for more and more touchpoints on the customer's journey in order to be able to smoothly surround the recipient with messages. As part of the considerations, it was examined how the forms and tools of marketing communication can support marketing activities at individual stages of the customer journey.
**Findings:** The presented publication classifies online marketing communication tools and indicates their links with the various stages of purchasing, the 5A model and building an active consumer attitude towards the brand.
**Research limitations/implications**: The article contains a preliminary study. In the future it is planned to conduct additional quantitative and qualitative research. The study will help to perform a comprehensive analysis of the application being discussed.
**Practical implications:** The right choice of forms and tools of marketing communication not only determines the purchase, but also builds the commitment and loyalty of the buyer, who may ultimately become a brand advocate. Therefore, it is particularly important to have a holistic approach to the dialogue with the consumer and to understand the mechanisms influencing his decisions.
**Originality/value:** Although the topic of e-commerce appears in academic publications, only a few of them relate these devices to the customer journey. This paper comprehensively deals with this topic and focuses on the relationship between online customer journey, the 5A model and the promotion mix tools.

**Keywords:** Customer Journey, Consumer Loyalty, E-Commerce, Market Communication, Buyer Behaviour.

**Category of the paper:** Technical paper, Conceptual paper.

## 1. Introduction

The mechanisms of consumer behaviour in the e-commerce market are becoming increasingly advanced thanks to the use of the latest technologies. However, in order to be able to consider how much influence technology has on the market, it is necessary to delve into the basic consumer decision-making processes taking place among many competing alternatives. The actions of buyers in the online marketplace, as in the real space, are determined by personality, life attitudes, beliefs and motivation, and culture, socio-economic status, pressure from the society or reference group in which they reside, among other factors (Doyle, 2016; Singh, Duhan, 2016; Mishra, 2020). All these factors in the final conclusion contribute to the outcome of the final shopping experience in the virtual world. The decisions and actions that the customer takes during the purchase process in this case can be referred to as the customer journey (Følstad, Kvale, 2018) in the online space. Despite numerous studies and analyzes of its course, the knowledge about its relationship with the optimization of sales processes and the proper design of the experience of visiting the store is still insufficient. This is due, among other things, to the dynamically progressing digital transformation, which constantly reshapes the purchasing habits of buyers (Sanak-Kosmowska, 2018).

The Internet and the digital age have fundamentally changed the way companies approach marketing tools, which have had to respond to new challenges from customers regarding convenience and speed of purchase, customisation of assortment and its price, as well as the way marketing communications are carried out. At the same time, the Internet provides the possibility of quick and wide access to information, the ability to interact harmoniously with the brand and the constant striving to improve the usability of the website interface [UI], as well as the user experience [UX]. Undoubtedly, the focus on the needs and expectations of the recipients means that the customer journey is increasingly controlled, automated and optimised thanks to dedicated algorithms.

The main objective of this article is to identify the phenomena occurring during the customer journey in the online space and their importance in building his involvement and loyalty. The paper also classifies online marketing communication tools and shows how they are related to particular shopping stages, the 5A model and building an active attitude of the consumer towards the brand.

## 2. Marketing communication in the online space

In the world literature, many scientific and business publications in the field of management sciences have been devoted to the subject of the customer journey (e.g. Blokdyk, 2020). The models proposed by researchers usually focus on identifying the buyer's needs, searching for information, comparing variants, selecting the most optimal method of meeting the needs and post-purchase assessment (Engel, Blackwell, Kollat, 1978; Lamb, Hair, McDaniel, 2011). It should be highlighted that consumer purchase behaviour is a particularly important topic in the context of marketing activities, because by definition they are supposed to aim at diagnosing consumer needs and preferences and their fulfilment by means of particular marketing-mix tools. This issue becomes even more important in the case of the online environment, where it is possible to precisely track customer behaviour and flexibly adapt marketing communication instruments to his individual needs and preferences. Indeed, digital technologies have significantly changed the face of the global economy in recent decades (Siebel, 2019; Hinterhuber, 2021; Upadrista, 2021) and continue to contribute to dynamic market transformation (Kotler et al., 2022). The processes of fulfilling buyers' needs are now mainly based on services, information and integration, which determine the factors that create value and profit. Overshadowed by thriving services and economic transformation, a key role for the aforementioned services is e-commerce (Chaffey et al., 2019; Wirtz, 2021; Kingsnorth, 2022). In fact, since its inception, the concept of benefits and specificities of e-commerce operation have become the focus not only of market practitioners but also of scientists (Roberts, Zahay, 2017).

For the purpose of this article, a bibliometric analysis of scientific articles available in Web of Science and Scopus databases was performed. Articles were searched for that dealt with both the customer journey and e-commerce. The number of records was only 64 in Web of Science and 90 in Scopus[1]. The total number of citations in the respective databases is 915 and 887, giving an average number of citations per article of 14.3 in Web of Science and 9.85 in Scopus. The h-index for this subject is 13. This indicates a significant shortage of scientific articles in this area, while at the same time the interest of the recipients is relatively high. This suggests the existence of a still undeveloped research gap and the need for further research and consideration in this area.

The development of the internet, as a particularly important medium nowadays, has contributed, among other things, to a decline in interest in traditional forms of marketing communication (Gołąb-Andrzejak, 2016). This is because new media offer brands advantages in the form of, among other things:

[1] Status on: May 29, 2022.

- personalization of sales activities,
- the possibility of comparing various product variants and assortments of different manufacturers,
- easy measurability of the effectiveness and efficiency of conducted campaigns,
- opportunities to reach audiences beyond regional and national borders,
- possibility of scaling the business,
- ability to quickly extend the assortment and expand the offer.

Consumers, especially in the online environment, move very fluidly between marketing messages and the customer journey. The movement of the consumer at such a rapid pace determines the company to adapt as quickly as possible to the current trends and expectations. For this purpose, enterprises use an appropriately selected set of forms and tools of marketing communication. The forms of marketing communication in the online environment are identical to those in traditional media [personal promotion; advertising; public relations and additional promotion]. However, there are differences between the specific tools used in the virtual space (Table 1).

**Table 1.**
*Classification of forms and tools of marketing communication in the online environment*

| **The marketing communication dimension** | **Form of marketing communication** | **Examples of tools** |
|---|---|---|
| **Interpersonal communication** | **Personal promotion** | • chats<br>• comments<br>• live streaming<br>• newsgroups<br>• messages by e-mail<br>• chatbots |
| **Mass communication** | Advertising | • website<br>• mobile applications<br>• advertising on social networking sites<br>• display advertising<br>• search engine advertising<br>• newsletters<br>• video marketing<br>• sponsored articles<br>• push notifications |
| | **Public relations** | • social media profiles<br>• blogs<br>• influencer marketing<br>• website positioning<br>• customer reviews<br>• online events<br>• workshops and webinars<br>• sponsorship |

Cont. Table 1.

| | | |
|---|---|---|
| | **Additional promotion** | • online sales<br>• free samples with order<br>• freebies to order<br>• online coupons and codes<br>• competitions & sweepstakes<br>• virtual stamps |
| **Marketing research** | **A priori research** | • Research on buyer preferences<br>• Website testing<br>• Comparative testing of advertising |
| | **A posteriori research** | • Ads and posts statistics<br>• Web analytics<br>• Research on effectiveness and efficiency of actions taken<br>• Customer satisfaction surveys |

Source: own study.

It should also be emphasised that marketing research cannot be treated as a separate element of marketing communication, but only as a complement to it. They support the preparation and evaluation of the effectiveness and efficiency of individual promotion tools (Bajak, 2021). Research is particularly important in the online environment, which provides the opportunity to control, automate and optimise activities in real time. This is because conducting marketing communication in such conditions requires its adaptation to the contextual situation, as well as compliance with the needs and expectations of buyers subjected to behavioural analysis and segmentation.

## 3. Trends on the e-commerce market in Poland

In 2020, the global e-commerce market reached 4.2 trillion US dollars. According to the data, this is as much as 25% more than in 2019. On the other hand, in 2022, the global e-commerce is predicted to exceed $5 trillion for the first time, which will account for more than a fifth of total retail sales (eMarketer report: Global Ecommerce Forecast, 2022). The data provided by the ecommercedg (Statista, 2022) website shows that Polish e-commerce is in 20th place when it comes to market size. It is estimated that in 2021 the e-commerce market reached over 120 billion PLN (interaktywnie.com, 2022).

According to Gemius' report (2021) "Ecommerce in Poland" as many as 77 percent of Internet users have shopped online at least once. According to another research by Mediapanel (2021) the number of internet users in 2021 reached almost 30 million, which would mean that less than 23 million people have shopped online at least once. Gemius (2021) reports that e-consumers include all groups of internet users. However, online shoppers are rarely the youngest, aged 15-24 (16%), and the largest group are Internet users aged 35-49, accounting for 34% of all Internet users. Throughout Poland in 2021, online shoppers most often decided

to buy: clothes (including accessories), shoes, cosmetics, books, CDs, films, audio/video devices. Due to the pandemic situation, the percentage of online purchases of cinema or theatre tickets dropped dramatically. Interestingly, 75% of online shoppers declare that they shop online on Polish e-commerce websites (Gemius, 2021).

Among the factors encouraging people to shop online are above all the availability of online shops 24 hours a day, 7 days a week, no need to go to the shop and unlimited time to choose products. Among the negative problems associated with Polish e-commerce, Internet users declare the long waiting time for delivery, intrusive ads for products seen before and high delivery costs. On the other hand, motives that would encourage Internet users to buy more often include lower delivery costs, lower prices than in traditional shops and a discount dedicated to online shoppers (Gemius, 2021).

According to practitioners of the e-commerce market, certain trends can also be identified that are taking place among online shoppers (Raport interaktywnie.com, 2021):

- J. Pieńkowska-Olczak, CEO of PayU – notes that online spending is growing every year in every shopping category, while the number of new consumers buying online is increasing all the time. She emphasises the fact that the internet has allowed companies to adapt more quickly to the outbreak of the global pandemic. Also, forecasts predict that the e-commerce market may double in value within years.
- President of the Chamber of Electronic Commerce – P. Sass-Staniszewska emphasises the fact that the dynamics of change in e-commerce can be called a revolution. A revolution that changed the perception of consumer behaviour and, as a result, business had to undergo a digital transformation and adapt to new realities. An important aspect and unquestionable trend in online shopping is the 24/7 availability – more than ¾ of respondents indicated this possibility as the most important advantage over traditional shopping.
- B. Wójcik, Sales Manager at Genius, mentions the importance of smartphones in the purchasing process of Poles as an important determinant – 76% of online shoppers are those who have made purchases at the m-commerce level. However, the relative reluctance of shoppers to this solution is caused by the inadaptation of websites to this type of device. Companies in the industry should develop facilities corresponding to the smartphone in the near future.
- The managing director of GSL Poland – T. Zwiercan, mentions two main determinants thanks to which Poles want to buy online: convenience and on time. Time is characterised as punctuality and reliability of delivery, and convenience is understood as personalised delivery to the final consumer.

It is also worth pointing out the ability to monitor user behaviour on the Internet. Personal data and permissions to track users' online activities have become the currency that consumers pay for the possibility to participate fully in social life. Nowadays, the lack of marketing consents is tantamount to a kind of digital exclusion (Surma, 2017). A report published by Cisco

(2019) indicates that in exchange for purchasing benefits, consumers are willing to provide sensitive data about themselves. For example, as many as 61% of respondents would agree to share information about their past purchases and health status in order to receive personalised product offers. A similar number of people surveyed (60%) would share their location to access consumer promotions at shops near them.

## 4. Online touchpoints with the consumer

A brand's marketing communication consists of both short, one-way messages sent by the brand as well as engaging messages designed to lead to two-way interactions with the recipient (Verhoef et al., 2015). Moreover, each individual communication channel represents a separate touchpoint (Royal, Hall, 2016) through which the relationship with the consumer is built. The brand should coordinate them seamlessly, adjusting the tools, media, and forms and content of marketing communication to align them with the other elements of the marketing mix (Hajduk, 2019). As a result, a multidimensional consumer-brand interaction experience is created, which often crosses the real and virtual worlds (Bajak, 2022). These environments interpenetrate and complement each other, engaging the recipient in a relationship with the brand. The multitude of channels of transmission, makes marketing communication take on an increasingly holistic structure. The brand-consumer dialogue starts to go more and more beyond the models adopted so far, such as, for example, mass communication (see Lasswell 1948; Katz, Lazarsfeld 1955), communication in a hypermedia computer environment (see Hoffman, Novak, 1996), or the spherical model of marketing communication (see Szymoniuk, 2017). For nowadays, marketing communication is often no longer a series of disconnected messages reaching the consumer from different sources, but is a continuous, systematised and harmonised process of continuous dialogue in which different media intermingle (Figure 1).

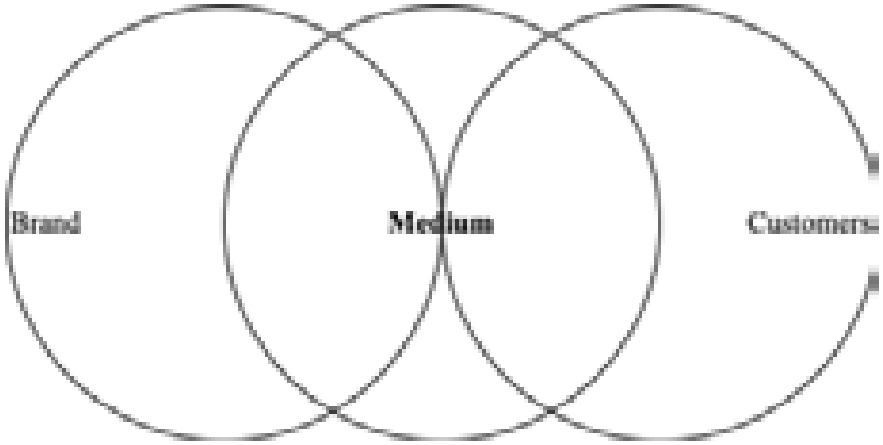


**Figure 1.** A model of permanent marketing communication. Source: own study.

It should be noted that despite the use of different message channels and forms of marketing communication, it is very important to maintain consistency in communication. The brand should seamlessly manage all its touchpoints where it conducts dialogue with the consumer (Moriarty, Schultz, 2012). This is because it enables the creation of harmonious experiences that build the impression of a unified communication environment (Rogala, Pilarczyk, 2020). At the same time, it is essential to be reliable, deliver on promises and share values (Grönroos, 1994) in order to create mutual commitment, cooperation and strengthen trust that forms the foundation of brand loyalty (Hunt et al., 2006). Communication focused on delivering value and creating relationships coincides with current trends in marketing communication (see Doyle, 2008; Kleczek, 2012; Marinov, 2020, Sugai, 2021) and the concept of H2H (human-to-human) marketing. This concept places the participants in market exchange in an equivalent position and focuses on cooperation that ensures the maximisation of market benefits for each party (Kotler et al., 2020). In this view, maintaining a dialogue with consumers is supposed to lead to arousing their interest in shared values and building their commitment and loyalty. The Internet creates an environment conducive to the realisation of these assumptions, thanks to the possibility of managing touchpoints and the global integration of recipients, while personalising activities. The result is a mutual network of relations between the community gathered around the brand, who share their emotions and experiences, mutually reinforcing their attachment and loyalty.

## 5. The online customer journey

Before a consumer makes a purchase, an intensive decision-making process takes place in his mind. In its generalised form, it can be divided into five basic stages (Engel, Blackwell, Kollat, 1978; Lamb, Hair, McDaniel, 2011):

1. need recognition – identification of requirements and preferences concerning the product and the purpose of its purchase,
2. information search – searching for ways of satisfying the need and data on particular alternatives,
3. evaluation of alternatives – comparison of various possibilities of satisfying the need on the basis of the acquired knowledge,
4. purchase – selection of the best option and making its purchase,
5. post-purchase evaluation – gathering experiences resulting from product consumption and its assessment.

It is worth noting that nowadays most of the touchpoints with the brand are on the Internet and it is the information obtained online that has a large impact on the outcome of the process. This is because the brand tries to actively accompany the consumer during the decision-making

process (Kaczorowska-Spychalska, 2017; Smilansky, 2018) and, through marketing communication tools, not only persuade him to buy its products, but also build his commitment and, consequently, loyalty (Figure 2).


**Figure 2.** Example set of marketing communication forms used on customer journey. Source: own study.

This approach was theoretically framed by the 5A path model (Kotler, Kartajayi, & Setiawan, 2017), which illustrates five consumer behaviors that the brand should strive to evoke during the purchasing process. This is, respectively:

1. aware – familiarizing the consumer with the brand and arousing his interest in it,
2. appeal – createng the desired brand image and building the foundations of customer relations,
3. ask – responding to the buyer's doubts, conducting a dialogue with them and educating about the product range,
4. act – encouraging the consumer to buy by using direct incentives for him to do so,
5. advocate – engaging the client to provide information about the brand and participate in the process of its creation.

In the online environment, in order to guide the consumer through the purchasing process by triggering the above-mentioned behaviors, it is necessary to influence him through a package of various marketing communication tools (Table 2).

**Table 2.**
*Customer journey in the online space*

| **Purchase steps of the customer** | | | | |
|---|---|---|---|---|
| Recognizing the need | Search for information | Assessment of the options | Making a purchase | Post-purchase behavior |
| ↓ | ↓ | ↓ | ↓ | ↓ |
| **Model 5A** | | | | |
| Aware | Appeal | Ask | Act | Advocate |
| ↑ | ↑ | ↑ | ↑ | ↑ |

Cont. Table 2.

| **Online enterprise marketing communication** | | | | |
|---|---|---|---|---|
| Search engine and social media advertising; building ranges | Use of influencers; attractive activities in a virtual environment, e.g real-time marketing | Possibility to consult virtual assistants; access to online reviews and rating | Price reductions and purchase bonuses for purchases and other online promotions; retargeting | Providing bonuses for providing opinions of the internet; competitions for the participants; virtual loyalty programme |
| ↓ | ↓ | ↓ | ↓ | ↓ |
| **The consumer's attitude on the mark** | | | | |
| Awareness | Liking | Conviction | Trust | Devotion |

Source: own study.

The correct use of the composition of tools and means of communication allows not only to successfully guide the consumer through the customer journey, but also to develop in him/her the desired attitudes towards the brand. In the first steps the brand should be presented to him so that he gets to know it (awareness). Next, it is important to arouse the recipient's affinity with the brand by showing its distinctive features and emphasising the attractiveness of the offer (liking). Later, efforts should be made to persuade the buyer of the brand's superiority over the competition (conviction). Making a purchase, in turn, should be a stimulus that forms and strengthens the attachment to it (trust). The final stage revolves around convincing the consumer to spread his opinion about the brand and to co-create it (devotion).

## 6. Summary

The online space creates an optimal environment for controlling, automating and optimising the communication process, which enables holistic support for the consumer at each stage of the customer journey (Figure 3). As a result, their behaviour and reactions during the purchase process are shaped - from building brand awareness, through dialogue with the brand, to taking action in the form of purchase and advocacy among other Internet users. A properly coordinated composition of promotion tools used on the web creates an integrated and comprehensive experience of constant interaction with the brand, which builds buyer engagement. The buyer travels from getting to know the brand through liking, belief and trust to devotion. By becoming a loyal and active user, he or she simultaneously contributes to value co-creation, actively participating in shaping not only the brand's marketing communication, but also other marketing-mix tools. At the same time, each such consumer is an important element of the network of relations in the community focused around the brand, which by sharing their experiences and emotions mutually reinforces their attachment and devotion.

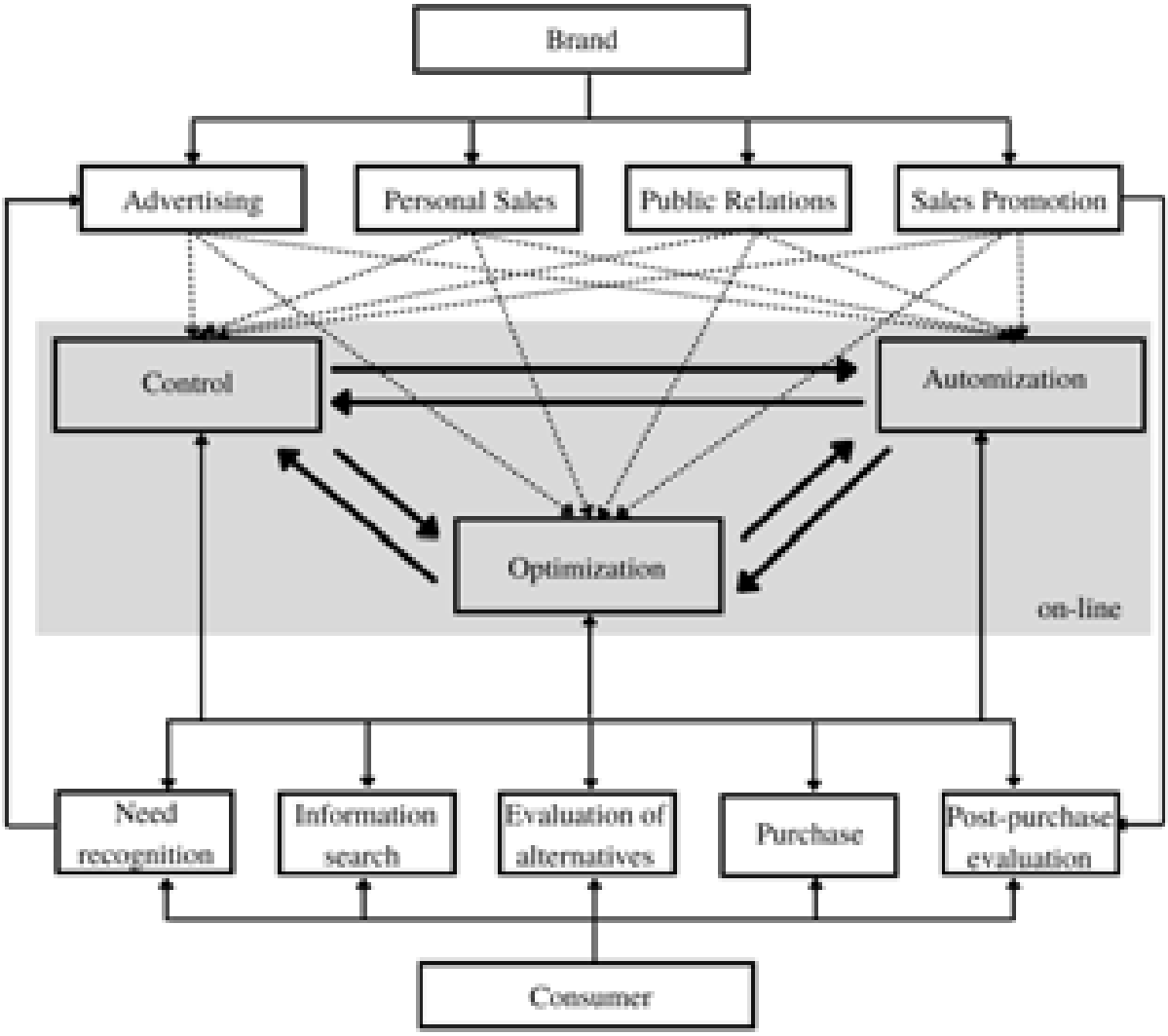


**Figure 3.** The relationship between the forms of marketing communication and customer journey. Source: own study.

The subject of influencing the purchase process of the customer online with the use of a package of various forms and tools of marketing communication is an area that still requires further study and development. It is important to carry out further deliberations and analyses aimed at detailed identification of consumer behaviour and preferences on the customer journey. This will allow more effective management of their purchasing behaviour and effective shaping of attitudes towards the brand. The work presented here focuses on creating customer engagement and loyalty using touchpoints. In the future, however, it is necessary to adopt a more integrated perspective on the topic. To this end, quantitative and qualitative research is planned. In addition, solutions used by leading brands will be analysed. This will make it possible to combine scientific knowledge with market practice and, from a business perspective, will further enhance the usefulness of the considerations and models presented.

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## References

1. Bajak, M. (2021). *Wykorzystanie beaconów w komunikacji marketingowej*. Warszawa: PWE.
2. Bajak, M. (2022). Beacons as the Touchpoints on the Customer Journey. *Scientific Papers of Silesian University of Technology. Organization and Management Series, 155*, pp. 17-29. doi: 10.29119/1641-3466.2022.155.2.
3. Blokdyk, G. (2020). *Consumer Journey a Complete Guide*. Queensland: Emereo Pty Limited.
4. Chaffey, D., Edmundson-Bird, D., Hemphill, T. (2019). *Digital Business and E-commerce Management*. London: Pearson UK.
5. Cisco (2019). *Consumer Privacy Survey*. Available online: https://www.cisco.com/c/dam/en/us/products/collateral/security/cybersecurity-series-2019-cps.pdf, 29.05.2022.
6. Doyle, Ch. (2016). *A Dictionary of Marketing*. Oxford: Oxford University Press.
7. Doyle, P. (2008). *Value-based Marketing*. Hoboken: Wiley.
8. *eMarketer raport: Global Ecommerce Forecast 2022* (2021). Available online: https://ecommerce-europe.eu/wp-content/uploads/2021/09/2021-European-E-commerce-Report-LIGHT-VERSION.pdf.
9. Engel, J.F., Blackwell, R.D., Kollat, D.T. (1978). *Consumer behaviour*. Ilinois: The Dryden Press.
10. Følstad, A., Kvale, K. (2018). Customer journeys: a systematic literature review. *Journal of Service Theory and Practice*, *28(2)*, pp. 196-227 doi: 10.1108/JSTP-11-2014-0261.
11. Garett R., Chiu J., Zhang L., Young S.D. (2016). A Literature Review: Website Design and User Engagement. *Online Journal of Communication and Media Technologies, 6(3),* pp. 1-4. doi: 10.29333/ojcmt/2556.
12. Genius (2021). *E-commerce w Polsce 2021.* Available online: https://www.gemius.pl/wszystkie-artykuly-aktualnosci/raport-e-commerce-w-polsce-2021.html.
13. Gołąb-Andrzejak, E. (2016). Konsumenci pokolenia Y – nowe wyzwanie dla komunikacji marketingowej. *Handel Wewnętrzny, 361(2)*, 140-151.
14. Grönroos, Ch. (1999). Relationship Marketing: Challenges for the organization. *Journal of Business Research, 46*, 327-335.

15. Hajduk, G. (2019). *Zarządzanie komunikacją marketingową. Integracja, nowe media, outsourcing*. Warszawa: Poltext.
16. Hinterhuber, A., Vescovi, T., Checchinato, F. (2021). *Managing Digital Transformation: Understanding the Strategic Process*. Abingdon: Routledge.
17. Hoffman, D.L., Novak, T.P (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing, 60(3)*, 50-68.
18. Hunt, S., Arnett, D., Madhavaram, S. (2006). The Explanatory Foundations of Relationship.
19. Interaktywnie.com (2021). Available online: https://interaktywnie.com/biznes/artykuly/raporty-interaktywnie-com/raport-ecommerce-2021-jak-sprzedawac-w-internecie-porady-dla-firm-ebook-260855.
20. Internatywnie.com (2022). Available online: https://interaktywnie.com/biznes/artykuly/raporty-interaktywnie-com/ebook-z-raportem-ecommerce-2022-trendy-w-sprzedazy-internetowej-261891.
21. Marketing Theory. *Journal of Business & Industrial Marketing, 21(2)*, 72-87.
22. Kaczorowska-Spychalska, D. (2017). Consumer perspective of omnichannel commerce. *Management*, *21(2)*, pp. 100-113. doi: 10.1515/manment-2017-0007.
23. Katz, E., Lazarsfeld, P.F. (1955). *Personal Influence*. Glencoe: Free Press.
24. Kingsnorth, S. (2022). *The Digital Marketing Handbook: Deliver Powerful Digital Campaigns*. London: Kogan Page Publishers.
25. Kłeczek, R. (2012). Marketing i wartość. *Metodologiczne aspekty badania skuteczności działań marketingowych*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
26. Kotler, Ph., Kartajayi, H. and Seriewan, I. (2017). Marketing 4.0. Moving from Traditional to Digital. Hoboken: John Wiley & Sons.
27. Kotler, Ph., Kartajaya, H., Setiawan, I. (2021). *Marketing 5.0: Technology for Humanity.* Hoboken: Wiley.
28. Królewski, J., Sala, P. (eds.) (2016). *E-marketing. Współczesne trendy. Pakiet startowy*. Warszawa: PWN.
29. Lamb, C.W., Hair, J.F., McDaniel, C. (2011). *Essential of Marketing.* Mason: Cengage Learning.
30. Lasswell, H.D. (1948). The Structure and Function of Communication in Society. In: L. Bryson (Ed.). *The Communication of Ideas* (pp. 37-52). New York: Harper and Brothers.
31. Marinov, M. (ed.) (2020). *Value in Marketing: Retrospective and Perspective Stance*. New York: Routledge.
32. Mishra, N. (2020). *Marketing Management*. Agra: SBPD Publishing House.
33. Moriarty, S., Schultz, D. (2012). Four Theories of How IMC Works. In: S. Rodgers, E. Thorson (Eds.), *Advertising Theory* (pp. 491-505). New York: Routledge.

34. Rogala, A., Pilarczyk, B. (2020). *Komunikacja marketingowa na rynku farmaceutycznym*. Warszawa: CeDeWu.
35. Sanak-Kosmowska, K. (2018). *Rola serwisów społecznościowych w komunikacji marketingowej marki*. Warszawa: Wydawnictwa Drugie.
36. Siebel, T.M. (2019). *Digital Transformation: Survive and Thrive in an Era of Mass Extinction*. New York: RosettaBooks.
37. Singh, A., Duhan, P. (2016). *Managing Public Relations and Brand Image through Social Media*. Hershey: IGI Global.
38. Smilansky, S. (2017). *Experiential Marketing: A Practical Guide to Interactive Brand Experiences*. London: Kogan Page Publishers.
39. Sugai, P. (2021). *Building Value through Marketing. A Step-by-Step Guide*. Abingdon: Routledge.
40. Surma, J. (2017). *Cyfryzacja życia w erze big data*. Warszawa: PWN.
41. Szymoniuk, B. (2017). Sferyczny model komunikacji marketingowej. *Marketing i Zarządzanie, 3(49)*, 193-208.
42. Trojanowski, M. (2010). *Marketing bezpośredni.* Warszawa: PWE.
43. Upadrista, V. (2021). *Formula 4.0 for Digital Transformation: A Business-Driven Digital Transformation Framework for Industry 4.0*. Abingdon: Routledge.
44. Verhoef, P.C., Kannan, P.K., Inman, J.J. (2015). From Multi-channel Retailing to Omnichannel Retailing: Introduction to the Special Issue on Multi-Channel Retailing. *Journal of Retailing, 91(2)*, pp. 174-181.
45. Wiktor, J.W. (2013) *Komunikacja marketingowa – modele, struktury, formy przekazu*. Warszawa: PWN.
46. Wirtz, B.W. (2021). *Digital Business and Electronic Commerce: Strategy, Business Models and Technology*. Cham: Springer International Publishing.

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# COMPETENCES OF THE PROJECT MANAGER

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**Purpose:** The main objective of the research presented in this paper was to identify the managerial competences of project team managers. In order to achieve this objective, the first part of the paper explains the meaning of the term "project management" in the literature on management and quality. The second part of the paper is devoted to an analysis of the conducted research, on the basis of which an attempt is made to answer the question: which managerial competences are key in the role of a project manager?
**Design/methodology/approach**: The research presented in this paper is based on the analysis of the literature on project management and managerial competences. 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:** An inseparable element of human life is change, which also accompanies enterprises on a daily basis. The information about changes in the market and competitors, provided every day, is a natural manifestation of economic life. Consequently, everyone has to improve their operations in the area of products, technology and organisation in order to remain on the market. As a result, every person, as well as every economic activity take actions aimed at achieving the intended goals, facing new needs and challenges. The way to achieve the desired results is a process known as a project. The efficient functioning of a project team requires the use of appropriate management support methods and tools, systematic measurement, constant comparison with competitors, removal of barriers and the exploitation of development opportunities.
**Research limitations/implications**: In the future, research will be continued on a larger research sample.
**Practical implications:** The paper presents the results of research carried out at a nationwide telecommunications operator that employs several thousand people. This company is part of a large capital group and, due to the group's communication policy, has reserved anonymity. The findings are very interesting and encourage research on a larger scale. They are a valuable source of information for managers responsible for the formation of project teams, the selection of its members, their functioning and project implementation. On the other hand, for persons

responsible for recruiting employees, the results may be useful in terms of developing a project team manager's profile, in particular when identifying the key managerial competences.
**Originality/value** Based on empirical research, the paper proposes an original set of systemic solutions for project management to improve organisational performance.

**Keywords:** project management, competences.

**Category of the paper:** Research paper.

## 1. Introduction

The dynamic changes taking place in the world also affect the organisation. In organisations, managers constantly have to adapt to changing conditions when making decisions. This presents them with many challenges and is at the same time a source of satisfaction. Competent and effective managers cause important changes in the undertaken projects and in the managed organisations, thus also influencing the environment. Traditionally perceived management functions such as planning, organising, leading and controlling are fulfilled in changing circumstances and efficient managers keep pace with new changes. The proper use by managers of their knowledge and skills as well as available management tools and techniques has a significant impact on the success of projects. Management is focused on the cooperation of the community and causes that its impact gives an effect greater than the sum of actions of individuals in the organisation. In order to increase the efficiency and reduce the risk generated by projects, the managers use the developed management methods and techniques.

Project management is used comprehensively by organisations. It enables the organisation to carry out its activities in a systematic and predictable manner, which significantly reduces the risks of its operations and allows it to undertake projects that would not be possible to implement in normal operations. The techniques used in project management by managers significantly increase the organisation's opportunities of effectively achieving project goals, while neutralising the impact of existing constraints and potential risks, as well as building the motivation of the project team and proper communication between project participants. Enterprises as complex organisations function to a large extent on the basis of interdependencies of individual units. Increasing the effectiveness of their activities is possible thanks to project management, which provides a uniform and standardised platform for cooperation for separate structures. It significantly contributes to improving the quality of cooperation between structures and expanding employees' knowledge of ongoing activities. However, simply applying standards is not enough. A competent project manager with the knowledge, skills, experience, personality traits predisposing him or her to management is required to coordinate the activities to achieve the set goal.

The knowledge of the project manager's key competences that determine his or her effective performance is an important indication in the development of managerial competences. For this reason, the aim of the research was to diagnose the project manager's key competences necessary to fulfill his or her role in project management.

## 2. Project management

An inseparable element of human life is change, which also accompanies enterprises on a daily basis. The information about changes in the market and competitors, provided every day, is a natural manifestation of economic life. Consequently, everyone has to improve their operations in the area of products, technology and organisation in order to remain on the market. As a result, every person, as well as every economic activity take actions aimed at achieving the intended goals, facing new needs and challenges. The way to achieve the desired results is a process known as a project. It can be concluded that a project is a temporary activity undertaken to produce a unique product, provide a unique service or achieve a unique result (Manewick et al., 2021; Project Management Institute, 2006; El Saba, 2001).

The nature of the project defined as temporary means that it is implemented on a one-off basis within a specified period of time, i.e. it has a strictly defined start and end. Another characteristic feature of the project is that it is also implemented in a manner that is relatively independent of the core economic activity.

The project is also unique because the organisation can implement many similar projects in the form of a project, but each will be unique in its own way: a different client, a different location, a different team, a different way of achieving the required, expected goal.

The project has specific parameters (Trocki et al., 2003 p. 21), defined as scope, cost, requirements and time. These parameters form the so-called triple constraint. They are interdependent, which means that a change in one of them automatically implies a change in at least one of the others. Shorter project implementation time will increase costs as additional employees will have to be engaged. It may also result in a reduction in the scope of works carried out and only certain goals being achieved.

Figure 1 shows the Triple Constraint. It shows the dependencies between the basic parameters of the project. The project implementation requires that the project constraints are kept in balance. To achieve this goal, the project manager must have the appropriate approach, knowledge and skills. It can be said that the project manager is required to have adequate project management competences.

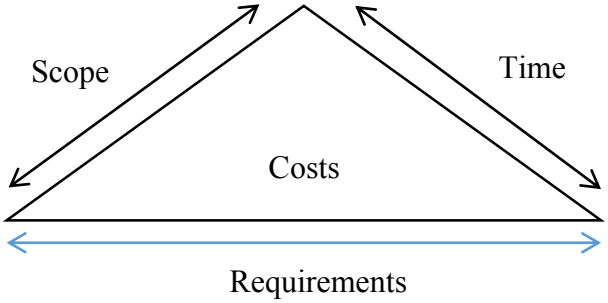


**Figure 1.** Triple Constraint – dependencies between the basic parameters of the project. Adapted from: Trocki M. Grucza B. Ogonek K. (2003, p. 22).

The project management is planning, delegating, monitoring and controlling all aspects of a project and motivating the people involved to achieve project goals within target performance indicators for time, cost, quality, scope, benefits and risks (Office of Government Commerce 2010, Radujković 2017).

The role of the project manager begins with the preparation of the basic assumptions of the project. The project manager is involved in setting up the project management team (Wysocki, 2013, p. 62). Then, the project initiation planning works are carried out. When the steering committee approves the project, the project manager initiates it. Throughout the project, the project manager manages the scope of the stage (SSM) through planning works (PW), stage control (SC) and stage closure (SCl). Each time it submits the final stage report for approval by the steering committee. In this way, a decision to continue the project is issued. When all stages of the project are completed, the project manager proceeds to the project closure (PC). After this stage, the role of the project manager ends. In turn, the responsibility of the steering committee lasts until the business result of the effects of entire project is completed.

The project manager works closely with the managers of the working teams who are responsible for managing the production of products (PP) (Office of Government Commerce, p. 67; Thomas et al., 2007). It is they who prepare implementation plans for the working teams they manage. Team managers receive from the project manager the groups of tasks to be performed at a given stage of the project. They report to the project manager on the performance of the assigned tasks in accordance with the communication plan in force. After completion of the assigned works, they submit a draft of the completed group of tasks to the project manager. Thanks to the role played by the managers of the working teams in the planning of project stages and risk assessment, the timeliness and quality of the project can be maintained. They, as subject matter experts, are a valuable source of information for the project manager on the proper design of the project implementation and the functionality of the end products. In the case of large and complex projects, the project manager must select the project team in such a way that the assumed business effect for the client is the most important in the project. It is also important to protect the interests of suppliers who often include representatives also from outside the organisation.

The principle of one-tier management applies to each project. It assumes that "my boss's boss is not my boss". It is applied regardless of the level of complexity of the project and regardless of the size of the project team. Thanks to this principle, all members of the project team clearly know who delegates tasks to whom and who reports and is accountable to whom. It enables to maintain order and transparency in the implementation and decision-making of the project.

The project team management is closely linked to the manager's managerial competences. According to the research that was conducted as part of the European project eLene4work in 2014, managers with well-developed soft skills are the most sought-after in the labour market (Jasińska et al., 2015, p. 16). This type of competence is highly valued, especially the soft social competences: team cooperation, interpersonal communication, assertiveness, as they allow for easier team management and adaptation to changing conditions.

The project manager must have high competences in team management and be aware that people are motivated by various factors (IPMA, 2015). The project manager does not have to meet every need of project team members, but should be aware of what motivates them and use his or her insights whenever possible for the benefit of the project. With experts in the team, they need to be given more freedom to demonstrate their professionalism. They will be able to effectively support the project by freely doing their job. This will strengthen their motivating factors, such as self-fulfilment or goal achievement, which trigger their optimal performance.

In the case of project managers, their project management competences, tools and techniques are a very important factor leading to project success. It should be stressed that managing a project team involves a number of tasks, i.e.: team building, analysis of project resources, division of tasks, pre-project training of team members, organisation of work, communication, knowledge sharing, decision making, effective motivation and evaluation, application of a proper project monitoring system and control of the planned task implementation, conflict resolution (Nicholas et al., 2012).

## 3. Methods and characteristics of the research sample

The research was carried out at a nationwide telecommunications operator that employs several thousand people. This company is part of a large capital group and, due to the group's communication policy, has reserved anonymity. Since the 1990s, the company has been constantly developing organically and through acquisitions, continuously expanding the range of services provided. It currently provides comprehensive online communication solutions such as: TV services and multimedia entertainment, high-speed access to fixed and mobile Internet for private users, companies and institutions.

The research presented in this paper is based on the analysis of the literature on project management. The literature studies also included secondary sources, which were research communications of similar scope.

The diagnostic survey and literature analysis, secondary sources allowed us to obtain a broader context of the phenomenon under study and ensured a higher quality of the research conducted. The variety of methods was intended to achieve consistency in the empirical basis of inference. A diagnostic survey was adopted as the guiding method. The other methods used in the paper were ancillary (complementary).

In the conducted diagnostic survey, an important element was a questionnaire dedicated to the definition of the key competences of the project manager by the respondents based on a five-point scale. This procedure was used to establish the existing situation declared by the respondents. The analysis of the own research was to identify those of the presented competences of a project manager, which most significantly influence the effectiveness of his or her actions. For better clarity, the 46 competences included in the questionnaire were grouped into four thematically coherent blocks as: professional (P), social (S), personal (O) and business (B) competences. The first category included 19 professional competences (representing 41.3% of all surveyed competences). The next one, social competences, had 9 items (representing 19.6% of all surveyed competences). The third category comprised 14 personal competences (representing 30.4% of all surveyed competences). The last category was represented by 4 business competences (representing 8.7% of all surveyed competences). The competences were rated by the respondents on a five-point scale of significance, where 1 meant irrelevant competences and 5 meant very important for the effectiveness of the project manager's actions. The research resulted in an objective source of data for further analysis in order to diagnose the key competences of the project manager.

Project managers of a company operating in the telecommunications industry who manage large projects for the construction of modern infrastructure fibre-optic networks were invited to the research. In order to maintain the anonymity of the company, the questionnaire sheet was sent electronically to the human resources manager for e-mail distribution to project managers in the regions. The questionnaires completed by the project managers were returned to the human resources manager and forwarded collectively to the person conducting the research. Due to this solution, there was a high response from the respondents. Of the 31 questionnaires sent out, 30 were completed. One project manager (woman) from the northern region did not participate in the research due to maternity leave.

**Table 1.**
*Number of respondents by gender and region*

| Region | Number of respondents | | TOTAL respondents |
|---|---|---|---|
| | women | men | |
| Western | - | 8 | 8 |
| Southern | 1 | 3 | 4 |
| Central | 1 | 7 | 8 |
| Eastern | 1 | 4 | 5 |
| Northern | -* | 5 | 5 |
| **TOTAL** | **3** | **27** | **30** |
| *did not participate in the research. | | | |

Source: Own research.

The selected research sample consisted of 31 respondents, of which only 13.3% were women and the rest were men. The research was conducted in the western, southern, central, eastern and northern regions. Among the respondents, the largest group were project managers in the age group 26-35 – 43.3% of all respondents. The next two age groups (36-45 and 46-55) had 26.7% of people in each. Only in the western region there is one project manager over 55 years of age. The highest percentage share of young project managers is in the northern and central regions, and the lowest in the southern region. The half of the respondents declared their work experience ranging from 6 to 15 years, 25% of the respondents indicated the age range below 5 and from 16 to 25 years. In total, 13% of the project managers have more than 25 years of work experience – one in the northern region and two in the western region.

The adopted diagnostic procedure also allowed to collect data on the respondents' project experience. Only six respondents were a member of the project team before taking up the position of project manager, five of them have project management experience ranging from 1 to 5 years, and only one has less than one year of experience. Table 2 contains data on the experience of the respondents in project management (in years) by regions.

**Table 2.**
*Experience of the respondents in project management (in years) by regions*

| Region | Experience of the respondents in years | | | | TOTAL respondents |
|---|---|---|---|---|---|
| | below 1 | 1-5 | 6-10 | Over 10 | |
| Western | - | 3 | 2 | 3 | 8 |
| Southern | - | 1 | 1 | 2 | 4 |
| Central | - | 3 | 3 | 2 | 8 |
| Eastern | - | 2 | 1 | 2 | 5 |
| Northern | 1 | 2 | - | 2 | 5 |
| **TOTAL** | **1 - 3.3%** | **11 - 36.7%** | **7 - 23.3%** | **11 - 36.7%** | **30 - 100.0%** |

Source: Own research.

The respondents are experienced project managers with at least several years of experience in this position. As many as 11 respondents declared that they had worked as a project manager for over 10 years. Seven respondents marked their work experience as a project manager between 6 and 10 years, eleven respondents between 1 and 5 years and just one below 1 year. The respondents of the research constitute a group of experienced project managers, which

provides a solid basis for conducting a research for the purpose of examining the key competences of the project manager.

The value of the research group is also determined by the number of projects managed by the respondents as project managers. As many as eighteen respondents out of thirty respondents managed more than 10 projects in their professional careers, eight of which managed more than 20 projects. Only six managers managed up to 5 projects which represents 20% of all respondents. Among them, there is a correlation between short work experience and the smallest number of managed projects.

An additional value of the project manager is the range of his or her management. This parameter was declared by the respondents in response to the question about the maximum size of the project team managed by the project manager. The half of the respondents managed project teams of between 6 and 15 members. Only one project manager from the central region managed a project team of more than 35 people. This is a large and challenging experience in his or her career. Only 10% of the research participants managed teams from 26 to 35 people. The range of managing a team of more than 26 people is a wide range and requires high managerial competences from the manager. In project management, the project manager is supported by the developed methodologies that standardise the series of actions taken, supporting a greater number of interactions.

The characteristics of the research sample in the area of project experience are complemented by the question of the maximum budget managed by the respondents. The data presented in Table 3 were obtained in response.

**Table 3.**
*Maximum project budget managed by the respondents (in PLN)*

| Region | Maximum project budget managed in PLN | | | | TOTAL respondents |
|---|---|---|---|---|---|
| | up to 100 thousand | 100 thousand – 1 million | 1 million – 10 million | over 10 million | |
| Western | - | 2 | 4 | 2 | 8 |
| Southern | - | - | 3 | 1 | 4 |
| Central | - | 2 | 5 | 1 | 8 |
| Eastern | - | 1 | 4 | - | 5 |
| Northern | - | 1 | 3 | 1 | 5 |
| **TOTAL** | **-** | **6 - 20.0%** | **19 - 63.3%** | **5 - 16.7%** | **30 - 100.0%** |

Source: Own research.

The vast majority of the surveyed project managers improve their competences through self-education (Table 4). This response was indicated by as many as 20 out of 40 indications. Of these, 10 replied that they had also participated in the trainings. Unfortunately, 10 of the project managers declared that they did not improve their competences. Only in the southern region, all project managers are improving their competences. As many as half of the respondents in the western region said that they did not improve their competences. None of the respondents indicated other forms of improving their project manager competences

apart from trainings and self-education. Table 4 summarises the data on the ways in which the surveyed project managers improve their competences by regions.

**Table 4.**
*Ways of improving competences by the project managers by regions*

| Region | Ways of improving competences | | | | TOTAL indications |
|---|---|---|---|---|---|
| | do not improve | trainings | self-education | other | |
| Western | 4 | 2 | 4 | - | 10 |
| Southern | - | 3 | 4 | - | 7 |
| Central | 3 | 2 | 5 | - | 10 |
| Eastern | 2 | 1 | 3 | - | 6 |
| Northern | 1 | 2 | 4 | - | 7 |
| **TOTAL** | **10** | **10** | **20** | **-** | **40** |

Source: Own research.

Summing up, it should be stated that the surveyed group consists of project managers mostly with extensive experience in project management (eleven out of thirty have over 10 years of experience), both in terms of project management and team management. The majority of respondents have competences that have been confirmed by international certificates (more than 86% of the respondents). It is worth emphasising that the respondents themselves care about the development of their competences. Men predominate among the respondents, accounting for as much as 90% of the research sample, which is significantly different from the company's employment characteristics. The average age of the respondents is statistically higher compared to the demographic data of the company, in which the research was conducted.

## 4. Key competences of the project manager in the context of own research

Assuming the achievement of the research objective, which was to identify the managerial competences of project team managers, the results obtained from the respondents were analysed using the questionnaire described above.

The research proposed a set of project manager competences following the categorisation proposed by Musioł-Urbańczyk (2010) in research on the same issue. The detailed part of the analysis refers to the results obtained for the individual competences studied. Table 5 presents the competences studied, which are ranked according to their assigned ranks. The lowest sum of ranks proves the highest significance of the project manager's competences affecting the effectiveness of his or her actions.

**Table 5.**
*Ranking of competences according to the sum of ranks*

| No. | Code | Competence | Sum of ranks |
|---|---|---|---|
| 1 | P9 | Ability to define project goals | 272.0 |
| 2 | O14 | Accuracy | 273.5 |
| 3 | P19 | Ability to make decisions | 288.5 |
| 4 | B1 | Entrepreneurship | 308.5 |
| 5 | O7 | Intelligence | 325.0 |
| 6 | B3 | Creativity | 336.0 |
| 7 | O10 | Persistence | 363.5 |
| 8 | P1 | Experience in project management | 391.0 |
| 9 | P3 | Ability to manage time in a project | 392.0 |
| 10 | S8 | Ability to negotiate | 394.0 |
| 11 | S1 | Ability to motivate team members | 412.0 |
| 12 | O1 | Self-confidence | 439.5 |
| 13 | P4 | Ability to manage costs in a project | 441.0 |
| 14 | P5 | Ability to manage quality in a project | 444.5 |
| 15 | O11 | Assertiveness | 450.0 |
| 16 | P2 | Ability to manage the project scope | 508.0 |
| 17 | B2 | Flexibility | 520.5 |
| 18 | S6 | Teamwork | 606.5 |
| 19 | O3 | Self-regulation (self-control) | 623.0 |
| 20 | P12 | Ability to build a team | 634.0 |
| 21 | P7 | Ability to manage risks in a project | 663.5 |
| 22 | S3 | Ability to communicate | 667.5 |
| 23 | S7 | Ability to resolve conflicts in a team | 730.5 |
| 24 | P8 | Ability to manage orders in a project | 740.5 |
| 25 | P18 | Knowledge of the methodology used in the company implementing the project | 744.0 |
| 26 | S2 | Leadership | 745.0 |
| 27 | P13 | Ability to apply an appropriate project management style | 748.5 |
| 28 | O4 | Integrity, fairness | 753.0 |
| 29 | S5 | Ease of making contacts | 753.5 |
| 30 | O9 | Coping with stress | 776.5 |
| 31 | P14 | Ability to use project management software | 787.5 |
| 32 | P6 | Ability to manage communication in a project | 802.5 |
| 33 | O2 | Self-awareness | 808.0 |
| 34 | O8 | Ambition | 834.5 |
| 35 | P10 | Client orientation | 910.0 |
| 36 | P11 | Focus on self-development and colleague development | 915.5 |
| 37 | O12 | Courage | 943.0 |
| 38 | O5 | Loyalty | 1,056.5 |
| 39 | O6 | Showing trust | 1,071.5 |
| 40 | S9 | Ability to "blend in" with the organisational culture | 1,088.5 |
| 41 | S4 | Empathy | 1,137.0 |
| 42 | O13 | Optimism | 1,139.0 |
| 43 | B4 | Ability to create a vision | 1,205.0 |
| 44 | P16 | Legal knowledge | 1,230.0 |
| 45 | P15 | Technical knowledge about the implemented project | 1,275.0 |
| 46 | P17 | Foreign languages | 1,342.0 |

Source: Own research.

The research also showed that the competences in the business competence category were rated highest, with an arithmetic mean of rating of 4.08 for the entire population surveyed. The lowest arithmetic mean was recorded for rating of professional competences with a score of 3.77. The range of means is 0.31 and represents 6.2% on a five-point scale. Table 6 presents

the aggregate statistical data on the average rating obtained in the competence categories by regions.

**Table 6.**
*Average rating in the competence categories by regions*

| Region | Competences | | | | Range |
|---|---|---|---|---|---|
| | professional | social | personal | business | |
| Western | 3.74 | 3.76 | 3.48 | 3.81 | 0.33 |
| Southern | 4.03 | 4.06 | 4.16 | 4.25 | 0.22 |
| Central | 3.67 | 3.93 | 4.10 | 4.22 | 0.55 |
| Eastern | 3.81 | 3.71 | 3.87 | 4.15 | 0.44 |
| Northern | 3.75 | 3.89 | 4.04 | 4.05 | 0.30 |
| **Arithmetic mean in the surveyed population** | **3.77** | **3.86** | **3.90** | **4.08** | **0.31** |

Source: Own research.

According to the sum of ranks assigned to competences, 10 competences have been identified that have the greatest impact on the effectiveness of the project manager. Table 7 shows their significance hierarchy and the results of calculations of the coefficient of variation for each competence.

**Table 7.**
*Highest rated competences according to the respondents*

| No. | Code | Competence | Sum of ranks | Coefficient of variation |
|---|---|---|---|---|
| 1 | P9 | Ability to define project goals | 272.0 | 0.09 |
| 2 | O14 | Accuracy | 273.5 | 0.09 |
| 3 | P19 | Ability to make decisions | 288.5 | 0.08 |
| 4 | B1 | Entrepreneurship | 308.5 | 0.10 |
| 5 | O7 | Intelligence | 325.0 | 0.10 |
| 6 | B3 | Creativity | 336.0 | 0.11 |
| 7 | O10 | Persistence | 363.5 | 0.12 |
| 8 | P1 | Experience in project management | 391.0 | 0.12 |
| 9 | P3 | Ability to manage time in a project | 392.0 | 0.11 |
| 10 | S8 | Ability to negotiate | 394.0 | 0.13 |

Source: Own research.

In order for the identified competences to be considered key, they must be characterised by a low coefficient of variation. The 10 competences indicated mainly include: the ability to define project goals, accuracy, ability to make decisions, entrepreneurship, intelligence, creativity and persistence. According to the respondents, the experience in project management, the ability to manage time in a project and the ability to negotiate are also important.

Additionally, a coefficient of the generalised opinion of the respondents $K_{max}$ was calculated for each of the listed competences. According to the formula:

$$K_{max} = \frac{m_{max\,j}}{m_j}$$

where:

$m_{maxj}$ – the number of respondents who gave the maximum number of scores when assessing j-th competence,

$m_j$ – the number of respondents who assess j-th competence.

This coefficient indicates the frequency of granting the highest possible rating obtained by the j-th competence. The value of the coefficient $K_{max}$ for individual competences is presented in Table 8.

**Table 8.**
*Highest rated competences and their coefficients $K_{max}$*

| No. | Code | Key competences | Mean | $K_{max}$ |
|---|---|---|---|---|
| 1 | P9 | Ability to define project goals | 4.87 | 0.90 |
| 2 | O14 | Accuracy | 4.87 | 0.90 |
| 3 | P19 | Ability to make decisions | 4.83 | 0.83 |
| 4 | B1 | Entrepreneurship | 4.80 | 0.83 |
| 5 | O7 | Intelligence | 4.77 | 0.80 |
| 6 | B3 | Creativity | 4.73 | 0.77 |
| 7 | O10 | Persistence | 4.67 | 0.70 |
| 8 | P1 | Experience in project management | 4.67 | 0.70 |
| 9 | P3 | Ability to manage time in a project | 4.60 | 0.60 |
| 10 | S8 | Ability to negotiate | 4.60 | 0.67 |

Source: Own research.

According to the respondents, the most preferred competence is *the ability to define project goals*. The project goal is defined by the project manager at the project initiation stage, allowing the business case to be clarified. This is a critical moment of the entire project, on which the success of the entire project depends. For this reason, this competence was considered the most important by the surveyed population of professionals. The project manager's high level of professionalism will enable him or her to precisely define the goal in the project initiation documentation, which will serve as a base reference at all stages of the project works for all project stakeholders.

The *accuracy* required in this respect was emphasised by the respondents also in the form of another key competence in the second position of the ranking. The obtained results for the first two competences are very similar. Both competences have the same mean of the obtained rating (4.87) and a very low coefficient of variation amounting to 0.9 in both cases. Similarly, the coefficient Kmax is equal to 0.90, which proves that both competences received the highest rating the same number of times.

The third rank is the *ability to make decisions*. This competence accompanies the project manager at every stage of the project life cycle and in the many interactions taking place with project stakeholders. It should be noted that the role of the project manager is based on his or

her decision-making capacity. Therefore, the quality of work and its effects in other members of the project team depends to a large extent on the level of this competence held by the project manager. It seems justified that project management practitioners declare such a high significance of this competence.

The set of the project manager's key competences also includes two more professional competences: *experience in project management and* the ability *to manage time in a project*. In each area of management, the manager's *experience* is extremely important for the effectiveness of his or her actions. It allows the project manager to accurately select the available techniques and tools that will support him or her and the structures subordinate to him or her in carrying out the tasks. In project management, especially for projects as large and complex as infrastructure investments, the experience of the project manager has a positive effect on the project from the beginning of its initiation (Scott-Young, Samson, 2008). Each passing of the project management procedure gives the project manager a package of new experiences, and the project management methodologies themselves formalise these aspects in the form of recommendations for preparing a register of experiences. The high rating given to this competence by a group of project managers with many years of experience is therefore justified.

The same is true for the competence, which is the *ability to manage time in a project*. Project managers acting within the framework of accepted standards, which support them significantly in the implementation of projects, have time management procedures and tools at their disposal. They are responsible for their timeliness and the timeliness of other members of the project team. The timeliness of the entire project may be based on the high level of the aforementioned competence of the project manager. The indication of this competence as a key one can orient the adepts of project management to the significance of scheduling.

In addition to *accuracy,* two other personal competences were included in the project manager's list of key competences. The first competence is *intelligence* with a high fifth rank. This competence in project management supports the ability to actively process a lot of information that a project manager has to deal with. It enables to efficiently respond to emerging changes while maintaining the primacy of striving to achieve the project goal. The predisposition to multi-threaded work using expert knowledge and skills is a competence that requires a project manager to have a high degree of intellectual disposition.

The above competence goes hand in hand with another personal competence, *persistence,* which has been considered as a key competence. Projects are complex undertakings implemented on various levels and at many stages. They require the project manager to work persistently during long systematic implementation of tasks as well as in periods of dynamic unforeseen changes. The persistence can be based on the determination of a project management novice as well as on the many years of experience of a practising project manager. Whatever the motivation of the project manager may be, the need for persistence is determined by the role the project manager plays in the project. Dividing the project implementation into

stages requires the active presence of the project manager at each stage. Other members of the project team are included in the implementation in accordance with their assigned tasks, for longer or shorter periods of time. The awareness of the significance of this competence, which is *persistence*, will allow the project manager to successfully complete each stage of the project.

The least numerous group of business competences among all the project manager's competences surveyed has two representatives among the key competences. *Entrepreneurship* was ranked fourth, and *creativity* was ranked sixth. The surveyed group of experienced project managers implementing large and complex investments in fibre-optic infrastructure throughout Poland is often confronted with the need for a business approach to the implementation of these demanding projects. Other project managers implementing projects, even in different industries, should also demonstrate entrepreneurship and creativity.

The key competences of the project manager identified as a result of the conducted research can be assessed as consistent and logical relationships can be found between them.

The applied division of competences into four thematically coherent categories, namely professional, social, personal and business competences, was introduced in order to achieve greater clarity. The research showed that, on average, the competences in the least numerous category of business competences were rated highest (4.08) and the competences in the most numerous category of professional competences were rated lowest (3.77). This shows how important the business approach is for the effectiveness of the project manager's actions.

All other competences should also be considered as dedicated to project managers, with particular emphasis on those that have been identified as key competences.

The development of competences is a continuous process (Balcerzyk, 2018), and their development results in the gradual transition to a higher and higher level of mastery. There is no closed list of competences in organisations. The researchers only create various sets of their combinations, profiles of competences that relate to the specific needs of the organisation and its specificity (Balcerzyk, 2021; Balcerzyk and Karczewski 2022; Czaińska, 2021; Simerson and Venn, 2010; Sus and Sylwestrzak, 2021). To a large extent, the diversity of approaches results from the specificity of research areas and the extensive management science, which allows to describe these issues. However, it is indisputable that an effective leader, a manager, must have specific competences and play various roles in order to successfully find himself or herself in a variety of difficult and unexpected situations.

## 5. Discussion

Based on the developed profile of the project manager's competences, the question can be answered: *Does the project manager have the key competences required for his or her position and are they at the appropriate level*? It is a useful tool for HR structures, which can be used

in the personnel selection of employees for the position of project manager, in periodic evaluation of employees in this position, in developing a development path for project managers and preparing competence trainings, as well as in motivating interviews and coaching.

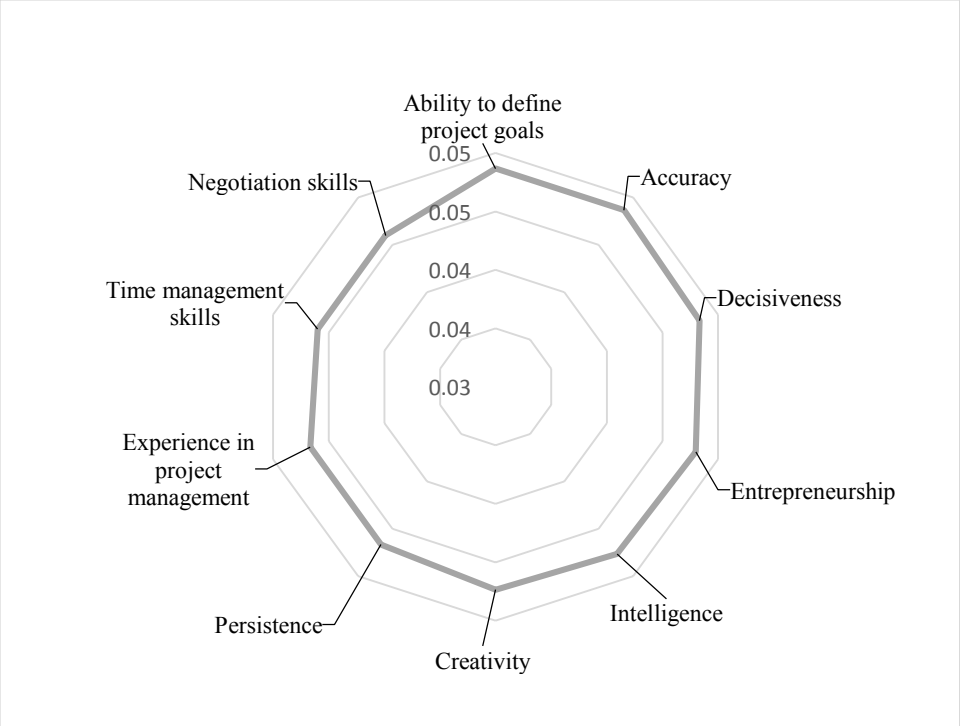


**Figure 1.** Project manager's profile of competences. Source: Own research.

The project manager's profile of competences will allow recruiters to formulate and publish a targeted job offer that includes a description of the competences sought. Applicants will know what is expected of them in the offered position. In the planning of internal promotions, it will be possible to make a precise selection of the employee who is best suited for the vacant position.

With a defined profile of competences for a project manager, it will be easier for the superior to formulate expectations for subordinates and to find an explanation for recurring failures in project implementation. All respondents indicated that their competences are assessed by their superior, and 75% of them also by project stakeholders. Only 16% of the respondents indicated that their competences are verified by the HR department, and 7% of them also by recruiters.

The competences held are also verified to some extent in the certification process. In the surveyed population of project managers, 86% had a project management certificate issued by an international certifying authority. Each certificate is a confirmation of high competences in the area of project management. One of the surveyed project managers boasted the prestigious project management professional (PMP) certificate, which is recognised as the gold standard of project management certification. The PMP certificate confirms high competences to perform the role of a project manager and to manage projects and teams. This fact demonstrates the respondents' knowledge of advanced project management techniques.

## 6. Conclusions

The definition of the project manager's key competences is important for the effectiveness of the recruitment process for this position, for conducting periodic employee evaluations and for developing a dedicated training programme. Above all, however, the knowledge of the project manager's key competences is essential for the project managers themselves to take effective actions to implement the project. The profile of competences will allow the targeted development of managerial traits and, as a result, will increase project managers' satisfaction with effective management.

The identification of the project manager's key competences and assigning them to the level indicated in the research made it possible to design the profile of competences of the project manager. This profile can be a useful tool in the hands of an experienced human resources specialist, for recruiters and management staff supervising the implementation of projects. In training structures, this profile will support the preparation of training programmes assisting in the development of these specific competences. It can also serve as a basis for further research, in order to further identify the key competences of the project manager, which are important for the effectiveness of project management.

## References

1. Balcerzyk, R. (2018). Wpływ kompetencji oficerów na rozwój ich na rozwój ich kariery zawodowej. *Zarządzanie Zasobami Ludzkimi, nr 3-4*, pp. 122-123.
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. Balcerzyk, D., Karczewski, D. (2022). The competencies of a manager as a factor contributing to the success of a company in the VUCA environment. *Scientific Papers of Silesian University of Technology – Organization and Management Series, No. 157,* pp. 9-23, DOI: http://dx.doi.org/10.29119/1641-3466.2022.157.1.
4. Czaińska, K. (2021). ICT Labor Market Needs: The Gap in Secondary School Graduate. Soft Skills as a Challenge for the Educational System. *Human Resource Management [Zarzadzanie Zasobami Ludzkimi], Iss. 1/2,* pp. 195-220.
5. El-Saba, S. (2001). The skills and career path of an effective project manager. International *Journal of Project Management, Vol. 19, Iss. 1,* pp. 1-7. https://doi.org/10.1016/S0263-7863(99)00034-4.
6. IPMA (2015). Individual competence baseline for project, programme & portfolio management. Version 4.0. Zurich, p. 5.

7. Kaufmann, C., Kock, A. (2022). Does project management matter? The relationship between project management effort, complexity, and profitability. *International Journal of Project Management, Vol. 40, Iss. 6,* pp. 624-633. https://doi.org/10.1016/j.ijproman.2022.05.007.
8. Marnewick, C., Marnewick, A.L. (2021). Digitalization of project management: Opportunities in research and practice. *Project Leadership and Society, Vol. 2, 100026*, https://doi.org/10.1016/j.plas.2021.100026.
9. Musioł-Urbańczyk, A. (2010). Kluczowe kompetencje kierownika projektu. *Marketing i Zarządzanie, 2(10),* pp. 93-108.
10. Nicholas, J.M., Steyn, H. (2012). *Zarządzanie projektami. Zastosowanie w biznesie, inżynierii i nowoczesnych technologiach*. Warszawa: Oficyna a Wolters Kluwer business, p. 18.
11. Office of Government Commerce (2010). *PRINCE 2TM – Skuteczne Zarządzanie Projektami.* London: The Stationery Office (TSO).
12. Podgórska, K., Jasińska, M. (2015). Między oczekiwaniami a rzeczywistością. Umiejętności miękkie u osób wchodzących na rynek pracy. *e-mentor, nr 5(62)*, pp. 16-20.
13. Project Management Institute Inc. (2006). *Kompendium wiedzy o zarządzaniu projektami. PMBOK® Guide III edycja*. Warszawa: MT&DC, p. 5.
14. Project Management Institute Inc. (2017). *A guide to the Project Management Body Of Knowledge. PMBOK® Guide VI edycja.* Warszawa: MT&DC.
15. Radujković, M., Sjekavica, M. (2017). Project Management Success Factors. *Procedia Engineering, 196,* pp. 607-615.
16. Scott-Young, Ch., Samson, D. (2008). Project success and project team management: Evidence from capital projects in the process industries. *Journal of Operations Management, Vol. 26, Iss. 6,* pp. 749-766. https://doi.org/10.1016/j.jom.2007.10.006.
17. Simerson, B.K., Venn, M.L. (2010). *Menedżer jako lider*. Warszawa: Oficyna a Wolters Kluwer business.
18. Sus, A., Sylwestrzak, B. (2021). Evolution of the Labor Market and Competency Requirements in Industry 4.0 versus the Covid-19 Pandemic. *European Research Studies Journal, Vol. XXIV, Iss. 1,* pp. 494-506.
19. Thomas, J., Mullaly, M. (2007). Understanding the Value of Project Management: First Steps on an International Investigation in Search of Value. *Project Management Journal, 38(3),* 74-89. https://doi.org/10.1002/pmj.20007.
20. Trocki, M., Grucza, B., Ogonek, K. (2003). Zarządzanie Projektami. Warszawa: PWE.
21. Wysocki, R. (2013). Efektywne zarządzanie projektami. Tradycyjne, zwinne, ekstremalne. Gliwice: Helion, p. 62.

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# SMALL CARPATHIAN CIRCLE AS THE MOST SIGNIFICANT INFRASTRUCTURE PROJECT IN WESTERN UKRAINE

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**Purpose:** the main purpose of this paper is to analyse the new infrastructure project in western Ukraine, show its main characteristics and to forecast how it will improve the socio-economic life of this region and how it will rise tourist flows in cross-border territories.
**Design/methodology/approach**: The Small Carpathian Circle was chosen as it is the biggest infrastructure project in western Ukraine that covers three oblast (regions) of Ukraine and will have a cross-border impact. Literature sources, statistical information and estimates data used in this paper were gathered from various international and Ukrainian official sources and websites. Personal knowledge about Carpathian region was also used as the author comes from Lviv oblast of Ukraine.
**Findings:** the outcome of this paper is that the Small Carpathian Circle has to be implemented in the nearest future in order to provide the efficient mobility in Carpathian region of Ukraine on the basis of sustainable development. The main reasons for its slow implementation in 2022 were highlighted.
**Originality/value:** it is the first research paper about the Small Carpathian Circle, as it wasn't analysed properly by scientists yet. It is addressed to a scientific circle, politicians, investors, international organisations and all people interested in Carpathian region development.

**Keywords:** Carpathian region, infrastructure, project, regional economy.

**Category of the paper:** conceptual paper.

## 1. Introduction

The theoretical foundations of the category of "infrastructure" were developed in the works of the world well-known economists: A. Smith, K. Marx, R. Jochimsen, P. Rosenstein-Rodan, P. Samuelson and others.

Ukrainian scientists Hutafel V.V., L. Kuzmenko, I. Kovelska, I. Rekunenko, I. Butyrska, M. Kovalenko, A. Tkach also worked on the formation of theoretical aspects of infrastructure and determined its impact on the development of the region's economy.

The scientific research of the infrastructure problems and prospects can be found among publications of scientists from Poland, Ukraine, Hungary, Slovakia, Slovenia, Romania, Austria, Check republic and other.

Antoine Goujard investigated improvement of transport and energy infrastructure investments in Poland. He emphasises that improving infrastructure in Poland is a key requirement for keeping the economy on a steep long-term growth path, enabling productive private investment and the creation of new activities. Poland has made significant progress to update its transport and energy infrastructure over the last 20 years (Goujard, 2016).

Wojciech Zalewski, Magdalena Osinska, Mirosława Żurek aimed to evaluate the acceptance and the actual utilization of GPS/GPRS-based telematics technology in road transport companies registered in Poland. Their study proposed using a classical and extended (to include workforce number) Technology Acceptance Model; they also estimated TAM models by micro, small, and medium-sized enterprises (Zalewski, Osinska, Zurek, 2022).

Among Ukrainian scientists we would like to mention Phd Perederko V.P. We can find useful information about development of eco- and geotourism infrastructure in the Carpathian region with the assistance of international technical assistance projects in his publications (Perederko, 2016).

Besides, Hutafel V.V. investigated the practical aspects of the current state of economic infrastructure in the Carpathian region in order to identify trends and preconditions for the further development of the region. His article provides a comprehensive assessment of the main component elements of economic infrastructure in the Carpathian region (Hutafel, 2015).

My paper contributes to the existing literature in an infrastructure development, but it adds research in a frontier regions. The project of the Small Carpathian Circle has not been discussed properly by scientists yet, because Russian full-scale aggression against Ukraine has shifted all topics and investigation directions to security issues.

Meanwhile, transport infrastructure plays an important role in ensuring the economic development of the Carpathian region and the efficiency of material production, because the transport system forms and operates the vast majority of material flows of goods, ensuring socio-economic development of the whole country and the region.

According to statistics, 23% of goods in the Carpathian region are transported by rail, 71% by road and 6% by pipeline. Accordingly, road transport can be identified as a priority in the infrastructure of economic development of the region.

The main goal of the development of transport infrastructure in the Carpathian region is the practical implementation of favourable transport and geographical location, intensification of work on building part of the national network of international transport corridors and its integration into the transport systems of European Union.

## 2. The Small Carpathian Circle project characteristics

The Small Carpathian Circle is a joint project of the regional authorities of Zakarpattia, Lviv and Ivano-Frankivsk regions together with Ukravtodor on the development of roads in the central part of the Ukrainian Carpathians. The project was presented In December 2019 and a relevant memorandum was signed. In February 2021, the future state investment project Small Carpathian Circle was introduced as a part of the program of the President of Ukraine «Large Construction». There is the political will in Ukraine to implement such great infrastructural projects. The Verkhovna Rada expressed readiness to adopt all necessary changes to the budgets so that the Project could be implemented. The Head of Ukrainian Government assured that such projects as the Small Carpathian Circle would have a positive result for the economy and development of the whole state.

The project would cover a network of roads with a total length of over 640 km (Figure 1). Meanwhile, a certain part of the roads had been repaired in 2020-2021. The Small Carpathian Circle project (hereinafter SCC project) will be a whole tourist complex with a length of hundreds of kilometres (Governmental portal, 2021).

The SCC project will bring together three European countries – Ukraine, Poland and Romania – around key Carpathian resorts (Figure 1) . Under the optimistic scenario, the project is expected to be completed in three years.


**Figure 1.** Small Carpathian Circle map. Source: OKKO…

To connect the key resorts of the Carpathian Mountains, to unite three European countries – Ukraine, Poland, Romania – to create European-level infrastructure and give a powerful impetus to the development of communities and their tourism potential for Transcarpathia and neighboring regions. The SCC project includes more than 400 km of highways from mountain Boberka (Lviv region, border with the Republic of Poland), through Rozhanky to Dolyna in Prykarpattia, and from Bolekhiv through Sukil to Dubyna with access to Slavske, then through Verkhny Studeny to Synevyr, to Yablunivka (Zakarpattia region, border with Romania) (Governmental portal, 2021).

It is also planned to build three new passes, which will provide better access to the recreational potential of Slavsk and Borzhava, connect Dovbush rocks with Tustanya and the resorts of Truskavets and Skhidnytsia, and create conditions for comfortable and safe travel in the Ukrainian Carpathians.

The well-known ski resort Slavsko with the legendary Trostyan will get a chance for a new round of development with better infrastructure. Very close, in a distance of two dozen kilometers, there is even a greater recreational potential of the slopes of Borzhava. However, historically, this place at the intersection of three regions was without road traffic.

A total of 16.7 billion UAH (618,5 mln USD in prices of 2021) is needed to implement one of the most ambitious infrastructure projects in western Ukraine (Governmental portal, 2021).

The SCC project is supposed to unite the resort and tourist centers of the three regions in the nearest future. Among the key centers are:

- in Lviv region – Slavske, Rozhanka (Upper and Lower), Skole and Play,
- in Zakarpattia region – Pylypets, Izky, Synevyr and Mizhhirya,
- in Ivano-Frankivsk region – Vyhoda, Vyshkiv and Bukovel.

This will increase the exchange of tourist flows, reduce travel time and, accordingly, increase investments and local budget revenues. SCC project will also have a positive social impact creating new jobs in the regions.

### 2.1. Zakarpattia region

Within Zakarpattia region, the SCC project includes national and local highways over 218 km long and the total cost of repair works is UAH 3.9 billion (1,4 mln USD in prices of 2021). In 2021, more than 95 km (44%) of roads were restored under this project in Zakarpattia.

UAH 1.7 billion was allocated from the state budget for the repair of state roads. With these funds, 71 km of routes M-06 Kyiv – Chop, T-07-18 Nyzhni Vorota – Volovets – Mizhhirya, T-07-37 Khust – Shayan – Vyshkovo – Bushtyno and R-21 Dolyna – Khust were provided with coverage of high quality.

Almost 100 mln UAH from the Road Fund was spent on repairing of the local roads. As of today, contractors have already provided high-quality coverage for more than 30 km of roads, and works continue.

The project also includes public roads of local importance O 070603 Synevyr – Kolochava – Bushtyno with a length of 66 km and O 071303 Vyshkovo – Yablunivka – state border with Romania – more than 9 km (Ukrinform, 2021).

### 2.2. Lviv region

In Lviv region 34 projects are being implemented for the overhaul and construction of new roads, as well as the reconstruction of bridges within the SCC project.

In Lviv region, the reconstruction of 5 existing roads is planned, including Slavske – Vyhoda, Slavske – Khashchovanya, Hitar – Tukhlya, Borynya – Mokhnate and Borynya – Boberka.

In addition, it is planned to build three new highways. This is the road that will connect Ivano-Frankivsk region with Slavske-Vyhoda road, which is 11 kilometers long. New construction of the highway from the village of Nizhne Studene, Zakarpattia region, to the road Slavske – Khashchovanya – 8,5 kilometers. Also, construction of a road bypassing the railway bridges connecting the Skole – Slavsk and Slavske – Vyhoda highways with a length of more than 1 kilometer.

In addition to local roads, the SCC project provides the repair and construction of 75.5 km of public roads of state importance in Lviv region. In particular, M-06 Kyiv – Chop – 51.5 km and T-14-24 Skole – Slavske – 24.0 km . Besides, it is planned to reconstruct 37 bridges (Lviv regional state administration, 2021).

It is important for international relations that there will be new checkpoints in Lviv region: Nyzhankovychi – Malkhovychi, Boberka – Smolnyk, Lopushanka – Mikhnovets in Sambir district, Varyazh – Usmezh, Belz – Budynin, Belz – Oserduv in Chervonohrad district.

The construction of new checkpoints on the Ukrainian-Polish border is necessary, because the existing ones can not provide the access of the great amount of people crossing the state borders every day, that's why we can observe huge lines on the checkpoints. But first of all, Ukraine has to build new roads and to restore the old highways to the new checkpoints.

Currently, work is underway on the Borynya – Boberka road. 130 mln UAH of subventions from the state budget were spent last year Lviv regional state administration, 2021).

The new checkpoint Bobernyk – Smolnyk will allow tourists form Republic of Poland to take the direct road Borynia – Boberka to the Kyiv – Chop road and from here use the newly built roads to move to either Zakarpattia or Ivano-Frankivsk. In addition, the construction of these new roads will reduce the traveling time by almost half.

It has to be mentioned that the roads in the mountains are not built as fast as on the plains. There are dozens of bridges, additional drainage, retaining walls, expansion are necessary. Of course, the cost of the roads will be three times more expensive. The implementation process is not easy, but it has to be continued.

### 2.3. Ivano-Frankivsk region

In Ivano-Frankivsk region three roads of local importance are being prepared for repair within the framework of the SCC project. Regional authorities are working on the project documents and preproject decisions for the repair and reconstruction of the roads Vyshkiv – Senechiv, Bolehiv – Kozakivka, Kozakivka – Sukil, which have become an integral part of the state project "Small Carpathian Circle".

Ukravtodor has already agreed to transfer these roads of local importance to their balance sheet.

An important part of the SCC project is the public road of state importance R-21 Dolyna – Khust, and the project itself is carried out within the framework of the presidential program "Major construction». On the R-21 road, from Dolyna to the border with Zakarpattia, average current repairs have already been carried out on a section of 45 km. For the safety of road users and tourist attraction, bicycle and pedestrian paths and lighting are planned here.

Within the framework of the SCC project, in 2021, the current average repair of the R-21 Dolyna – Khust road was carried out along its entire length within the Ivano-Frankivsk region, on a section of almost 45 km from Dolyna to the border with Transcarpathia.

Thanks to the SCC project, not only three regions of the Western region of Ukraine will be connected with good roads, it will also allow us to revive the central part of the Ukrainian Carpathian Mountains. After all, road infrastructure plays a very important role for the region development. The repaired roads will positively affect the development of tourism and the socio-economic situation of the region as a whole. In addition to good and quality road surface, safe roads are equally important. All objects are designed according to the same technical standards with a bicycle path, sidewalk, lighting, with a width of at least 7-8 m.

## 3. Gaps of SCC project

Of course, SCC project has some gaps. One of the most important of them is that the SCC project doesn’t possess issues concerning electrocars and charging stations for them. The network of electric cars charging stations in Ukraine is just beginning to develop, so it’s complicated to travel by electric car in Carpathian Mountains. Today, charging stations are mainly concentrated in large and medium-sized cities. There are also several start-ups in rural areas.

For example, In 2019, a modern charging station for electric cars with a capacity of 50 kW was put into operation on the territory of the "Ekopal" car service in Kalush, Ivano-Frankivsk region. This charging station is designed for all existing types of electric cars. The convenient location of the charging station will allow drivers to get there by electric car along the

H10 route, for example from Lviv to Ivano-Frankivsk or Bukovel. It's also possible to get easily to Burshtyn, Rohatyn, Berezhan or Ternopil from Dolyna by highway T 0910.

So, when going on a trip to the popular Carpathian resorts: Bukovel, Palyanitsa, Tatariv, Vorokhta or Yaremche from Kyiv, Lviv or other cities, it's not a problem to find a charging station for electric cars on a way. But it's a problem for remote districts of Carpathian Mountains as we can see on an online map of charging stations for electric cars (on-line map, 2022).

That's why it is recommended to widen a network of charging stations for electric cars as a part of SCC project. It will be also very useful to install such charging stations near hotels in remote areas.

## 4. Travel & Tourism Competitiveness Index

Infrastructure has a direct impact on tourist attractiveness of a country. The main purpose of SCC project is to increase tourist flows and to develop tourism in Carpathian Mountains.

The Travel & Tourism Competitiveness Index measures the set of factors and policies that enable the sustainable development of the travel and tourism sector, which contributes to the development and competitiveness of a country.

**Table 1.**
*The Travel & Tourism Competitiveness Index of some European countries*

| Rank in the world | Country | Value (1-7 (best)) | Score* | Diff. From Global avg. (%) |
|---|---|---|---|---|
| 1 | Spain | 5,4 | 0,3 | 41,4 |
| 2 | France | 5,4 | 1,5 | 40,4 |
| 11 | Austria | 5,0 | 2,1 | 28,8 |
| 42 | Poland | 4,2 | 2,9 | 10,0 |
| 48 | Hungary | 4,2 | 3,4 | 9,0 |
| 56 | Romania | 4,0 | 5,7 | 3,7 |
| 60 | Slovak Republic | 4,0 | 2,0 | 3,3 |
| 78 | Ukraine | 3,7 | 6,5 | -3,2 |
| 103 | Moldova | 3,3 | 6,4 | -14,5 |

* Change in score is displayed as a percentage.

Source: Travel and Tourism Competitiveness Report, 2019.

In the tables 1 and 2 there are displayed two countries with the highest indexes (Spain and France have been being leaders for many years); Austria as its natural resources are similar to Ukrainian Carpathian Mountains; Ukraine and neighbouring countries of Ukraine.

**Table 2.**
*Factors of the Travel & Tourism Competitiveness Index*

| Rank in the world | Country | Business Environ-ment | Priori-tization of travel and tourism | Price Compt-ness | Air. ransp I nfr | Ground infra-struc-ture | Tourist service infrastr. | Natural resour-ces | Cultural (Res. And business travel) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Spain | 4,5 | 5,9 | 5,0 | 5,0 | 5,2 | 6,6 | 4,8 | 6,7 |
| 2 | France | 4,8 | 5,1 | 4,5 | 4,8 | 5,6 | 5,7 | 4,9 | 6,8 |
| 11 | Austria | 4,8 | 5,3 | 4,7 | 4,2 | 5,2 | 6,7 | 4,1 | 3,2 |
| 42 | Poland | 4,3 | 4,2 | 5,7 | 3,2 | 4,3 | 4,5 | 3,2 | 3,0 |
| 48 | Hungary | 4,3 | 5,1 | 5,3 | 3,4 | 4,2 | 4,8 | 2,7 | 2,3 |
| 56 | Romania | 4,4 | 4,1 | 5,6 | 2,7 | 3,1 | 4,6 | 3,2 | 2,3 |
| 60 | Slovak Republic | 4,1 | 4,3 | 5,4 | 2,0 | 4,2 | 4,4 | 3,4 | 1,6 |
| 78 | Ukraine | 4,1 | 4,3 | 5,9 | 2,7 | 3,1 | 4,3 | 2,2 | 1,9 |
| 103 | Moldova | 4,0 | 3,7 | 6,0 | 2,1 | 2,6 | 2,9 | 1,7 | 1,2 |

Source: Travel and Tourism Competitiveness Report, 2019.

Analysis of the indicators of the sub-index "Infrastructure" of the Competitiveness Index in the field of travel and tourism WEF (Table 2) shows that the most problematic elements of Ukrainian infrastructure are air transport infrastructure, cultural (rest and business travel) and natural resources. It is forecasted that SCC project will help to increase Ukrainian indicators and will have positive results for socio-economic life of people in this regions of Ukraine and tourism development as well.

## 5. Infrastructure projects while Russia's full-scale aggression against Ukraine

Russia's full-scale aggression against Ukraine has put on a pause almost all infrastructure projects implementation all over Ukraine. SCC project as a part of presidential program «Great Construction» has been stopped too. Unfortunately, not only security measures matter in this case, but also economic problems in Ukraine, such as budget deficit. There is a great lack of funds to finance great projects that are very expensive. As for now the main tasks for Ukraine are to rebuild and restore all destroyed infrastructure. Nevertheless, the positive fact is that some parts of SCC project, regarding restoring of the most important parts of state roads, are being implemented this year too.

Private investments in new infrastructure objects were also put on a pause because of the risks during the war. For example, OKKO Group Holding planed to build a great ski resort on the territory of the Slavske amalgamated territorial community in Lviv region (Interfax Ukraine, 21.12. 2020). It was planned to build the resort 15 km from Slavske in the villages of Verkhnia Rozhanka and Volosianka.

This is a long-term project that will last about four years. Austrian experts came to study the slopes, the height of the mountains, infrastructure and these settlements were included in the strategy. Now all issues with the land have been resolved, the next step is the development of the project, design estimates and the start of construction work. The resort will be eight or nine years ahead of Bukovel in technical development. The complex will include over 60 km of skiing pistes.

OKKO registered all its shares in Slavske and, accordingly, the tax paid by the company remains here in the community. These funds will be reinvested in the development of ski infrastructure, in the Slavske brand, in road repairs and community development. The project had to be implemented in three stages, but for now it's unclear when the construction will start.

Transport cooperation with Poland in the conditions of Russia's aggression against Ukraine has become a model of true good neighbourliness. Freight transport has already been partially liberalized. In particular, Ukraine is grateful to Poland for providing the possibility of unauthorized passage through its territory of trucks transporting fuel to Ukraine. Today, joint border and customs control is already carried out at four checkpoints for passenger and passenger cars on the Ukrainian-Polish border. Thanks to the "single window" approach, the duration of registration and waiting in line will be reduced by 1.5 times, which is of interest to both states. In addition to reducing queuing time, expanding jointly controlled checkpoints is expected to improve the efficiency of stationary scanning systems and reduce corruption risks (Governmental portal, 2022).

Ukrainian and Polish colleges are also working on the creation of a joint railway company to increase the export potential of the Ukrainian economy.

The potential for growth of cooperation is not exhausted, especially with regard to the capacity of road checkpoints.

It is expected that the successful experience of such cooperation will be extended to the checkpoint with other EU neighbouring countries. Ukrainian goal is the full liberalization of trucking with the European Union.

## 6. Conclusion

It is forecasted that the Small Carpathian Circle will improve Ukraine's key factors of tourist competitiveness. This project will facilitate the exchange of tourist flows, reduce of travel time, as well as will significantly affect the socio-economic development and increase tourism potential of the region. SCC project will contribute to developing the Carpathian region into an all-year-round resort with a wide variety of accommodation types and outdoor activities (skiing, hiking, horse-riding, rafting, berry and mushroom picking, wine and cheese festivals, folk crafts etc.).

The new infrastructure in the region has to be built on the sustainable development basis, therefore it will provide the region with convenience, reliability, comfort, high mobility, safety and tourist attractiveness.

## References


1. Goujard, A. (2016). *Improving transport and energy infrastructure in Poland. OECD working paper.* Retrieved from: https://read.oecd-ilibrary.org/economics/improving-transport-and-energy-infrastructure-investment-in-poland_5jlwz8jrf89r-en#page2, 23.03.2022.
2. Shmyhal, D. *The Small Carpathian Circle project will be a whole tourist complex with a length of hundreds of kilometers. Communications Department of the Secretariat of the CMU.* Retrieved from: https://www.kmu.gov.ua/en/news/denis-shmigal-proekt-male-karpatske-kolo-stane-cilim-turistichnim-kompleksom-protyazhnistyu-v-sotni-kilometriv, 22.12.2021.
3. https://managementpapers.polsl.pl/wp-content/uploads/2022/07/Zalewski-Osińska-Żurek.pdf.
4. Ministry of Infrastructure. *Ukraine and Poland will carry out joint control at all road checkpoints.* Retrieved from: https://www.kmu.gov.ua/en/news/mininfrastrukturi-ukrayina-ta-polshcha-zdijsnyuvatimut-spilnij-kontrol-na-vsih-avtomobilnih-punktah-propusku, 22.05. 2022.
5. OKKO seeks to start building ski resort in Carpathian Mountains in 2021, investments to reach $500 mln. *Interfax Ukraine, 21.12.2020*. Retrieved from: https://en.interfax.com.ua/news/investments/711418.html, 02.06.2022.
6. *On-line map of electro cars charging stations*. Retrieved from: https://www.autocentre.ua/ua/karta-zapravok-dlya-elektromobilej-v-ukraine, 20.06.2022.
7. *Travel and Tourism Competitiveness Report* (2019). World Economic Forum. Retrieved from: https://www3.weforum.org/docs/WEF_TTCR_2019.pdf, 05.04.2022.
8. Zalewski, W., Osinska, M., Żurek. M. (2022). Do telematics technologies help to manage road transport enterprises? Evidence from SME in Poland. *Scientific Papers of Silesian University of Technology. Organisation and Management Series, no. 157,* pp. 723-736. http://dx.doi.org/10.29119/1641-3466.2022.157.46.
9. Бутирська, І.В. [Butyrska, I.V.] (2006). *Інфраструктурне забезпечення регіонального розвитку: проблеми та шляхи їх вирішення.* Чернівці: Книги – ХХІ, 238.
10. Гутафель, В.В. [Hutafel, V.V.] (2015). *Сучасний Стан і Тенденції Розвитку Інфраструктури Карпатського Економічного Регіону.* Миколаївський національний

університет імені В.О. Сухомлинського, 694-699. Retrieved from: http://global-national.in.ua/archive/5-2015/142.pdf, 20.03.2022.

11. Лендєл, О.Д. [Lendel, O.D.] (2019). Вплив інфраструктури на коркурентоспроможність регіонального ринку туристичних послуг. *Науковий вісник Мукачівського державного університету, Серія Економіка. Випуск, 1(11),* pp. 87-95. DOI:10.31339/2313-8114-2019-1(11)-87-95.
12. *Мале Карпатське коло: ЛОДА реалізує 34 проекти з будівництва, ремонту доріг місцевого значення та мостів.* Lviv regional state administration. Retrieved from: https://loda.gov.ua/news?id=56240, 05.01.2021.
13. На *Закарпатті ремонт доріг «Малого карпатського кола» коштував майже 4 мільярди гривень. Ukrinform.* Retrieved from: https://www.ukrinform.ua/rubric-tourism/3338786-na-zakarpatti-remont-dorig-malogo-karpatskogo-kola-kostuvav-majze-4-milardi-griven.html, 25.10.2021.
14. Передерко, В.П. [Perederko, V.P.] (2016). Розвиток інфраструктури еко- і геотуризму в Карпатському регіоні за сприяння проектів міжнародної технічної допомоги. *Економіка і суспільство, 2,* 418-424 Retrieved from: https://economyandsociety.in.ua/journals/2_ukr/75.pdf, 28.03.2022.

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# THE IMPACT OF EXTERNAL DEBT ON POLAND'S ECONOMIC GROWTH

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**Purpose:** The primary purpose of this paper is to examine the relationship between external debt and economic growth in Poland for the period 2004-2021.
**Design/Methodology/Approach:** The study uses quarterly, secondary data spanning from 2004 to 2021. The data gathered in the research were analysed using the ordinary least squares (OLS) regression and backward stepwise regression model.
**Findings:** The empirical results of research show that relationship between changes in ratio of external debt stock to GDP and economic growth is positive but not significant in period 2004-2021. This suggest that foreign borrowing minimally contributes to economic expansion of Poland. Furthermore, the results for the control variables indicate that trade openness and investment have a positive and significant effect on economic growth, whereas financial development and inflation negative.
**Practical Implications:** Understanding variables that influence countries' economic growth is essential for designing appropriate economic policies, including debt management strategy. The research results can be used to formulate debt management strategy, which helps to minimalize risk connected with foreign borrowing. Poland should decrease dependence on external debt and increase reliance on domestic savings and other non-debt creating inflows. In addition, the results of study provide a reasonable basis for further research on the influence of the foreign debt' composition on economic expansion of the country.
**Originality/Value:** The nexus external debt-economic growth is widely debated by researchers, however until now, little research has been done about this relationship in Poland.

**Keywords:** external debt, economic growth, Poland.

**JEL classification**: F34, F4.

**Paper type**: Research study.

## 1. Introduction

The prime objective of economic policy of most countries is to attain sustained economic growth. Dynamic and growing economy can help to reduce poverty, lead to new and better employment opportunities, improve living standards of people and provide a foundation for achieving environmental and social goals. Hence, understanding variables that influence countries' economic growth is essential for designing appropriate economic policies, including debt management strategy.

Economic growth is influenced by many determinants. The neoclassical theory emphasized the importance of capital accumulation for economic growth. Economies have both internal and external sources of capital to fund investment needs, and a combination of them can be used to foster economic expansion. External debt financing is one of external resources that affects economic growth. Despite numerous studies on this nexus, the impact of external debt on economic growth is still inconclusive. According to economic theory external debt contributes positively to economic growth, both through capital accumulation and productivity growth. However, large accumulated external debt may be a threat to the economic stability and an obstacle to growth (Pattillo, Poirson, Ricci, 2002).

Until now, little research has been done about relationship between external debt and economic growth in Poland. Previous literature on external debt have focused mainly on low income economies, individually or sets of countries. Moreover, studies that have analysed the impact of external debt on economic growth are ambiguous, with mixed results. The relevance of such a study is becoming increasingly important, as over the past few decades, the Poland's external debt has increased significantly, making the debate on its role in financing the development process, crucial.

The paper aims to examine whether there is a link between economic growth and external debt in Poland. For this purpose, quarterly time series data for the period from 2004 to 2021 have been used.

## 2. An overview of the literature

The issue of external debt and its relationship with economic growth has brought about an increasing literature. However previous studies indicated different results regarding the impact of external debt on economic growth in various countries or group of countries. Economic theories suggest that a reasonable level of debt should help both, developing and developed countries enhance their economic growth (Al Kharusi, Ada, 2018). External debt is one of the sources of financing capital formation in any economy. The main benefit associated

with the inflow of foreign debt is a possibility of increasing capital supply that permits a country to invest more than it can save domestically. Import of capital is especially important in developing countries, where limited stocks of capital – preventing many investments, is a barrier to economic growth. Increasing investment outlays, in turn, should bring positive macroeconomic effects in the form of an increase in production and employment, which will enable the improvement of the living conditions in the country, that imports capital. Import of capital is especially important in developing countries, where limited stock of capital – preventing many investments, is a barrier to economic growth.

According to (Dey, Tareque, 2019) external borrowing is not a negative issue for a country until it can generate higher returns than the cost of borrowing.The benefits resulting from gathering external debt depend mainly on optimal allocation of the externally sourced fund. Theoretically, a country will benefit from the positive effect of external debt, if it has been efficiently allocated to productive investment, resulting in a higher rate of growth. Increases in domestic income and export earnings are expected to cover the servicing of outstanding debt obligations.

However the strategy of accelerating economic growth, through accruing external debt may turn out to be risky (Ciftcioglu, Sokhanvar, 2018; Dey, Tareque, 2019; Soydan, Bedir, 2015). In the literature relating to the potential negative effect of a foreign debt on growth, the principal channel by which large debt is thought to hinder growth is the so-called "debt overhang". Debt overhang for a country exists when the country's debt service burden is so heavy, that a large portion of the current output accrues to foreign lenders and consequently creates disincentive to invest (Sen, Kasibhatla, Stewart, 2007).

Debt burden can affect country's growth through other channels. It is argued that external debt service payments can potentially influence economic growth by creating a "crowding out" effect. According to this view, high debt service payments can directly crowd out investment by preventing a country from devoting resources to productive investment areas (Soydan, Bedir, 2015). High debt service, in the absence of sufficient export earnings or other forms of capital inflows, can also lead to reduced import, resulting in lower investment and growth (Serieux, Yiagadeesen, 2001). In addition, increases in the debt burden imply that a higher default risk might become a concern for creditors. Due to the fear of losses, creditors might require a higher borrowing cost premium and discourage capital flows, leading to future growth slowdowns (Wang, Xue, Zheng, 2021). The effect of debt can vary from developed to developing countries. (Presbitero, 2012) found that industrialized countries are better than developing countries at using debt in a productive way by utilizing it in added value projects and thus avoiding the risks attributed to debt .

High external debt can be a source of vulnerability to external shocks. With the globalization of financial markets, capital has become more mobile, which means that countries with foreign debt became particularly vulnerable to risks associated with "sudden stop" in capital flows. Rapid changes in the directions of capital's movement bring about very serious consequences for the economy, especially the stability of the financial sector. They may cause changes in the level of foreign exchange reserves of the country, cause disruption in the process of money creation and large fluctuations in exchange rates. One of the most serious consequences of a "sudden stop" may be the financial crisis, with large adverse effects on economic activity.

Moreover, the globalization of financial markets means that the outflow of capital from one country can cause disturbances in another country, even if it has maintained stable macroeconomic policies. This situation can not be predicted, as investors hold portfolios composed of securities purchased in different countries. They may want to offset losses incurred in one market by reducing investments in other countries.

In the empirical literature, a positive impact of external debt on economic growth was found by (Khursheed, Siddiqui, 2016) who examined this relationship for the eight countries in the South Asia during twenty years, from 1994 to 2014. Their findings confirm the importance of external debt for increasing the economic growth of the South Asian countries. Similar results were found by (Mohd, Halim, Azman-Saini, 2013) who analysed the contribution of external debt to Malaysia's economic growth. The results showed that that the accumulation of external debt is associated with an increase in Malaysia's economic growth up to an optimal level, however an additional increase of external indebtedness beyond the level has inversely contributed to the Malaysian economy.

The positive relationship between external debt and economic growth was also revealed by (Joshua, Adedoyin, Sarkodie, 2020) who analysed the impact of external debt among other external factors, like trade openness, exchange rate on GDP growth and found that all the variables exerted a positive influence on economic expansion in South Africa. This suggests that external capital used to balance the gap between savings and investment would bring positive yields. (Patillo, Poirson, Ricci, 2004), empirically studied the relationship between total external debt and the growth rate of GDP for developing countries and found that it depends on the level of debt. At low levels of debt, the effect of debt is generally positive but often insignificant for growth, whereas negative at high levels of debt. Moreover the growth of already high debt reduces significantly physical capital accumulation and total factor productivity, while low debt seems to positively influence total factor productivity and negatively – capital.

Some studies have found no causal relationship between debt and economic growth. (Ogunmuyiwa, 2011) sought to determine whether external debt can promote economic growth in Nigeria. Empirical results have failed to establish causality between external debt and growth. Hence, it can be stated that external debt is not a specific factor determining the rate of economic growth or economic slowdown in Nigeria.

The existence of a negative relationship between external debt and growth was revealed by numerous studies. Most of them examined this nexus in low-income economies to make rational suggestions to policies aimed at sustainable development and economic growth for developing countries. (Sen, Kasibhatla, Stewart, 2007) results support the ''debt overhang'' hypothesis for Latin American and Asian borrowers. Their study provides strong evidence, that a high level of external debt causes a significant slowdown of economic growth in the Latin American countries. On average, economic growth in these countries has been approximately 2% below what it would have been without the heavy external debt burden. The debt overhang reduces Asian growth as well, but to a much lesser extent. Growth in capital formation contributes positively to economic growth in both regions. Findings by (Prasad, Shanker, 2017) also concluded that external debt has had a negative impact on India's economic growth from 1990 to 2016, what may be regarded as a loose verification of the debt overhang problem in India.

(Safwat, Salah, El Sherif, 2021) investigated how total foreign debt impacts the economic growth of Egypt for a time period of 39 years (1980-2018). The study found that total foreign debt as a percentage of GDP exerts a significant negative impact on the Egyptian economic growth in the long run and an insignificant impact in the short run. Furthermore, the results for the control variables show that the Egyptian economic growth is positively impacted by trade openness, while negatively by financial development, real interest rate, inflation rate and exchange rate.

Stungwa (2022) examined the relationship between external debt and economic growth in South Africa for a period from 1994 to 2020. Long run relationship was not found. The short run findings of the study state that there is a 0.198 drop in GDP growth for every 1% increase in the external debt stock, and there is a 0.288 boost for every 1% decrease in the external debt stock. When the foreign debt stock value is positive, GDP increases faster than when it is negative, whereas falling foreign debt leads to faster GDP growth than rising external debt.

Dey and Tareque (2019) analysed the external debt-growth relationship in a macroeconomic context and found the negative impact of external debt on GDP growth in Bangladesh, but the larger positive impact of newly constructed macroeconomic policy (MEP) index. This variable was used to analyse the effectiveness of economic policies in using external debts. Their results indicate that adverse effect of debt can be mitigated or even nullified by sound MEP and appropriate human resource policy, what allows the formulation of interesting policy conclusions.

One of the few studies that have focused on analysing the nature of the relationship between external debt and economic growth specifically for a sample of Central and Eastern Europe countries, including Poland, is (Ciftcioglu, Sokhanvar, 2018). The paper provides evidence of a statistically significant negative correlation between external debt and economic growth for an average country in a sample of CEE countries over the sample period of 1995-2014. This finding suggests that an increase in the stock of external debt is associated with lower growth rates of real GDP and per capita real GDP. However significant causal effect of foreign

borrowing on economic growth for a specific country was found in eight of the twelve investigated countries and for remaining four (Poland among them) the existence was not revealed.

Until now the empirical evidence on the nexus between debt and growth in developed countries is scarce. Developed countries usually have not only large foreign liabilities but also foreign assets, which reduce the risk attributed to external finance. However recent global financial crisis and following European sovereign debt crisis has brought attention from researchers to external debt problems in developed countries. According to (Gros, 2011) public debt is not a sufficient explanation of financial problems in EU periphery countries. Belgium, despite of debt-to-GDP ratio much higher than that of Portugal, has not experienced a crisis. He focuses on the importance of external debt in explaining the causes of the crisis, pointing out that Belgium, in contrast to Portugal, is a net creditor towards the rest of the world. The same conclusions can be found in (Silva, 2020) who examined the impact of external debt on the Portuguese economic growth for the 1999-2019 period. He stated that the increasing variation in the Portuguese external debt seems to have been unsustainable up to the European sovereign debt crisis. The rise of external debt was greater than the increase in productivity, investment and private gross value added.

## 3. Research methods

In line with the objective of this study, to empirically examine the relationship between external debt and economic growth in Poland, secondary, quarterly data, spanning from 2004 to 2021, collected from the Central Statistical Office were used. The selection of period is based on the availability of data. The ordinary least squares (OLS) regression and backward stepwise regression model were used to test the relationship among the selected variables. The estimated model in this work is based on (Ciftcioglu, Sokhanvar, 2018). The empirical analysis is based on the following equitation:

$GR_t = \alpha_0 + \alpha_1 ED_t + \alpha_2 TO_t + \alpha_3 INV_t + \alpha_4 IN_t + \alpha_5 FD_t + u_t,$

where (at time t):

$GR_t$ is economic growth proxied by nominal Gross Domestic Product growth rate.

$ED_t$ is total external debt[1] as GDP ratio.

$TO_t$ is trade openness calculated by adding import to exports in relation to GDP.

[1] While most of previous empirical studies focused on the public external debt we focus on total external debt because this is a proxy for the funding of the economy as a whole (Gros, 2011). The definition of external debt is based on a residency concept and it includes both public and private sector debt. Gross external debt (including both government and private debt owed to nonresidents) is defined as the outstanding amount of actual current, not contingent, liabilities of residents of an economy to creditors outside the country, that require payments of principal with or without interest (IMF External Debt Statistics: Guide for Compilers and Users, 2003).

$INV_t$ is investment rate calculated as a gross fixed capital formation in relation to GDP.
$IN_t$ is inflation rate measured by the consumer price index.
$FD_t$ is financial development proxied by domestic banks credit to private sector taken as GDP ratio.
$u_t$ is stochastic error term.

## 4. Results of the research

Ordinary least squares (OLS) regression results presented in Table 1 reflect positive impact of total external debt as a percentage of GDP on the Polish economic growth. The estimated regression coefficient of 0,06849 indicates that a 1% increase in external debt will result in a 0,06849 % increase in GDP. This finding is in line with literature which claims that there is a positive relationship between total external debt and growth (Khursheed, Siddiqui, 2016).

**Table 1**.
*The OLS estimation results of modeling Poland's GDP rate in the period 2004-2021*

| N = 72 | R-squared 0,78341612 Adjusted R-squared 0,76700825<br>F(5,66) = 47,746 p < 0,0000 Standard error 0,04654 | | | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **Std. Error** | **t-Statistic** | **P -value** |
| Constant | -0.270845 | 0.070662 | -3.83298 | 0.000285 |
| ED | 0.068490 | 0.097578 | 0.70190 | 0.485209 |
| TO | 0.202836 | 0.049652 | 4.08518 | 0.000122 |
| INV | 1.542469 | 0.118489 | 13.01780 | 0.000000 |
| IN | -0.092292 | 0.339275 | -0.27203 | 0.786449 |
| FD | -0.355681 | 0.130026 | -2.73547 | 0.007993 |

Note. For variables definitions and sources see section 3. The p-values are in fact very small and not equal to 0, which is due to rounding to four decimal places. N – number of observations. Significance was tested for $\alpha = 0.05$.

Source: Author's computation using STATISTICA version 13Software.

However this impact is statistically insignificant. Our results can be supported by (Ciftcioglu, Sokhanvar, 2018) whose overall findings suggest negative effect of external debt for the panel of countries, however with exceptions in the country-specific results, which do not confirm evidence of a statistically significant causal effect of external debt on economic growth in Poland. Similar findings have been obtained by (Ogunmuyiwa, 2011), who concluded that causation between debt and growth was weak and insignificant in Nigeria.

The above results show that trade openness positively and significantly affects the economic growth of Poland. The regression coefficient is 0,20283 which suggests that a 1% increase in trade openness results in a 0,20283% increase in GDP growth. This indicates that greater openness to international trade leads to an increase in the growth rate. The positive impact of an increase of trade openness on economic growth has been demonstrated in many empirical

studies (Safwat, Salah, El Sherif, 2021). (Joshua, Adedoyin, Sarkodie, 2020 ) reached the same conclusion for South Africa confirming the trade-induced growth hypothesis.

The research revealed that the coefficient of investment is also positive and statistically significant. Specifically, the coefficient of 1,542469 suggests that a 1% increase in investment to GDP is associated with a 1,542469 % increase in GDP growth. This finding is consistent with several economic growth theories, which point to the prominent role of domestic investment as an engine of growth (Keller, Yeaple, 2009; Sen, Kasibhatla, Stewart, 2007).

Inflation rate results shows negative but statistically insignificant impact on Polish economic growth. Many authors have established that at higher levels, inflation has an essential negative impact on economic growth. However, recent studies specifically test for non-linearity in the relationship between inflation and economic growth. That is, lower rates of inflation impact economic growth statistically insignificant or positively, but at higher levels, inflation has a strong negative effect on economic growth (Švigir, Miloš, 2017).

The last control variable, which is financial development, exerts a significant negative impact on the economic growth of Poland. The result contradicts traditional theory which describes financial development as the key of economic growth (Khan, Senhadji, 2000). However this finding is aligned with some recent studies that have shown negative impact of financial development on economic growth (Wen et al., 2021). One possible explanation of this negative effect of financial development could be that our study approximates financial development with one measure of financial depth – the ratio of domestic banks credit to private sector to GDP which is widely accepted variable, however does not take into account the complex multidimensional nature of financial development (Svirydzenka, 2016).

The results show the coefficient of determination (R-squared) is 76.7% which means that the explanatory variables explain 76.7% of the variations in the dependent variable (economic growth). The remaining 23,3% of variations in GDP may be attributed to other factors, which are not included in the model.

The results of modeling GDP based on the backward stepwise regression model confirm the findings of ordinary least squares (OLS) regression (Table 2). In the estimation process external debt as GDP ratio and inflation rate were eliminated due to insignificant impact on Polish GDP growth rate. As with the previous method, there is a significant positive relationship between trade openness, investment rate and economic growth and negative in case of financial development.

**Table 2.**
*The results of backward stepwise regression modeling Poland's GDP rate in the period 2004-2021*

| N = 72 | R-squared 0,78108193 Adjusted R-squared 0,77142378<br>F(3,68) = 80,873 p < 0,0000 Standard error 0, 04609 | | | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **Std. Error** | **t-Statistic** | **P -value** |
| Constant | -0.291103 | 0.064637 | -4.50364 | 0.000027 |
| TO | 0.208970 | 0.047374 | 4.41110 | 0.000038 |
| INV | 1.552706 | 0.116738 | 13.30073 | 0.000000 |
| FD | -0.274192 | 0.081813 | -3.35147 | 0.001316 |

Note. For variables definitions and sources see section 3. The p-values are in fact very small and not equal to 0, which is due to rounding to four decimal places. N – number of observations. Significance was tested for $\alpha = 0.05$.

Source: Author's computation using STATISTICA version 13 Software.

## Conclusions

The need to attain strong growth on the one hand and insufficient domestic savings on the other hand, triggered Poland to resort to external debt over the past few decades. Consequently the country's external debt stock has increased significantly and Poland became dependent on foreign capital. The main concern is whether or not external borrowing leads to economic growth. The paper attempts to answer this question.

The results of empirical research show a positive, contribution of external debt to Polish GDP rate. However the coefficient is too low to consider external debt as a significant determinant of expansion of economy. This result could raise the question of whether external borrowing has been effective in raising the economic growth in Poland. The research on the subject should be continued, in order to make the obtained results more detailed. In addition, the results for the control variables indicate that trade openness and investment have a positive and significant effect on economic growth, whereas financial development negative.

The paper allows for interesting policy recommendations. Since external debt contributes minimally to gross domestic product growth in Poland, it is suggested that economic policy should be properly formulated in order to control and maintain the level of external indebtedness at a manageable level before a debt overhang reduces economic expansion. Efforts should be made towards substituting external debt with domestically issued debt. For this strategy to be implemented, it would require competitive and deep domestic financial market. More developed local financial markets would provide government and private corporations with new opportunities to raise funds for investments. However participation of foreign investors on domestic market could create a source of external vulnerability. Another policy suggestion is that, in order to reduce the risks arising from dependence on foreign financing, government should strengthen policies aimed at mobilizing the accumulation of domestic savings to provide financial base for investment and accelerate economic growth.

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## References

1. Al Kharusi, S., Ada, M. (2018). External Debt and Economic Growth: The Case of Emerging Economy. *Journal of Economic Integration*, *Vol. 33, No. 1*, pp. 1141-1157, http://dx.doi.org/10.11130/jei.2018.33.1.1141.
2. Ciftcioglu, S., Sokhanvar, A. (2018). External debt-economic growth nexus in selected CEE countries. *Romanian Journal of Economic Forecasting, Vol. 21,* pp. 85-100. Retrieved from https://ipe.ro/rjef/rjef4_18/rjef4_2018p85-100.pdf, 20.05.2022.
3. Dey, S., Tareque, M. (2019). External debt and growth: role of stable macroeconomic policies. *Journal of Economics, Finance and Administrative Science, Vol. 25, No. 50*, pp. 185-204, DOI 10.1108/JEFAS-05-2019-0069.
4. Gros, D. (2011). External versus domestic debt in the euro crisis. *CEPS Policy Brief, No. 243*. Retrieved from https ://ssrn.com/abstr act=18986 56, 14.06.2022.
5. IMF (2003). *External Debt Statistics: Guide for Compilers and Users*. Retrieved from https://www.imf.org/external/pubs/ft/eds/Eng/Guide/file1.pdf, 07.02.2022.
6. Joshua, U., Adedoyin, F., Sarkodie, S. (2020). Examining the external-factors-led growth hypothesis for the South African economy. *Heliyon, Vol. 6,* pp. 1-8, https://doi.org/10.1016/j.heliyon.2020.e04009.
7. Keller, W., Yeaple, S.R. (2009). Multinational enterprises, international trade, and productivity growth: firm-level evidence from the United States. *The Review of Economics and Statistics, Vol. 91, Iss.4*, pp. 821-831.
8. Khan, M., Senhadji, A. (2009). Financial Development and Economic Growth: An Overview. *IMF Working Papers, No. 209,* DOI:10.5089/9781451874747.001.
9. Khursheed, A., Siddiqui, F. (2016). Do debt boosts economic growth? a study of the South Asian countries. *International Journal of African and Asian Studies*, *Vol. 22*, pp. 1-16.
10. Mohd, N., Halim, A., Azman-Saini, W.N.W. (2013). Does External Debt Contribute to Malaysia Economic Growth? *Ekonomska istraživanja – Economic Research, Vol. 26, Iss. 2,* pp. 346-363. Retrieved from https://hrcak.srce.hr/file/152934, 23.03.2022.
11. Ogunmuyiwa, M.S. (2011). Does External Debt Promote Economic Growth in Nigeria? *Current Research Journal of Economic Theory, Vol. 3, No. 1,* pp. 29-35.

12. Pattillo, C., Poirson, H., Ricci, L. (2004). What Are the Channels through Which External Debt Affects Growth? *International Monetary Fund Working Paper, No. 15*. Retrieved from https://www.imf.org/external/pubs/ft/wp/2004/wp0415.pdf, 07.04.2022.
13. Prasad, S., Shanker, I. (2017). External Debt and Economic Growth in India. *Social Science Asia, Vol. 4 No. 1,* pp. 15-25.
14. Presbitero, A. (2012). Total Public Debt and Growth in Developing Countries European. *Journal of Development Research, Vol. 24, No. 4*, pp.606-626.
15. Safwat, A., Salah, A., El Sherif, M. (2021). The Impact of Total Foreign Debt on the Economic Growth of Egypt (1980-2018). *Open Journal of Social Sciences*, *Vol. 9,* pp. 130-151, https://doi.org/10.4236/jss.2021.910010.
16. Sen, S., Kasibhatla, K., Stewart, D. (2007). Debt overhang and economic growth–the Asian and the Latin American experiences. *Economic Systems, Vol. 31,* pp. 3-11, doi:10.1016/j.ecosys.2006.12.002.
17. Serieux, J., Yiagadeesen, S. (2001). *The Debt Burden Service*. Paper prepared for the WIDER Development Conference on Debt Relief, Helsinki.
18. Shah, A., Masih, M. (2018). The determinants of economic growth: the Malaysian case. *MPRA Paper, No. 107859*. Retrieved from https://mpra.ub.uni-muenchen.de/107859/, 28.04.2022
19. Silva, J. (2020). Impact of public and private sector external debt on economic growth: The case of Portugal. *Eurasian Economic Review, Vol. 10*, pp. 607-34, https://doi.org/10.1007/s40822-020-00153-2.
20. Soydan, A., Bedir, S. (2015). External Debt and Economic Growth: New Evidence for an Old Debate. *Journal of Business, Economics & Finance, Vol. 4, No. 3,* pp.500-522, DOI: 10.17261/Pressacademia.2015313068.
21. Stungwa, S. (2022). Empirical modeling of South Africa's external debt on economic growth (1994-2020): NARDL Cointegration approach. *MPRA Paper, No. 112527.* Retrieved from https://mpra.ub.uni-muenchen.de/112527/, 23.03.2022.
22. Švigir, M., Miloš, J. (2017). Relationship between Inflation and Economic Growth; Comparative Experience of Italy and Austria. *Financije i Pravo, Vol. 5,* pp. 91-101.
23. Svirydzenka, K. (2016). Introducing a New Broad-based Index of Financial Development. *International Monetary Fund Working Paper, No. 5*. Retrieved from https://www.imf.org/external/pubs/ft/wp/2016/wp1605.pdf, 27.05.2022.
24. Wang, R., Xue, Y., Zheng, W. (2021). Does high external debt predict lower economic growth? Role of sovereign spreads and institutional quality. *Economic Modelling, Vol. 103*, DOI: 10.1016/J.ECONMOD.2021.105591.
25. Wen, J., Mahmood, H., Khalid, S. & Zakaria, M. (2021). The impact of financial development on economic indicators: a dynamic panel data analysis. *Economic Research-Ekonomska Istraživanja*, DOI: 10.1080/1331677X.2021.1985570.

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# BUSINESS PROCESSES AND PERFORMANCE MANAGEMENT OF MEDIUM-SIZED OUTPATIENT CLINICS THROUGH THE SARS-COV-19 PERIOD. A CASE STUDY FROM POLAND

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**Purpose:** The purpose of this paper is to study how the Sars-Cov-19 pandemic has affected the processes and performance management of medium-sized outpatient clinics in Poland. Given the novelty of the studied area and lack of relevant literature, the case study approach has been employed.
**Design/methodology/approach**: The case study was performed at CortenMedic, a medium-sized outpatient clinic located in Poland. We analyzed materials obtained from CortenMedic and interviewed its management board. Following an in-depth restructuring of processes, performance management, and business processes management governance, the CortenMedic adjusted to an environment and has taken advantage of opportunities.
**Findings:** As a result, the CortenMedic recognized outstanding results superior to those before the Sars-Cov-19 period. This study shows that the business processes management and performance management should be dynamic and follow the changes identified inside and outside the companies. The changes through Sars-Cov-19 appear very quickly and are of temporary nature. We postulate the threat of the Sars-Cov-19 pandemic can be converted by the healthcare organizations into an opportunity.
**Research limitations/implications:** Several limitations of our research must be acknowledged. Firstly, we shall note we based our study on only one organization located in Poland. Since we do not compare our results with other Polish and European clinics, obtained in this study results might not be generalizable.
**Practical implications:** The increased role of BPM governance in the pandemic period, as compliance with processes, especially with work safety standards, become of utmost importance, posing a thrill of infection otherwise. In this sense, the postulates of this study might be applicable to other healthcare services providers. Additionally, the results of the paper can provide guidance to a decision-maker or management staff through improving the structure of primary and secondary processes depending on the needs and expectations of a dynamic environment.

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**Social implications:** The article's findings may still offer astute insights to researchers and practitioners who wish to consider more information regarding the importance of the BPM and PM in the healthcare sector through the business process restructuring.
**Originality/value:** The added value of the article is the answer to the question study how the Sars-Cov-19 pandemic has affected the BPM and performance management (PM) of medium-sized outpatient clinics in Poland.

**Keywords:** business processes management, performance management, healthcare, BPM governance, Sars-Cov-19.

**Category of the paper:** case study.

## 1. Introduction

Healthcare sector organizations are increasingly looking for effective methods and tools to support management processes. One of the popular concepts implemented in medical facilities is business process management (BPM), enabling the control of treatment processes, cost monitoring and the effective use of resources. The implementation of BPM in healthcare facilities requires a lot of efforts and efforts of top management, as well as commitment on the part of the staff (BPM Governance). This enables the provision of medical services in line with patients' expectations. In healthcare organizations, services are performed with due diligence to ensure adequate quality. Moreover, there is a noticeable improvement in the effectiveness of units' operations and the efficiency of the primary and secondary processes (Lenz & Reichert, 2007). The most significant advantage is being achieved when secondary (service provision) processes are optimized, due to which primary processes (medical treatment) can be left undisturbed, and so enhance the overall processes flow (Lennerts et al., 2005). Through the Sars-Cov-19 pandemic, the secondary processes become particularly important for the continuity of primary processes. Pursuant to the onset of Sars-Cov-19, a number of new primary processes appeared, while the secondary processes have been thoroughly adjusted. The Sars-Cov-19 pandemic has been an uneven period, with at least two phases, which differently affected the primary and secondary processes and triggered their restructuring (Alreshidi et al., 2020; Bellino et al., 2021; Levin et al., 2021). BPM restructuring means a change in the process map. There is little research on the restructuring of service provision processes in the context of the Sars-Cov-19 pandemic, in particular the secondary processes. This is a consequence of, firstly, the novelty of the problem and, secondly, the focus on the process of providing services to Sars-Cov-19 -patients. To our best knowledge, this is the first study aimed to fill this gap.

It is necessary to constantly improve BPM in healthcare units and adapt to the requirements of the environment and the dynamic changes taking place in the environment, in particular Sars-Cov-19. We employ a case study carried out in the CortenMedic, a healthcare service provider in Poland. The objective of this paper is to study how the Sars-Cov-19 pandemic has affected the BPM and performance management (PM) of medium-sized outpatient clinics in Poland. The rest of this paper is structured in the following way. In Section 2, we provide a brief literature review of BPM and PM. In Section 3, research methods are given. Section 4 provides results derived from our study. Section 5 provides a discussion and limitations of this study. Finally, we provide conclusions and practical implications.

## 2. Business process and performance management in healthcare

The key concept used in contemporary healthcare organizations is a BPM, which encompasses the discovery, modelling, analyzing and improvement of processes (De Ramón Fernández et al., 2020; Zacarias et al., 2017). This approach is also used in healthcare institutions that should respond to the needs of patients. As we already mention, healthcare processes can be classified as primary (medical treatment) and secondary (facility management, service provision) processes (Lenz & Reichert, 2007). A medical treatment process is also named a clinical process and is directly related to the patient. This process is performed according to a diagnostic and therapeutic cycle of observation, reasoning and action (De Ramón Fernández et al., 2020). The diagnostic and therapeutic cycle depends largely on the medical knowledge of case-specific decisions, which are made through the interpretation of patient-specific information (Rebuge & Ferreira, 2012). Secondary processes, on the other hand, are general process patterns that support medical treatment processes. They are not tailored to a specific condition but are intended to coordinate treatment among different individuals and organizational units. They are performed in an environment that is constantly changing and are widely recognized as one of the most complex compared to other environments (Poulymenopoulou et al., 2003). The healthcare environment and its underlying processes have special characteristics in terms of their degree of dynamism, complexity and multidisciplinary nature.

In order to adapt to the environment of healthcare, the companies need to learn how to manage and restructure both primary and secondary processes in an efficient and effective way (Bogodistov et al., 2019). Several primary processes will remain unchanged (e.g. connected with diagnosis), whereas secondary processes (e.g., health data analysis, internal communication) will change immediately (Bogodistov et al., 2019). BPM aims at improving some existing processes and is connected with is the strategic transformation of interrelated organizational subsystems, producing varying levels of impact (Dumas et al., 2018).

It has been already acknowledged, the implementation of BPM in healthcare organizations provides many benefits, including (1) order improvement, (2) clarification and limitation of employees responsibility, (3) improvement of communication and information sharing, (4) improvement of individual employees performance through independent decision-making, (5) streamlining of processes means that work is performed where there is a demand for it, (6) improving the quality of medical services provided and contacts with patients, (7) reduction of operating costs, rational management of the institution's resources, (8) an increase in the efficiency and effectiveness of the operation of the entire organization, and consequently the increase in profitability (Cid-De-La-Paz et al., 2019; De Ramón Fernández et al., 2020; Dumas et al., 2018).

As postulated by A. Spanyi, the metrics, performance and chief executive officer (CEO) responsibilities in the context of processes capacity are the foundation for success in building BPM governance (Bandara et al., 2019; Spanyi, 2004). Although the concept of PM has been already over 100 years old, with the Du Pont model (published at the very beginning of the last century) to be considered as the first PM system (Taticchi & Balachandran, 2008), following the 1990s', it has become increasingly popular among scholars and decision-makers. The popularity of PM can be best described with the fact that around 70% of large and medium-sized firms located in the USA and Europe have already used this concept (de Waal & Kourtit, 2013). Despite the fact that many scholars define PM in various ways, according to Melnyk (Melnyk et al., 2014), all of the definitions refer to the measurement, which cannot be separated from PM (Hourneaux et al., 2017). It has been already discussed in the literature that the PM should: (1) measure and support the execution of the strategy, (2) provided a holistic and balanced view of the organization and (3) be dynamic, continuously adjusting to changes inside and outside the organization (Korneta, 2020; Taticchi et al., 2010). The concept of PM is also tightly linked with the processes of the organization and should provide timely and reliable information on how the processes flow and on their efficiency. Since the overall objective of PM is to support the strategy of the organization, it should therefore primarily focus on the critical process. This can be well achieved with the assignment of key performance indicators (KPI) to the processes, which provide a comprehensive summary of the processes. KPI should be specific, measurable, attainable, realistic and time-sensitive (Korneta, 2019; Parmenter, 2015).

## 3. Research methodology

Given the novelty of the studied area, we employed a case study in one of the medium-sized outpatient's clinics located in Poland. Case study research, as an overall approach, is based on in-depth explorations of complex phenomena in their natural or real-life settings. Empirical

case studies typically enable dynamic understanding of complex challenges and provide evidence about causal mechanisms and the necessary and sufficient conditions (contexts) for intervention implementation and effects. Case study research provides evidence about context and transferability but also for helping strengthen causal inferences when pathways between intervention and effects are likely to be non-linear (Fàbregues & Fetters, 2019; Hyett et al., 2014; Paparini et al., 2020). Here, the data was gathered from participatory observation and individual interviews as well as document analysis.

An important source of data involves two years period of participatory observation (2019-2020) to gain insight into the dynamics and practices within and around the Sars-Cov-19 situation. One of the authors contributed as an insider-researcher as he has been employed in the organization for a long time and was thus able to work closely with the informants, resulting in many open talks and discussions.

We also draw on the detailed accounts of key actors obtained from three in-depth interviews with board members. During the in-depth interviews, we focused on identifying key processes characteristic for different pandemic phases and before they commenced. We also discussed the roles of these processes, including why are they important and how the CortenMedic approached measuring them. Finally, we have identified the five key processes for the CortenMedic in each of the studied periods. By key processes, we define the process that requires the most attention of the management board. These processes can be either primary or secondary; noting, however, our objective is to identify the process which reflects the true focus of the management board on the CortenMedic.

We also draw on the materials obtained from CortenMedic relating to BPM, PM, corporate governance and financial results for studied periods.

The case study was carried out in CortenMedic. CortenMedic is a polish, medium-sized healthcare services provider established in 1993. The CortenMedic is located in two major districts of Poland and operates 12 multi-clinics. 5 – years ago, the CortenMedic changed its strategy, and as a consequence, through the last three years before the pandemic, the sales revenue of the CortenMedic grew around 20%. The employment of CortenMedic amounted to around 500 and 700 employees in the end of 2019 and 2020 respectively.

At the time the article is written, the key primary CortenMedic processes are (1) dental treatment; (2) primary healthcare; (3) outpatient specialist care; (4) mobile dental treatment and during the pandemic period Sars-Cov-19 (5) Sars-Cov-19 testing and (6) Sars-Cov-19 dentistry. The execution of primary processes requires a considerable number of secondary processes, including, inter alia, (1) HRM, (2) procurement, (3) accounting and payroll, (4) work safety, (5) sales development, (6) operations management, (7) Information *technology* (IT) management and (8) strategic ones (new initiatives, acquisitions, develop a strategy).

# 4. Business Process Restructuring of the CortenMedic from a performance management perspective

## 4.1. Business processes and performance management before Sars-Cov-19

In due course of our interviews, we have identified five key processes and attached them to the performance indicators for the CortenMedic before the pandemic has commenced. In Table 1, we provide the list of these processes and selected by the management board key performance indicators measuring their efficiency. The decisions relating to listed in Table 1 processes were taken by: chief operating officer (COO) (processes 3 and 4), chief financial officer (CFO) (processes 1 and 5), and chief strategy officer (CSO) (process 2).

**Table 1.**
*The list of top 5 processes for value creation at CortenMedic before the Sars-Cov-19 pandemic commenced*

| | **Process** | **Key performance indicators** | | |
|---|---|---|---|---|
| 1 | Recruitment of orthodontists and dental prosthetics | Number of orthodontists/dental prosthetics | S | CFO |
| 2 | Acquiring new contracts | Number of new contracts signed | S | CSO |
| 3 | Scheduling of medical doctors work | Number of patients per hour, patient waiting times | S | COO |
| 4 | IT and Management Information Systems (MIS) development | Number of new initiatives implemented | S | COO |
| 5 | Acquisitions | Number of acquisition evaluations | S | CFO |

Note: S – denotes secondary process.

As disclosed in Table 1, the five key processes before the pandemic commenced had been the secondary ones. The management commented it was because the primary processes had been already fully efficient and under good control. Hence, there was no point in further improvements. The first key process was the recruitment of new orthodontists and dental prosthetics. The highest rank of these processes results from significant shortages of these specialists in the polish healthcare market. The waiting times for these specialists, depending on the clinic and the medical doctor, vary up to even three months. Since the CortenMedic has under good control the remaining sub-process of orthodontic and prosthetic healing processes, the recruitment was a bottleneck. At the end of 2020, CortenMedic employed 23 orthodontists and 22 dental prosthetics. The Chief Operations Officer of CortenMedic stated: "If it was only possible, we could give full-time employment for ten new orthodontists and dental prosthetics starting even from today". The CortenMedic measures this process with the following key performance indicator (KPI) the number of new orthodontists and dental prosthetics hired (monthly measurement). Additionally, the CortenMedic uses several performance indicators, acting as auxiliary indicators to stated KPI. The second key process is assigned to the business development department of the CortenMedic, which hires two business developers who acquire new B2B contracts (business to business) from public institutions and the companies.

The third process relates to efficient scheduling of medical doctors work and requires constant attention. The CortenMedic measures this process with two key performance indicators: (1) the number of patients per medical doctor working hour and (2) waiting times.

The fourth process was the IT and Management Information Systems (MIS) development. The role of IT and MIS in the healthcare industry is increasingly growing. As a result, many healthcare services providers, among which the CortenMedic is, pay a lot of attention to IT and MIS development. The CortenMedic measures IT and MIS development with the number of new IT and MIS initiatives implemented (quarterly).

The fifth process relates to acquisitions. The Polish healthcare market is highly fragmented, with many mergers and acquisitions continuously taking place. CortenMedic acknowledges mergers and acquisitions as an important source for further growth; hence, the remaining KPI before the pandemic was the number of evaluated acquisitions (quarterly).

### 4.2. Business processes and performance management during Sars-Cov-19

In conducting in-depth interviews, we have identified that the pandemic period from March to December 2020 was not homogenous but comprised two different periods, with considerable differences between them.

**The beginning of the pandemic (March-May 2020)**

At the beginning of the pandemic, the reluctance of medical doctors emerged as a key issue, with dentists being especially against providing any physical services. This is because, during the dentistry process, tissues get scattered, enabling the quick spread of infected material. As a result, more than half of medical doctors refused to go to clinics. The CortenMedic had to launch several new subprocesses to ensure the continuity of services provided.

The risk of Sars-Cov-19 infection forced the CortenMedic to restructure and implement new safety, anti-Sars-Cov-19 standards and procedures. Although safety standards had been under good control before the pandemic and required almost no attention from the management board, these processes became critical.

The following process, which becomes critical to the CortenMedic at the beginning of the pandemic, was purchases and management of safety materials usage. It was tough to purchase any antiseptic materials due to their shortages.

Since the vast majority of dentists in Poland withdraw from the provision of services, pain patients had significant problems with treatment. A fraction of these patients had Sars-Cov-19 symptoms. National Health Fund agreed with CortenMedic to start in its selected dentistry clinics 24 hours per day pain patients with Sars-Cov-19 symptoms treatment. Table 2 provides key processes and their measurement on which the management focused in March-May 2020 period. The decisions relating to listed in Table 2 processes 1-4 were taken by the COO. Additionally, the CFO supported the COO with ensuring the continuity of dentistry services provision (process 1). CSO initiated and developed process 5, specific for the Sars-Cov-19 pandemic.

**Table 2.**

*The list of top 5 processes for value creation at CortenMedic in March-May 2020*

| | **Process** | **Key performance indicators** | | |
|---|---|---|---|---|
| 1 | Ensuring the continuity of dentistry services provision | Daily number of dentists available hours | P | COO&CFO |
| 2 | Ensuring the continuity of primary healthcare services provision | Daily number of general practitioners available hours | P | COO |
| 3 | Implementation of work safety standards against Sars-Cov-19 | % of clinics sufficiently secured against Sars-Cov-19 per day | S | COO |
| 4 | Anti-Sars-Cov-19 protection materials purchases and management | Sars-Cov-19 safety materials stock levels and their usage (per employee) | S | COO |
| 5 | Implementation of Sars-Cov-19 dentistry | Number of clinics ready to provide dentistry services to Sars-Cov-19 patients | P | CSO |

P – denotes primary process; S – denotes the secondary process.

Moreover, interviewed management board members draw our attention to the increased role of corporate governance as non-compliance with the CortenMedic's standards, especially those relating to work safety ones, aimed to prevent the infections, could have a significant consequence to both the CortenMedic and the employees.

**The second phase of the pandemic (Jun-Dec 2020)**

In the second phase of the pandemic, the CortenMedic's focus shifted from mostly provision of treatment services to implementing the new process aimed to adjust the CortenMedic to the pandemic. The CortenMedic developed telemedicine considerably and opened new testing points. Next, the IT development followed together with the improvement of the CortenMedic's PM. The number of CortenMedic staff increased from 500 to over 700 employees. At the beginning of December 2020, the CortenMedic commenced preparations for the vaccination process. The decisions relating to listed in Table 3 processes were taken by: COO (process 3), CFO (process 4), and CSO (processes 1,2 and 5).

**Table 3.**

*The list of top 5 processes for value creation at CortenMedic in the Jun-Dec 2020 period*

| | **Process** | **Key performance indicators** | | |
|---|---|---|---|---|
| 1 | Development and provision of telemedicine | Number of telemedicine functionalities available | P | CSO |
| 2 | Opening and maintenance of new Sars-Cov-19 testing points | Number of new Sars-Cov-19 testing points opened | P | CSO |
| 3 | Development of IT tools for Sars-Cov-19 activities | % of integration completion with intercompany diagnostic platform (MARCEL) | S | COO |
| 4 | PM of Sars-Cov-19 dentistry | Gross (medical) margin | P | CFO |
| 5 | Preparation to Sars-Cov-19 vaccination process | % of preparation works done at each clinic | P | CSO |

P – denotes primary process; S – denotes secondary process.

## 5. Financial results of the CortenMedic

The financial results of the CortenMedic are presented for 2019 and 2020 in two separate phases (table 5). The first one is adjusted figures as if no extra actions related to Sars-Cov-19 were taken by the CortenMedic. The second provides full financial results for 2020, i.e. the results of statutory and Sars-Cov-19 activities. For comparative purposes, we also provide the financial results of the CortenMedic for 2019 before the pandemic commenced.

**Table 4.**
*The financial results of the CortenMedic in 2019. The financial results of the statutory, new and total activities of the CortenMedic in 2020. All amounts in PLN thousand*

| | **2019** | **2020** | **2020** | **2020** |
|---|---|---|---|---|
| | Statutory activities | Statutory activities | Sars-Cov-19 activities | Total |
| Dentistry | 10 290 | 8 912 | | 8 912 |
| Primary healthcare | 4 481 | 5 104 | | 5 104 |
| Specialists | 4 168 | 2 214 | | 2 214 |
| Mobile dentistry | 1 525 | 1 061 | | 1 061 |
| Sars-Cov-19 testing | | | 8 267 | 8 267 |
| Sars-Cov-19 dentistry | | | 2 836 | 2 836 |
| **Sales revenues** | **20 464** | **17 291** | **11 103** | **28 394** |
| Medical margin | 7 087 | 4 931 | 6 312 | 11 243 |
| Remaining running costs | -5 984 | -5 984 | -1 874 | -7 858 |
| **Profit before tax** | **1 103** | **-1 053** | **4 438** | **3 385** |

As presented in Table 4, if the CortenMedic had not changed its strategy, followed by the change in its processes, their ranks. It is PM, the CortenMedic's sales revenue would have declined by PLN 3,172 thousand or by 15,5 % as compared to 2019, and the CortenMedic would recognize the loss for 2020 of PLN 1,053 thousand. The extra sales and profit recognized on the Sars-Cov-19 activate totalled PLN 11,103 thousand and PLN 4,438 thousand, respectively. As a result of that, CortenMedic's combined sales revenue increased by PLN 7,931 (or by 38,7%) and the CortenMedic's profit before tax jumped to PLN 3,385 thousand in the pandemic period. We also note very high medical margins recognized on Sars-Cov-19 activities of 28,5% of sales revenues.

## 6. Discussion

The novel coronavirus disease 2019 (Sars-Cov-19) has altered the economy, society, and healthcare system (Wosik et al., 2020). While the Sars-Cov-19 crisis has presented the world healthcare delivery system with unprecedented challenges (Brownson et al., 2020), it has catalyzed rapid changes in primary and secondary processes. The primary process is

critical to the organization and is the first to be improved. Once they work efficiently, the organization moves to the secondary processes. Before the pandemic, the primary processes of CortenMedic had been already working well. Hence the full focus of the management was on the secondary processes, which required improvements and was expected to create more value than the primary ones. In the pandemic, the CortenMedic had to move back and once again pay attention to primary processes. In the first phase of the pandemic, three out of five key processes were primary ones, while in the second, four out of five processes were primary ones. None of the five key process characteristics for the CortenMedic before the pandemic remains critical in the time of the pandemic, except the IT. Those changes show that the Sars-Cov-19 crisis period is not homogeneous. Hence, our results are aligned with other research (Alreshidi et al., 2020; Ortiz-Prado et al., 2021).

An analysis of the literature shows that at least two phases during the Sars-Cov-19 crisis period can distinguish. In the first initial phase, virtually no country was prepared to deal with the influx of patients seeking medical help with almost complete paralysis of the healthcare system (Alreshidi et al., 2020; Ortiz-Prado et al., 2021). Units providing medical services in the face of a crisis situation had to answer the fundamental questions: how to change the structure of processes, how to adapt to the current situation, taking into account the specificity of the processes (Puri et al., 2020). In the second phase, the processes of development and strengthening of telemedicine and testing in anticipation of the appearance of a vaccine were particularly important (Post et al., 2021).

Only due to in-depth restructuring of business processes and PM, the CortenMedic improved its profitability in an unfavourable environment. Some researchers indicated that business process needs to be aligned with external dynamics through agile BPM (Badakhshan et al., 2019). This agile approach improves alignment, communication among customers and employees and ensure the response to change opportunities in efficient and effective ways (Zacarias et al., 2017). If the CortenMedic has not changed its process thoroughly, it will incur considerable losses.

The problems provided in the case study were typical of the healthcare services providers during dynamic changes in the actual environment. On the other hand, the solutions adopted by CortenMedic and the pace at which the restructuring of the processes took place were unusual. We chose CortenMedic to show that although the Sars-Cov-19 crisis triggered challenges to all healthcare services providers, only some of them were able to address them properly and improve the profitability.

## 7. Conclusions

The Sars-Cov-19 pandemic has caused the onset of many threats and opportunities for medium-sized outpatient clinics in Poland. Following many complex and significant changes to the BPM and PM, the organizations could convert the threats into opportunities. These changes appeared suddenly and were of temporary nature. The case of CortenMedic shows that approaching the Sars-Cov-19 pandemic without an in-depth restructuring of business processes and PM would result in significant losses. That is why BPM and PM must be dynamic and follow the changes of strategy and operation perspective. PM hence, are not only the target values of performance indicators that in all cases must be meet but dynamic systems which should follow the changes within and outside organizations. We recommend the organizations approach a Sars-Cov-19 pandemic in an agile way towards the BPM and PM. The traditional approach might not be suitable for such conditions, especially for healthcare services providers.

Finally, we shall note the increased role of BPM governance in the pandemic period, as compliance with processes, especially with work safety standards, become of utmost importance, posing a thrill of infection otherwise. In this sense, the postulates of this study might be applicable to other healthcare services providers. Additionally, the results of the paper can provide guidance to a decision-maker or management staff through improving the structure of primary and secondary processes depending on the needs and expectations of a dynamic environment.

The article's findings may still offer astute insights to researchers and practitioners who wish to consider more information regarding the importance of the BPM and PM in the healthcare sector through the business process restructuring.

Several limitations of our research must be acknowledged. Firstly, we shall note we based our study on only one organization located in Poland. Since we do not compare our results with other Polish and European clinics, obtained in this study results might not be generalizable.

Further investigation on this topic should be incentivized to generalize and complement the findings as far as possible, as well as to other healthcare providers and their experiences with the BPM and PM in the contemporary environment.

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## References


1. Alreshidi, N.M., Haridi, H.K., Alaseeri, R., Garcia, M., Gaspar, F., & Alrashidi, L. (2020). Assessing healthcare Workers' knowledge, emotions and perceived institutional preparedness about COVID-19 pandemic at Saudi hospitals in the early phase of the pandemic. *Journal of Public Health Research*, *9*(4). https://doi.org/10.4081/jphr.2020.1936.
2. Badakhshan, P., Conboy, K., Grisold, T., & vom Brocke, J. (2019). Agile business process management: A systematic literature review and an integrated framework. In *Business Process Management Journal, Vol. 26, Iss. 6.* https://doi.org/10.1108/BPMJ-12-2018-0347.
3. Bandara, W., Merideth, J.C., Techatassanasoontorn, A., Mathiesen, P., & O'Neill, D. (2019). Mechanisms for creating successful BPM governance: Insights from Commonwealth Bank of Australia. *CEUR Workshop Proceedings*, *2428*.
4. Bellino, S., Rota, M.C., Riccardo, F., Andrianou, X., Urdiales, A.M., Del Manso, M., Punzo, O., Bella, A., Villani, A., Pezzotti, P., Fabiani, M., Boros, S., Vescio, M.F., Spuri, M., Filia, A., D'Ancona, P., Siddu, A., Urciuoli, R., Giannitelli, S., … Re, F. Da. (2021). Pediatric COVID-19 cases prelockdown and postlockdown in Italy. *Pediatrics*, *147*(2). https://doi.org/10.1542/peds.2020-035238.
5. Bogodistov, Y., Moormann, J., & Sibbel, R. (2019). From openness to change to patients' satisfaction: A business process management approach. *Lecture Notes in Business Information Processing*, *360*. https://doi.org/10.1007/978-3-030-26643-1_12.
6. Brownson, R.C., Burke, T.A., Colditz, G.A., & Samet, J.M. (2020). Reimagining public health in the aftermath of a pandemic. In *American Journal of Public Health, Vol. 110, Iss. 11.* https://doi.org/10.2105/AJPH.2020.305861.
7. Cid-De-La-Paz, V., Morales, L., & Ramos, J.M. (2019). A practical medical experience of successfully mixing model-driven paradigm and business process management principles. *MODELSWARD 2019 - Proceedings of the 7th International Conference on Model-Driven Engineering and Software Development*. https://doi.org/10.5220/0007484704120418.
8. De Ramón Fernández, A., Ruiz Fernández, D., & Sabuco García, Y. (2020). Business Process Management for optimizing clinical processes: A systematic literature review. *Health Informatics Journal*, *26*(2). https://doi.org/10.1177/1460458219877092.
9. de Waal, A., & Kourtit, K. (2013). Performance measurement and management in practice. *International Journal of Productivity and Performance Management*, *62*(5). https://doi.org/10.1108/ijppm-10-2012-0118.
10. Dumas, M., La Rosa, M., Mendling, J., & Reijers, H.A. (2018). Fundamentals of business process management: Second Edition. In *Fundamentals of Business Process Management: Second Edition*. https://doi.org/10.1007/978-3-662-56509-4.
11. Fàbregues, S., & Fetters, M.D. (2019). Fundamentals of case study research in family

medicine and community health. *Family Medicine and Community Health*, *7(2).* https://doi.org/10.1136/fmch-2018-000074.

12. Hourneaux, F., Carneiro-da-Cunha, J.A., & Corrêa, H.L. (2017). Performance measurement and management systems: Different usages in Brazilian manufacturing companies. *Managerial Auditing Journal*, *32*(2). https://doi.org/10.1108/MAJ-11-2015-1277.
13. Hyett, N., Kenny, A., & Dickson-Swift, V. (2014). Methodology or method a critical review of qualitative case study reports. *International Journal of Qualitative Studies on Health and Well-being,* V*ol. 9, Iss. 1.* https://doi.org/10.3402/qhw.v9.23606.
14. Korneta, P. (2019). Critical success factors for Polish agricultural distributors. *British Food Journal*. https://doi.org/10.1108/BFJ-06-2018-0398.
15. Korneta, P. (2020). Stakeholders and Performance Management Systems of Small and Medium-Sized Outpatient Clinics. *Foundations of Management*, *12*(1). https://doi.org/10.2478/fman-2020-0016.
16. Lennerts, K., Abel, J., Pfründer, U., & Sharma, V. (2005). Step-by-step process analysis for hospital facility management: An insight into the OPIK research project. *Facilities*, *23*(3-4). https://doi.org/10.1108/02632770510578539.
17. Lenz, R., & Reichert, M. (2007). IT support for healthcare processes - premises, challenges, perspectives. *Data and Knowledge Engineering*, *61*(1). https://doi.org/10.1016/ j.datak.2006.04.007.
18. Levin, R.A., Tsao, H.S., Amanullah, S., Genisca, A., & Chapman, L. (2021). COVID-19 in Pediatric Patients: Observations from the Initial Phase of the Global Pandemic in Rhode Island. *Rhode Island Medical Journal (2013)*, *104*(1).
19. Melnyk, S.A., Bititci, U., Platts, K., Tobias, J., & Andersen, B. (2014). Is performance measurement and management fit for the future? *Management Accounting Research*, *25*(2). https://doi.org/10.1016/j.mar.2013.07.007.
20. Ortiz-Prado, E., Simbaña-Rivera, K., Barreno, L.G., Diaz, A.M., Barreto, A., Moyano, C., Arcos, V., Vásconez-González, E., Paz, C., Simbaña-Guaycha, F., Molestina-Luzuriaga, M., Fernández-Naranjo, R., Feijoo, J., Henriquez-Trujillo, A.R., Adana, L., López-Cortés, A., Fletcher, I., & Lowe, R. (2021). Epidemiological, socio-demographic and clinical features of the early phase of the COVID-19 epidemic in Ecuador. *PLoS Neglected Tropical Diseases*, *15*(1). https://doi.org/10.1371/journal.pntd.0008958.
21. Paparini, S., Green, J., Papoutsi, C., Murdoch, J., Petticrew, M., Greenhalgh, T., Hanckel, B., & Shaw, S. (2020). Case study research for better evaluations of complex interventions: rationale and challenges. *BMC Medicine*, *18*(1). https://doi.org/10.1186/s12916-020-01777-6.
22. Parmenter, D. (2015). K*ey Performance Indicators Developing, Implementing, and Using Winning KPIs*. Wiley.
23. Post, L.A., Lin, J.S., Moss, C.B., Murphy, R.L., Ison, M.G., Achenbach, C.J., Resnick, D., Singh, L.N., White, J., Boctor, M.J., Welch, S.B., & Oehmke, J.F. (2021). SARS-CoV-2

wave two surveillance in east Asia and the pacific: Longitudinal trend analysis. *Journal of Medical Internet Research*, *23*(2). https://doi.org/10.2196/25454.

24. Poulymenopoulou, M., Malamateniou, F., & Vassilacopoulos, G. (2003). Specifying Workflow Process Requirements for an Emergency Medical Service. *Journal of Medical Systems*, *27*(4). https://doi.org/10.1023/A:1023701219563.
25. Puri, O., Rathaur, V.K., Pathania, N., & Pathania, M. (2020). A New Phase of Healthcare: COVID-19 and Medical Advancements. *Journal Of Clinical And Diagnostic Research*. https://doi.org/10.7860/jcdr/2020/46510.14254.
26. Rebuge, Á., & Ferreira, D.R. (2012). Business process analysis in healthcare environments: A methodology based on process mining. *Information Systems*, *37*(2). https://doi.org/10.1016/j.is.2011.01.003.
27. Spanyi, A. (2004). *Beyond Process Maturity to Process Competence*. BPTrends, c.
28. Taticchi, P., Asfalti, A., & Sole, F. (2010). Performance measurement and management in smes: Discussion of preliminar results from an Italian survey. *Business Performance Measurement and Management: New Contexts, Themes and Challenges*. https://doi.org/10.1007/978-3-642-04800-5_1.
29. Taticchi, P., & Balachandran, K.R. (2008). Forward performance measurement and management integrated frameworks. *International Journal of Accounting & Information Management, Vol. 16, Iss. 2*. https://doi.org/10.1108/18347640810913807.
30. Wosik, J., Fudim, M., Cameron, B., Gellad, Z.F., Cho, A., Phinney, D., Curtis, S., Roman, M., Poon, E.G., Ferranti, J., Katz, J.N., & Tcheng, J. (2020). Telehealth transformation: COVID-19 and the rise of virtual care. *Journal of the American Medical Informatics Association, Vol. 27, Iss. 6*. https://doi.org/10.1093/jamia/ocaa067.
31. Zacarias, M., Martins, P.V., & Gonçalves, A. (2017). An Agile Business Process and Practice Meta-model. *Procedia Computer Science*, *121*. https://doi.org/10.1016/j.procs.2017.11.024.

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# INVESTING IN DIVIDEND VS. NON-DIVIDEND STOCKS – EFFICIENCY ASSESSMENT USING FRACTAL MEASURES

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**Purpose:** The purpose of the paper is to reveal potential differences in risk and profitability of investment in dividend and non-dividend stocks.
**Design/methodology/approach**: The scientific aim of the paper is achieved by conducting a scrupulous literature analysis. Moreover, the authors use methods of comparative analysis to investigate the characteristics of dividend and non-dividend stocks and reveal similarities and differences. Study of fractal features of chosen stocks and comparisons between abovementioned groups of shares are conducted using the ANOVA methods.
**Findings:** The results of the empirical analyses conducted in this paper prove that dividends paid by US dividend companies grow at significantly lower rate than dividends distributed by Polish dividend stocks. Additionally, rates of return on Polish dividend stocks are more heavily influenced by dividend pay-outs than rates of return on US ones. Taking into account riskiness of investments there are no differences in risk level between dividend and non-dividend stocks in USA and Poland, independently whether the risk measure exploited is stock volatility or its fractal dimension.
**Research limitations/implications**: The research was based on limited number of companies analyzed. As a result, there could be present a bias introduced by the deterministic method of choosing a sample of stocks. It is recommended to enlarge the analyzed set in future research.
**Practical implications:** Knowledge about similarities and differences among dividend and non-dividend companies is highly relevant to investors as well as corporate managements. As a consequence, better financial decisions could be taken leading to increased final wealth.
**Social implications:** Among the social implications of the paper the possible change in investors' attitude towards dividend and non-dividend companies seems most important. This could influence companies' boards to adjust their payout policies to satisfy the investors. Finally, the improvement in investor's needs fulfillment can be achieved.
**Originality/value:** The novelty of the paper is the comparison of dividend and non-dividend stocks taking into account classical and modern risk measures. Moreover, it compares the efficiency of investing in dividend and non-dividend stocks during period 2015-2021, i.e. partially catching the effect of SARS-CoV-2 pandemic filling a gap in our knowledge.

**Keywords:** payout policy, dividend, financial investment, fractal dimension.

**Category of the paper:** Research paper.

## 1. Introduction

Since the publication of the groundbreaking paper by F. Modigliani and M. Miller (Miller, Modigliani, 1961) proving that dividend policy has no impact on stock prices, the issue of dividend payments has become the subject of many scientific studies (Al-Malkawi, Rafferty, Pillai, 2010). Apart from the basic question of whether dividend policy has an effect on asset prices, and if so, what effect, the question of whether dividend-paying companies are different from other companies naturally arose. In particular, it was considered a key issue to determine whether investing in dividend companies makes it possible to achieve above-average income, also if adjusted for the level of risk (McQueen, Shields, Thorley, 1997). However, the construction of an optimal investment portfolio requires knowledge of the properties of the assets to be included in it, in particular the characteristics of the dividend policy pursued.

Changes in stock prices of dividend companies and the issues of investing in stock of dividend-paying companies are widely discussed in the literature (i.a. P. Asquith & D.W. Mullins Jr, B. Graham, M. Lichtenfeld, H. Rubin & C. Spaht II, M. Skousen). The results of research indicate specific common features of dividend companies' stock listings both in terms of stock price volatility, rates of return, as well as capital drawdown when the market is in a downturn. Investors expecting a stable cash flow from dividend payments take special scrutiny of the history of management board activities with regard to dividend payments, variations in the amount of dividends paid, and any periodic interruptions in dividend payments. Particularly during a downturn, it becomes important to regularly receive dividends, as they can be used to increase the share of undervalued dividend stocks in the portfolio. In the view of J. Pioch (Pioch, 2015), a dividend is a manifestation of property rights in their purest form – as an owner's income from their capital invested in the stocks or shares of a particular company. Long-term, fundamental investors prefer shares of companies whose management indicates the dividend policy adopted and, based on it, pays stable or increasing dividends on a regular basis (this is known as the so-called clientele effect). The characteristics of a dividend company are often determined by guidelines from capital market institutions. In the US stock market, according to Standard & Poor's, a company can be characterized as a dividend aristocrat, if it belongs to the S&P 500 index and at the same time has increased its dividend payments every year for the past 25 years, its capitalization is at least $3 billion on the index update date, and for the 6 months preceding the index update, the company's stock turnover averaged $5 million per day. On the Warsaw Stock Exchange, in turn, a company can be classified in the WIGDIV index for dividend companies if it has the highest dividend yield at the end of November each year and has paid dividends at least three times in the last 5 years of trading.

Research by H. Rubin and C. Spaht II (Rubin, Spaht, 2011) confirms that regular and increasing dividends received by investors are an important hedge against portfolio declines regardless of capital market sentiment (Lichtenfeld, 2015; Skousen, 2011). Also P. Asquith and

D.W. Mullins Jr. (Asquith, Mullins, 1983) indicate that when investing in dividend companies, it is important for investors to consistently receive increasing dividends. Furthermore, studies conducted by A. Williams and M. Miller (Williams, Miller, 2013) and K.P. Fuller and M.A. Goldstein (Fuller, Goldstein, 2011) confirm that such investments are reasonable. Regardless of changes in stock prices in the capital market, dividends provide a hedge against depreciation in the value of a securities portfolio. The authors claim that dividends paid become particularly important during a downturn, since the stocks of dividend-paying companies have lower declines then. It is also worth noting that the worst reputation from the point of view of the stability of dividends paid can be attributed to companies characterized by high volatility of earnings, which translates into unpredictability of future dividends.

The literature points out that the investor's income in the form of expected dividends is more important than the expected gain on the sale of stock – the dividend is certain, while any gain on an increase in the stock price is not (this is known as the so-called "bird-in-hand" theory) (Cwynar, Cwynar, 2007; Kowerski, 2011). It is worth mentioning that dividend payment certainty applies to dividend companies with a clear record of regular dividend payments. The company's management board which recommends paying dividends on a continuous basis is winning the votes of those shareholders who hope that dividends will be further paid. According to B. Graham (Graham, 1999, 2009), in the past the dividend policy used to be a frequent subject of dispute between minority shareholders and the management board. If it is assumed that profits "belong" to shareholders and they are entitled to receive them, and that for many shareholders the cash flow from dividends is a form of maintaining their standard of living, while cash retained in the company may not have such tangible value, then regular dividend payments are an important factor in the selection of stock for investment portfolios. M. Skousen (Skousen, 2011) points out in turn that the regular payment of dividends is a form of pressure on the company's management board. According to this view, it will focus on highly profitable projects, because the worst possible scenario for a dividend company is that, as a result of unsuccessful investment decisions by the board, the level of dividend payments will fall or they will be suspended altogether. The author also claims that there is growing evidence that companies paying regular dividends show better long-term results and lower risk than non-dividend-paying companies focused on rapid growth. D.J. Skinner and E.F. Soltes (Skinner, Soltes, 2011) have identified a number of financial characteristics of dividend companies. First of all, there is a low probability of loss for a dividend-paying company and the financial results generated by these companies are more stable than those of companies that do not pay dividends, and this trend continues over the long term.

In view of significant turbulence in financial markets related to the SARS-CoV-2 pandemic, the authors found it advisable to examine potential differences occurring between dividend and other companies listed on the US and Polish markets in the period covering the aforementioned turbulence. The literature search conducted reveals that there are no such studies for the period indicated. Also, there are no studies devoted to analyzing the differentiation of investment risk

between dividend-paying and non-dividend-paying companies, particularly for the Polish stock market. By filling the indicated research gaps, the authors aimed to detect the identified potential differences.

The paper is organized as follows. In the next section a literature review and hypothesis development are provided. Section 3 describes sample selection and methodological issues. In the next section the results obtained are presented. The final section concludes.

## 2. Literature review and research hypotheses development

Analyzing the efficiency of investing in dividend vs. non-dividend stocks, it is worth referring to the research conducted on the historical performance of investments in dividend stocks. According to M. Lichtenfeld (Lichtenfeld, 2015), the average annual return of the S&P Dividend Aristocrats index for the period 2001–2011 was 7.1%. For the same period, the S&P 500 index generated the average annual return of 2.9%. A. Williams and M. Miller (Williams, Miller, 2013, pp. 58-69) found that during the US financial market crisis (2001 and 2008), the returns of companies ranked among dividend aristocrats were higher than those of the S&P 500 index. M. Lichtenfeld (Lichtenfeld, 2015) also points out that the standard deviation of the dividend aristocrats' return amounted to 18.4% and was lower than the same parameter calculated for the S&P 500 index at 21.3%. M. Skousen (Skousen, 2011), based on his research, concludes that dividend-paying stocks deliver better financial results than stocks that do not pay dividends.

Investors who include dividend stocks in their portfolios base their investment decisions on a number of indicators relating to the regularity and growth rate of dividends. Particularly relevant dividend market indicators include dividend yield (DY), cumulative dividend yield ($DY_C$), and dividend growth rate (g). Key information about the attractiveness of an investment in particular stocks can be obtained by an investor by analyzing the dividend yield ratio (DY). The DY level from the perspective of the price changes every session, while from the perspective of the DPS parameter – when the dividend is paid. The higher the value of the ratio, the higher the dividend paid per share market price. Therefore, it reflects the attractiveness of the investment from the perspective of dividends paid at a given price to be paid for shares (for companies that have not paid dividends the ratio is not calculated). An alternative use of the ratio is to compare it to DY for the entire market or a selected group of companies, such as dividend companies. However, this makes sense if the issuer is a dividend company and consistently pays dividends. For long-term investments, the traditional dividend yield measure is modified to the cumulative dividend yield ($DY_C$). It is calculated taking into account the purchase price of shares (rather than the current quotations) and the sum of dividends received since the date the shares were purchased.

Modification of the DY ratio allows tracking the growth scale of the dividends paid in relation to the level of investment in shares. Exceeding 100% means that the sum of dividends received exceeded the investment (such a reading is not possible with a traditional DY ratio, since the stock price would have to be adjusted to 0 after the dividend right is cut off). In other words, exceeding 100% means that the company has paid in dividends to the investor the entire amount that had been invested in its shares. The level of $DY_C$ also changes when an investor decides to buy more shares in a company. Then the purchase price changes and becomes the average purchase price of shares (this is known as the so-called cost-averaging strategy). The last discussed parameter supporting investor decisions – the dividend growth rate (g) – shows the annual rate at which dividend payments per share change.

A high dividend growth rate is possible to be maintained by an issuer over the long term only if financial results grow at least at this rate. Therefore, maintaining a high rate of growth in dividend payments without confirming it in the issuer's earnings could mean the risk of reducing future dividends or even discontinuation of dividend payments in the future. For this reason, dividend companies, particularly those included in the S&P 500 Dividend Aristocrats index, pay dividends at a stable growth rate that exceeds inflation by several percentage points, even though the dividend they pay could show a higher rate of change. Therefore, investors prefer companies that pay dividends with a satisfactory cumulative dividend yield and a stable dividend growth rate that exceeds inflation by several percentage points.

The main focus of the above discussions was on issues related to the profitability of dividend companies, with less attention paid to their riskiness. However, the issue of the riskiness of the indicated instruments must also be included in the analyses if they are to present the full spectrum of financial consequences for the investor. As past research indicates (Fama, French, 2001; Gwilym, Seaton, Thomas, 2005), companies that pay regular dividends are generally of significantly larger size (Fama and French indicate that in the sample they analyzed, the difference in the size of companies paying and not paying dividends is 10 times) (Fama, French, 2001; Karpavičius, Yu, 2018) and have a stabilized financial position (including higher profitability). In contrast, companies that have never paid dividends are generally companies with expected high growth rates (companies with strong growth potential), high capital expenditures and high P/BV ratios, but lower profitability than dividend-paying companies. The least favorable situation, in turn, is found in the once dividend-paying companies, which now most often have low earnings, low capital expenditures, and liquidity problems. The indicated characteristics of the entities that make up the analyzed classes (i.e., dividend-paying and non-dividend-paying companies) allow us to make the assumption that it is riskier to invest in companies that do not pay dividends (although these are factors different from the previously indicated faster realization of benefits by investors in case of dividend-paying companies). At the same time, it is pointed (Allen, L. et al., 2012) to the impact of significant debt as a factor limiting the ability to pay dividends (i.a. as a result of monitoring and prudential measures taken by providers of debt, particularly credit institutions). On the other hand,

(Gwilym, Seaton, Thomas, 2005) indicate that dividend companies are no longer dominant when returns earned are adjusted for the level of risk – adjustments made as suggested in (McQueen, Shields, Thorley, 1997). The considerations presented clearly indicate the need to expand the ongoing research also to include relevant measures of investment risk.

There is a fairly widespread belief among researchers that companies paying (above-average) dividends generally produce above-average returns (Clemens, 2012), yet neither the motives behind managers' decisions to pay dividends nor the mechanism for generating excess returns have been conclusively explained – as Black (Black, 1976) has already pointed out. Some researchers justify the higher returns on portfolios of dividend companies by the increased risk (Fama, French, 1993; McQueen, Shields, Thorley, 1997) associated with *value investing*, which includes investing in dividend companies, but this view is sometimes challenged (Clemens, 2012).(Andrikopoulos, Daynes, 2004) state that "(…) companies with value potential are less risky than companies with growth potential given standard measures like beta or standard deviation (…)". Existing studies based on classical risk measures do not provide definitive guidance. A pioneering study focusing primarily on the level of riskiness of investments is the work by (Baskin, 1989). The methodology developed by the author became common in further studies of the indicated phenomenon, based on the study of the impact of the dividend yield and the dividend payout ratio on stock price volatility while using control variables that included company size, operating profit volatility or debt level. In the analyzed sample of 2,344 US companies listed between 1967 and 1986, the author clearly confirmed the negative impact of the dividend payout ratio or the dividend yield (as well as company size) on return volatility, combined with a positive (as expected) impact of earnings or debt volatility.

Similar studies have been conducted in later periods for other markets as well. Among developed markets, the US, UK, and Australian markets were analyzed. (Profilet, 2013) for US companies represented in the Value Line Investment Survey found a significant negative effect of the dividend yield on the volatility of stock returns with a non-significant positive relationship for the dividend payout ratio. Analogous research conducted by (Hussainey et al., 2011) for the UK market led to conclusions similar to those of (Baskin, 1989), however, the research sample in this case was much smaller (comprising 123 entities). Similar results for the Australian market were achieved by (Allen, D. E., Rachim, 1996), but in this case the negative correlation for the dividend yield proved to be statistically insignificant. In case of European stock exchanges (except for the London stock exchange), research on the discussed phenomenon is rather limited. However, mention should be made of the results obtained for the Frankfurt Stock Exchange (Karlsson, von Renteln, 2021). Having analyzed 30 companies in the DAX index from 2000 to 2020, the authors were able to confirm Baskin's results (Baskin, 1989) for both dividend yield and dividend payout ratio. The indicated negative correlation thus appears to be a fairly common rule for developed markets.

Some different conclusions from the results obtained for developed markets were obtained for developing economies. (Rashid, Rahman, 2008) noted a positive effect of the dividend yield on price volatility of stocks listed on the Dhaka Stock Exchange between 1999 and 2006, but the relationship was not statistically significant. Their results were confirmed for the years 2008-2017 in the studies by (Hossin, Ahmed, 2020). Similar results for the Jordanian market in the period 2001-2013 were obtained by (Al-Shawawreh, 2014), as well as for the Karachi Stock Exchange in the period 2005-2009 (Lashgari, Ahmadi, 2014). In turn, research by (Jahfer, Mulafara, 2016; Nazir et al., 2010; Nguyen et al., 2020) finds a statistically significant indicated positive relationship for the stock exchanges of Sri Lanka, Pakistan, and Vietnam.

Conclusions similar to the results obtained for developed markets have been made i.a. for Malaysia, Vietnam, Iran, Pakistan, and Nigeria. Research by (Hooi, Albaity, Ibrahimy, 2015) conducted on a sample of 319 Malaysian companies clearly shows the volatility-reducing impact of the increased dividend yield as well as the dividend payout ratio. Analogous results were also obtained by (Zainudin, Mahdzan, Yet, 2018), while for Pakistan by (Nazir, 2012; Shah, Noreen, 2016) and the Tehran Stock Exchange by (Lashgari, Ahmadi, 2014), although for much smaller samples (166, 75, 50 and 51 entities, respectively). Analyses presented by (Dang, Tran, Tran, 2019) for 248 Vietnamese companies suggest a significantly negative effect of an increase in the dividend payout ratio on the volatility of returns, with no significance attributed to the dividend yield. The opposite results were found by (Hashemijoo, Ardekani, Younesi, 2012) for a group of 84 Malaysian companies engaged in the manufacture of consumer goods and by (Okafor, Mgbame, Chijoke-Mgbame, 2011). However, it seems that the limitations imposed on the set of entities analyzed in the studies by (Hashemijoo, Ardekani, Younesi, 2012) may distort the actual relationships present in the Kuala Lumpur Stock Exchange, and due to the larger sample and wider time range, the results obtained by (Hooi, Albaity, Ibrahimy, 2015; Zainudin, Mahdzan, Yet, 2018) should be considered more reliable.

The results of the research presented so far clearly indicate the existence of an effect of dividend policy on the volatility of stock returns as measured by the standard deviation, most often estimated using a procedure based on the use of extreme values. However, it should be noted that the spectrum of risk measures is much wider, and the use of a single (though undoubtedly common and methodologically sound) risk measure limits the universality of the conclusions drawn. One of the purposes of this paper, therefore, is to examine whether the indicated relationship is also true for companies listed on the Warsaw and New York Stock Exchanges, and whether it remains valid if risk measures other than the standard deviation of returns are used in the analyses. However, it is still challenging to select the right measures so that they do not duplicate the information already contained in the classical measures. Empirical studies to date (Bhatt, Dedania, Shah, 2015; Buła, 2017, 2018; Buła, Pera, 2015) indicate the possibility of using the fractal dimension as a non-classical measure of the riskiness of financial investments, as advocated by the creator of the concept of a fractal (Mandelbrot, Hudson, 2010). Therefore, this study also uses the fractal dimension as a measure of investment riskiness.

The fractal dimension was proposed as a characterization of objects of a new type, previously unknown and perceived by 19th-century mathematicians as "monstrous" or "pathological", due to their extremely complex structure, which was difficult to describe mathematically. This belief was all the stronger because it was assumed that all objects could be treated as exhibiting regularity. However, the indicated alleged disadvantage turned out to be an advantage when, with the development of science, the existing apparatus proved inadequate to describe reality correctly.

The concept of a fractal (Latin: *fractus* – broken) was introduced by Mandelbrot (Mandelbrot, 1983). It has become widely used in both natural and social sciences. The formal definition of a fractal object: "A fractal is by definition a set for which the Hausdorff-Besicovitch dimension strictly exceeds the topological dimension" (Mandelbrot, 1983, p. 15) has proved to be of little use in empirical studies, so it has been replaced by a series of conditions, the most important of which is the condition of the self-similarity (or self-affinity) of the analyzed object. According to the mentioned condition, an object is called a fractal if it is self-similar or self-affine, also in the statistical sense (in other words, it is required that the probability distribution of the analyzed quantity belongs to the same family of distributions with the accuracy of the parameter values). For stochastic processes, a process $X(t)$ is considered to be self-similar if it meets the following condition:

$$X(t) \overset{d}{=} r^{-H} X(rt), \quad t \geq 0 \tag{1}$$

for any $r > 0$ (*H-ss* process),
where:
$t$ – time,
$H$ – self-similarity coefficient,
$r$ – constant,
$\overset{d}{=}$ – denotes equality in the sense of probability distribution.

The fractal dimension can then be considered a characteristic describing the global and at the same time local behavior of the indicated process. As there are many definitions of the fractal dimension, for the purposes of this paper it was decided to use the box-counting dimension (cube-counting, Minkowski-Bouligand, sometimes referred to as the Kolmogorov entropy or the entropic dimension). The box-counting dimension is defined as:

$$\dim_{\mathrm{B}}(X) = \lim_{\varepsilon \to 0} \frac{\ln N_{\varepsilon}(X)}{\ln \frac{1}{\varepsilon}}, \tag{2}$$

where $N_\varepsilon(X)$ is the number of hypercubes of the grid with the side length of $\varepsilon$, having at least one point in common with the analyzed object X. The definition is derived from the relationship:

$$N_{\varepsilon}(X) \sim \varepsilon^{-\dim_{\mathrm{B}}(X)} \tag{3}$$

for $\varepsilon \to 0$. Thus, the box-counting dimension illustrates the fluctuation of the number of squares necessary to cover the analyzed object when the side length of the square grid is reduced in the limit to zero.

The fractal dimension can be considered not only as one of the characteristics of the time series, but also as a measure of risk, as evidenced by the studies, i.a. by (Buła, 2013; Mularczyk, 2005; Zwolankowska, 2001). As it has been demonstrated, "(...) instruments with a higher fractal dimension are assigned a higher level of risk (...) when the length of the investment horizon decreases to zero. (...) for the long term (...) instruments with a lower fractal dimension should be considered riskier" (Buła, 2013, p. 465). As indicated in the literature, when classical assumptions about the nature of time series derived from the financial market are not met, this measure can be of great use (Mandelbrot, Hudson, 2010). Therefore, it was used in this study to measure the risk of investing in shares of dividend and other companies.

Based on the literature review and the identified research gaps, the following research hypotheses were defined:

$H_1$: Dividend companies listed in the US have a higher average dividend growth rate than dividend companies listed in Poland.

$H_2$: The returns of US dividend companies are determined to a greater extent by dividend payments than by changes in stock prices.

$H_3$: Investment risk understood as the volatility of returns is lower for dividend companies.

$H_4$: Long-term investment risk as measured by the fractal dimension is lower for dividend companies, i.e. their fractal dimension is significantly higher – according to the conclusions made in (Buła, 2019).

The hypotheses are verified later in the paper.

## 3. Sample selection and methodology

For achieving the purpose of the paper, companies listed on the stock exchange in the US and in Poland were investigated. In each of the two markets, 30 companies included in the S&P 500 and WIG indices with the highest stock market capitalization at the end of 2021 were selected. These are for the S&P 500 index: AAPL.US, MSFT.US, AMZN.US, TSLA.US, GOOG.US, FB.US, NVDA.US, UNH.US, JPM.US, JNJ.US, HD.US, WMT.US, PG.US, BRK-B.US, BAC.US, V.US, MA.US, PFE.US, DIS.US, AVGO.US, ACN.US, ADBE.US, CSCO.US, NFLX.US, LLY.US, XOM.US, TMO.US, KO.US, COST.US and ABT.US, and for the WIG index: SAN, UCG, CEZ, PKO, PGN, SPL, ING, PEO, LPP, PKN, PZU, KGH, MOL, CPS, CDR, MBK, KRK, PGE, BNP, IIA, LTS, OPL, MIL, BHW, ACP, ALR, CAR, KRU, EAT and KTY.

The research was carried out in the following stages:

Stage one – breaking the companies down into those that paid dividends in 2016-2021 for the 2015–2020 period without interruption or with one period of no distribution of the financial result to shareholders – the group was defined as dividend stocks (Dividend US and Dividend PL, respectively). The remaining companies did not pay dividends or paid them intermittently – they were identified as other stocks (Other US and Other PL, respectively).

Stage two – among the selected groups of companies, the total return for the period 2015-2021 and the average annual return (both taking into account changes in share prices and dividends paid), the cumulative dividend yield, the average dividend change rate, as well as the share of the cumulative dividend yield in the return for the entire analyzed period were calculated and analyzed.

Stage three – for the selected companies, volatility of returns and their fractal dimension (for cumulative yields) were estimated. The resulting values were then used to benchmark the entities included in the identified groups. For this purpose, relevant variance analysis methods were used.

## 4. Benchmark of dividend companies listed in the US and in Poland – research results for the period 2015-2021

In order to select dividend companies listed in the US and in Poland, they were divided taking into account the regularity of dividend payments. On this basis, 22 dividend stocks were selected that are components of the S&P 500 index and 14 dividend stocks from the WIG index. The remaining companies in the group of 30 were classified as companies that did not pay dividends (AMZN.US, TSLA.US, GOOG.US, FB.US, BRK-B.US, ADBE.US, NFLX.US, BNP, MIL, ALR and EAT) or made dividend payments intermittently. These are, in turn, the group of Other US and Other PL (Table 1).

**Table 1.**
*Groups of analyzed companies*

| Dividend US | Dividend PL | Other US | Other PL |
|---|---|---|---|
| AAPL.US | CEZ | AMZN.US | SAN |
| MSFT.US | PGN | TSLA.US | UCG |
| NVDA.US | SPL | GOOG.US | PKO |
| UNH.US | PEO | FB.US | ING |
| JPM.US | LPP | BRK-B.US | KGH |
| JNJ.US | PKN | DIS.US | CPS |
| HD.US | PZU | ADBE.US | CDR |
| WMT.US | MOL | NFLX.US | MBK |

Cont. table 1.

| | | | |
|---|---|---|---|
| PG.US | KRK | | PGE |
| BAC.US | BHW | | BNP |
| V.US | ACP | | IIA |
| MA.US | CAR | | LTS |
| PFE.US | KRU | | OPL |
| AVGO.US | KTY | | MIL |
| ACN.US | | | ALR |
| CSCO.US | | | EAT |
| LLY.US | | | |
| XOM.US | | | |
| TMO.US | | | |
| KO.US | | | |
| COST.US | | | |
| ABT.US | | | |

Source: own research.

The Dividend US group for the period under review had the highest return (435.86%) and thus the highest average annual return (72.64%). An analogous group of companies from the Polish market generated a much lower total return (141.08%) and annual average return (23.51%). Similar trends are characteristic of Other US and Other PL groups. Companies not classified as dividend stocks in the US market generated for the entire period a return of 368.99% and in the Polish market 106.74% (Figure 1).

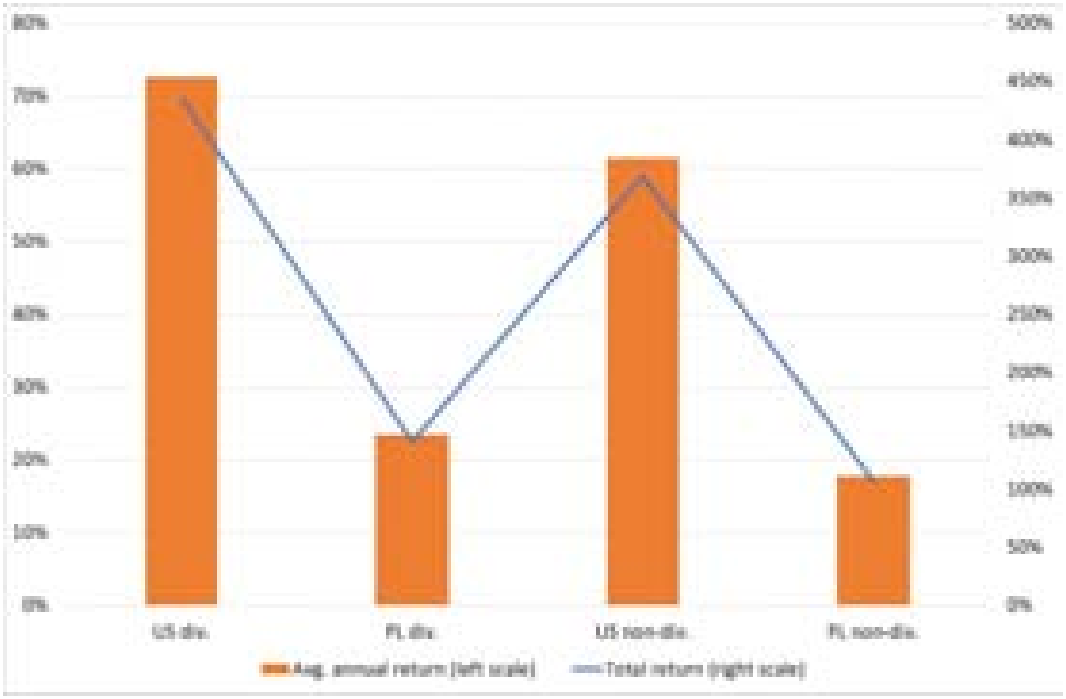


**Figure 1.** Returns of analyzed company groups. Source: own research.

When analyzing companies that regularly share profits with shareholders, it should be noted that dividend stocks included in the S&P 500 index had a lower cumulative dividend yield (25.75%) than Polish dividend stocks (42.3%). Moreover, companies from the Dividend PL group also had a higher average dividend growth rate (31.58%) compared to the Dividend US (16.33%). Analysis of other groups of companies not classified as dividend stocks from the point of view of parameters based on dividend payments does not make sense due to the small number of payments and thus the significant impact on the averages (for example, IIA paid dividends only in 2018 and 2019 with a dividend change rate of 1,120%). For this reason, both groups of companies (Other US and Other PL) were excluded from this area of analysis (Table 2).

**Table 2.**
*Parameters of the analyzed company groups*

| Company groups | Rate of return | | Cumulative dividend yield | Average dividend change rate | Share of the cumulative dividend yield in the return for the entire period |
|---|---|---|---|---|---|
| | for the entire period | annual average | | | |
| Dividend US | 435.86% | 72.64% | 25.75% | 16.33% | 5.91% |
| Dividend PL | 141.08% | 23.51% | 42.30% | 31.58% | 29.98% |
| Other US | 368.99% | 61.50% | 0.83% | 5.74% | 0.23% |
| Other PL | 106.74% | 17.79% | 8.01% | 182.87% | 7.50% |

Source: own research.

Conclusions of the analysis of the share of the cumulative dividend yield in the return for the entire period are surprising. It shows that for US companies the share is 5.91%, while for Polish companies it is as high as 29.98%. If we use the stock indices under which the analyzed companies are listed as a benchmark, then for the period 2015–2021 the change in the S&P 500 index was 133.19% and in the WIG index – 49.13%. This means that the total return of dividend companies in the S&P 500 index is mainly determined by changes in stock prices and not by the amount of dividend payments, which cannot be said of Polish dividend companies.

In the next step, the characteristics necessary for risk analysis were estimated, i.e. the volatility of returns (annualized using the average number of trading sessions during the investigated period) and the fractal dimension. The empirical distributions (also taking into account the average return) are shown in the figures below.

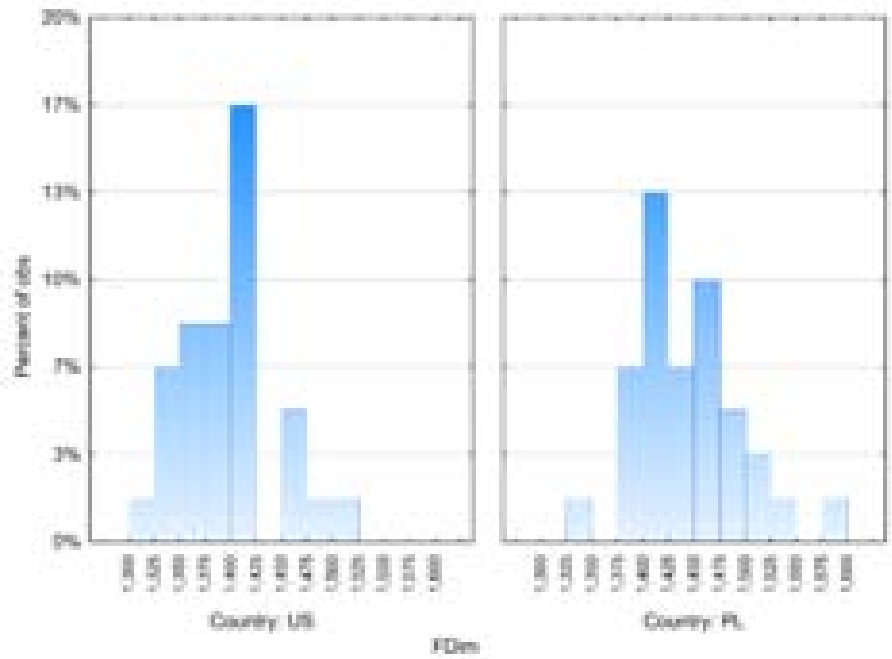


**Figure 2.** Empirical distribution of the fractal dimension of the investigated Polish and US companies. Source: own research.

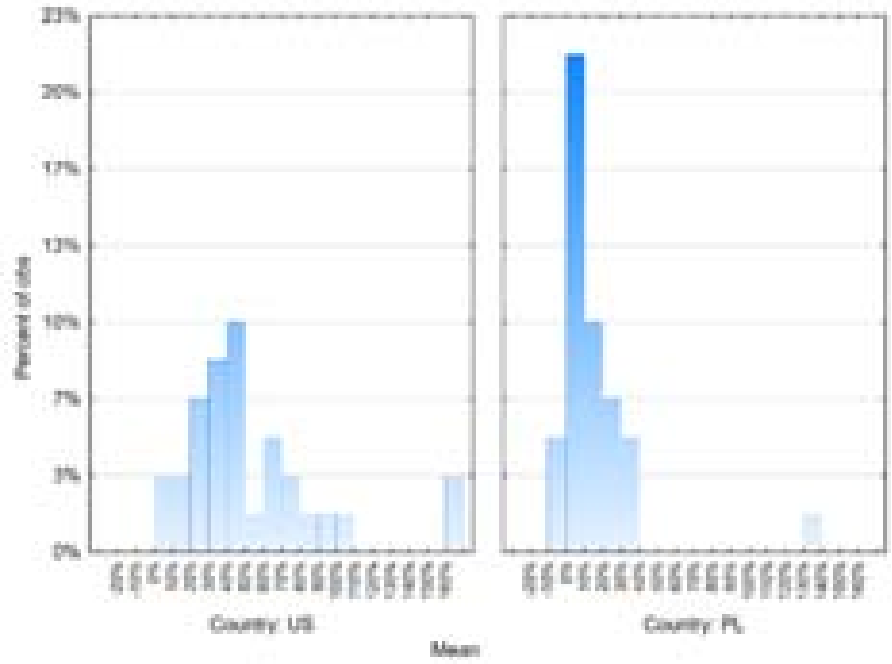


**Figure 3.** Empirical distribution of the average annual return of the investigated Polish and US companies. Source: own research.

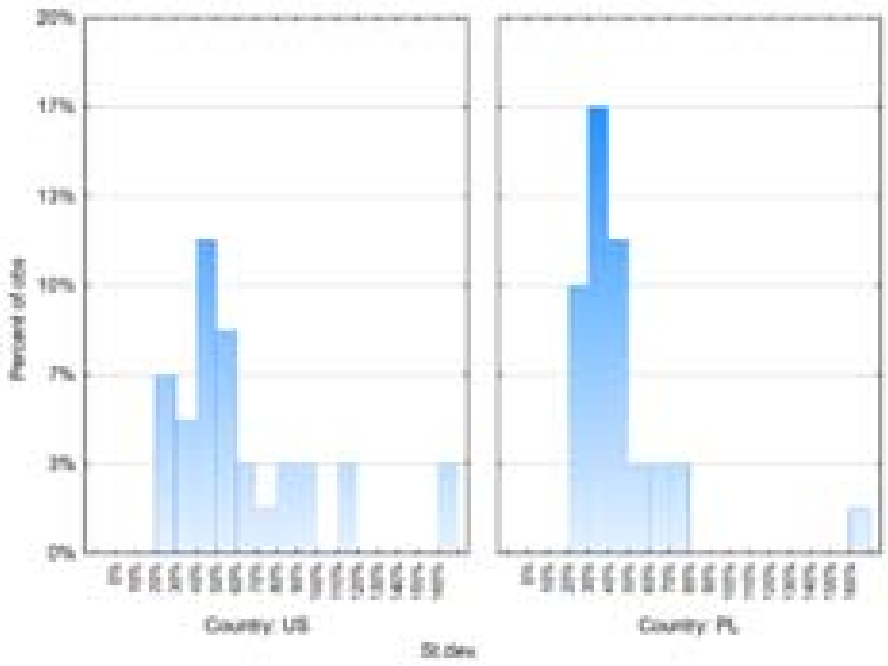


**Figure 4.** Empirical distribution of the annualized standard deviation of returns of the investigated Polish and US companies. Source: own research.

In the next step, the indicated parameters were compared using variance analysis. First, the normality of the distribution of the quantities considered in the groups was assessed using the Shapiro-Wilk test. The hypothesis of normality of distribution was rejected for the average value of returns and their standard deviation (for a significance level of 0.05). Therefore, when comparing these quantities, the Mann-Whitney test was used. In turn, the non-rejection of the null hypothesis of the equality of variances across groups with respect to the fractal dimension (significance level of 0.05, F-test, Levene test and Brown-Forsythe test) led the authors to use the classical t-test in this case. The results of the statistical tests are summarized in the tables below.

**Table 3.**
*Variance analysis results*

| Test hypothesis | Div. | Non-div. | p-value | Decision |
|---|---|---|---|---|
| $H_0$:$FDim_{US,div}$=$FDim_{US,non-div}$ | 1.3986 | 1.3965 | 0.917 | $H_0$ supported |
| $H_0$:$FDim_{PL,div}$=$FDim_{PL,non-div}$ | 1.4299 | 1.4530 | 0.213 | $H_0$ supported |
| $H_0$:$\overline{R}_{US,div}$=$\overline{R}_{US,non-div}$ | 68.35% | 85.64% | 0.496 | $H_0$ supported |
| $H_0$:$\overline{R}_{PL,div}$=$\overline{R}_{PL,non-div}$ | 16.46% | 16.46% | 0.271 | $H_0$ supported |
| $H_0$:$\sigma_{US,div}$=$\sigma_{US,non-div}$ | 75.91% | 118.08% | 0.181 | $H_0$ supported |
| $H_0$:$\sigma_{PL,div}$=$\sigma_{PL,non-div}$ | 41.13% | 70.49% | 0.062 | $H_0$ supported |

Source: own research.

In none of the cases analyzed was it possible to reject the null hypothesis of the equality of the examined parameters (with a significance level of 0.05). For a significance level of 0.10, the hypothesis of equality of standard deviations for Polish dividend and non-dividend stocks can be rejected (with dividend stocks having lower volatility, in line with previous results). The results of the variance analysis presented here do not support the hypothesis that dividend and non-dividend stocks differ in terms of their profitability and risk as measured by both standard deviation and fractal dimension.

## 5. Discussion and conclusions

Research conducted on the characteristics of dividend stocks listed in Poland and in the US showed significant differences in parameters based on dividends paid. The Dividend US group of companies for the period under review had a higher average annual return (72.64%) than Dividend PL companies (23.51%), with the difference determined, in case of US dividend companies, by changes in stock prices rather than the amount of dividend payments (and thus the dividend yield).

Relating the above results to the research conducted by the others, it must be emphasized that different conclusions have been drawn. Contrary to the claims of (Lichtenfeld, 2015) and (Williams, Miller, 2013, pp. 58-69) dividend stocks do not perform better in terms of the expected rate of return. Results of this study also do not support the remarks formulated by (Skousen, 2011) claiming, that dividend-paying stocks deliver better financial results than stocks that do not pay dividends. On the other hand, taking into account risk level it must be underlined that dividend stocks seem to be less risky than non-dividend stocks, although the difference is not statistically significant. Summarizing, the authors did not find any significant statistical difference between the abovementioned groups of stocks, what stands in opposition to the results obtained by other authors.

The share of the cumulative dividend yield in the return for the entire analyzed period for US companies was 5.91%, while for Polish companies it was as high as 29.98%. The companies from the Dividend PL group also had a higher average dividend growth rate (31.58%) compared to the Dividend US (16.33%).

The considerations presented and the statistical tests performed also made it possible to conclude that dividend stocks and other stocks do not differ significantly in either average profitability or level of risk, whether measured by volatility or level of fractal dimension. For this reason, an investor should definitely attach more importance to the choice of the market, rather than to whether or not an entity pays a dividend.

Based on the conducted research, the adopted research hypotheses were verified, and on this basis, it was concluded that:

$H_1$: Dividend companies listed in the US have not higher, but lower average dividend growth rate than dividend companies listed in Poland. This hypothesis was verified negatively.

$H_2$: The returns of US dividend companies are determined not to a greater extent, but to a lower extent by dividend payments than by changes in stock prices. This hypothesis was verified negatively.

$H_3$: There are no statistically significant differences between dividend and non-dividend companies with regard to the level of their volatility as measured by the standard deviation of returns.

$H_4$: Long-term investment risk as measured by the fractal dimension is the same for dividend and other companies.

A certain shortcoming of the study conducted is the limitation of the time scope of the analysis, as well as the set of companies analyzed. It is possible that an analysis of a broader set of entities for a longer period would lead to different conclusions. The authors' intention is to conduct analogous analyses for a more extensive dataset. Nonetheless, given the importance of the entities studied in terms of their capitalization, the conclusions drawn provide important guidance for both researchers and investors.

## References

1. Allen, D.E., Rachim, V.S. (1996). Dividend policy and stock price volatility: Australian evidence. *Applied Financial Economics*, *Vol. 6, No. 2,* pp. 175-188. doi:10.1080/096031096334402.
2. Allen, L., Gottesman, A., Saunders, A., Tang, Y. (2012). The Role of Banks in Dividend Policy. *Financial Management*, *Vol. 41, No. 3,* pp. 591-613. doi:10.1111/j.1755-053X.2012.01207.x.
3. Al-Malkawi, H.-A. N., Rafferty, M., Pillai, R. (2010). Dividend policy: A review of theories and empirical evidence. *International Bulletin of Business Administration*, *Vol. 9, No. 1,* pp. 171-200.
4. Al-Shawawreh, F.K. (2014). The Impact of Dividend Policy on Share Price Volatility: Empirical Evidence from Jordanian Stock Market. *European Journal of Business and Management*, *Vol. 6, No. 38,* pp. 1-12.

5. Andrikopoulos, P., Daynes, A. (2004). *An Investigation of the Value Premium in the UK Stock Market 1988-2002: Some New Evidence* (SSRN Scholarly Paper, No. 549865). doi:10.2139/ssrn.549865.
6. Asquith, P., Mullins, D.W. (1983). The Impact of Initiating Dividend Payments on Shareholders' Wealth. *The Journal of Business*, *Vol. 56, No. 1,* pp. 77-96.
7. Baskin, J. (1989). Dividend policy and the volatility of common stocks. *The Journal of Portfolio Management*, *Vol. 15, No. 3,* pp. 19-25. doi:10.3905/jpm.1989.409203.
8. Bhatt, S.J., Dedania, H.V., Shah, V.R. (2015). Fractal dimensional analysis in financial time series. *International Journal of Financial Management*, *Vol. 5, No. 2,* pp. 57-62.
9. Black, F. (1976). The Dividend Puzzle. *The Journal of Portfolio Management*, *Vol. 2, No. 2,* pp. 5-8. doi:10.3905/jpm.1976.408558.
10. Buła, R. (2013). Ryzyko inwestycji a wymiar fraktalny. *Studia Ekonomiczne*, *Vol. 155,* pp. 450-466.
11. Buła, R. (2017). Analiza wymiaru fraktalnego spółek notowanych na Giełdzie Papierów Wartościowych w Warszawie–aspekty metodyczne. *Nauki o Finansach*, *Vol. 1, No. 30,* pp. 9-27.
12. Buła, R. (2018). Fractal Dimension vs. Non-fractal Risk Measures–Correlation Analysis. In: J. Nešleha, F. Hampl, M. Svoboda (Eds.), *European Financial Systems 2018. Proceedings of the 15th International Scientific Conference* (pp. 53-60). Brno: Masaryk University.
13. Buła, R. (2019). *Implikacje teorii rynku fraktalnego dla oceny ryzyka inwestycji finansowych*. Warszawa: Urząd Komisji Nadzoru Finansowego.
14. Buła, R., Pera, K. (2015). Применение концепции фрактальной размерности для оценки инвестиционного риска на финансовых рынках. In: С.А. Белозеров (Ed.), *Международный экономический симпозиум-2015* (pp. 217-235). Санкт-Петербург: Санкт-Петербургский Государственный Университет.
15. Clemens, M. (2012). *Dividend Investing: Strategy for Long-Term Outperformance* (SSRN Scholarly Paper, No. 2056317). doi:10.2139/ssrn.2056317.
16. Cwynar, A., Cwynar, W. (2007). *Kreowanie wartości spółki poprzez długoterminowe decyzje finansowe*. Warszawa: Wydawnictwo Wyższej Szkoły Informatyki i Zarządzania.
17. Dang, N.H., Tran, B.M., Tran, M.D. (2019). Impact of dividend policy on variation of stock prices: Empirical study of Vietnam. *Journal of Economics and Development*, *Vol. 21*, pp. 96-106.
18. Fama, E.F., French, K.R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *Vol. 33, No. 1,* pp. 3-56.

19. Fama, E.F., French, K.R. (2001). Disappearing dividends: changing firm characteristics or lower propensity to pay? *Journal of Financial Economics*, *Vol. 60, No. 1,* pp. 3-43. doi:10.1016/S0304-405X(01)00038-1.
20. Fuller, K.P., Goldstein, M.A. (2011). Do dividends matter more in declining markets? *Journal of Corporate Finance*, *Vol. 17, No. 3,* pp. 457-473.
21. Graham, B. (1999). *Mądry inwestor*. Kraków: Wydawnictwo Profesjonalnej Szkoły Biznesu.
22. Graham, B. (2009). *The Intelligent Investor, Rev. Ed: The Definitive Book on Value Investing*. New York: Harper Collins.
23. Gwilym, O.A., Seaton, J., Thomas, S.H. (2005). Dividend Yield Investment Strategies, the Payout Ratio and Zero-Dividend Stocks. *The Journal of Investing*, *Vol. 14, No. 4,* pp. 69-74. doi:10.3905/joi.2005.605284.
24. Hashemijoo, M., Ardekani, A.M., Younesi, N. (2012). The Impact of Dividend Policy on Share Price Volatility in the Malaysian Stock Market. *Journal of Business Studies Quarterly*, *Vol. 4, No. 1,* pp. 111-129.
25. Hooi, S.E., Albaity, M., Ibrahimy, A. (2015). Dividend policy and share price volatility. *Undefined*. Retrieved from https://www.semanticscholar.org/paper/Dividend-policy-and-share-price-volatility-Hooi-Albaity/c1b7a30f0c425945715aae6a99c776e002fb8537, 22.06.2022.
26. Hossin, M.S., Ahmed, M.F. (2020). Dividend policy and stock price volatility in the Bangladesh capital market: An experimental analysis. *Saudi Journal of Economics and Finance*, *Vol. 4, No. 7,* pp. 359-367.
27. Hussainey, K., Chijoke, O., Mgbame, Chijokemgbame, M. (2011). Dividend policy and share price volatility: UK evidence. *The Journal of Risk Finance*, *Vol. 12*. doi:10.1108/15265941111100076.
28. Jahfer, A., Mulafara, A.H. (2016). Dividend policy and share price volatility: evidence from Colombo stock market. *International Journal of Managerial and Financial Accounting*, *Vol. 8, No. 2,* pp. 97-108. doi:10.1504/IJMFA.2016.077947.
29. Karlsson, C., von Renteln, A. (2021). *Stock price volatility and dividend policy: The German stock exchange* (Bachelor thesis). Jönköping: Jönköping University.
30. Karpavičius, S., Yu, F. (2018). Dividend premium: Are dividend-paying stocks worth more? *International Review of Financial Analysis*, *Vol. 56,* pp. 112-126. doi:10.1016/j.irfa.2018.01.004.
31. Kowerski, M. (2011). *Ekonomiczne uwarunkowania decyzji o wypłatach dywidend przez spółki publiczne*. Kraków-Rzeszów-Zamość: Konsorcjum Akademickie Wydawnictwo WSE w Krakowie, WSIiZ w Rzeszowie i WSZiA w Zamościu.

32. Lashgari, Z., Ahmadi, M. (2014). The Impact of Dividend Policy on Stock Price Volatility in the Tehran Stock Exchange. *Kuwait Chapter of Arabian Journal of Business and Management Review*, *Vol. 3, No. 10,* pp. 273-283. doi:10.12816/0018408.
33. Lichtenfeld, M. (2015). *Get Rich with Dividends: A Proven System for Earning Double-Digit Returns*. John Wiley & Sons.
34. Mandelbrot, B.B. (1983). *The Fractal Geometry of Nature*. New York: Henry Holt and Company.
35. Mandelbrot, B.B., Hudson, R.L. (2010). *The (Mis)Behaviour of Markets: A Fractal View of Risk, Ruin and Reward*. London: Profile Books.
36. McQueen, G., Shields, K., Thorley, S.R. (1997). Does the 'Dow-10 Investment Strategy' Beat the Dow Statistically and Economically? *Financial Analysts Journal*, *Vol. 53, No. 4,* pp. 66-72.
37. Miller, M.H., Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *The Journal of Business*, *Vol. 34, No. 4,* pp. 411-433.
38. Mularczyk, A. (2005). Ryzyko działalności współczesnego przedsiębiorstwa w ujęciu fraktalnym. *Studia Ekonomiczne*, *No. 36,* pp. 141-156.
39. Nazir, M.S. (2012). How Dividend Policy Affects Volatility of Stock Prices of Financial Sector Firms of Pakistan. *American Journal of Scientific Research*, *Vol. 61, No. 1,* pp. 132-139.
40. Nazir, M.S., Nawaz, M.M., Anwar, W., Ahmed, F. (2010). *Determinants of Stock Price Volatility in Karachi Stock Exchange: The Mediating Role of Corporate Dividend Policy*. *Vol. 55, No. 55,* pp. 100-107.
41. Nguyen, T., Nguyen, H., Tran, Q., Le, Q. (2020). Dividend policy and share price volatility: empirical evidence from Vietnam. *Accounting*, *Vol. 6, No. 2,* pp. 67-78. doi:10.5267/j.ac.2019.12.006.
42. Okafor, C.A., Mgbame, C.O., Chijoke-Mgbame, A.M. (2011). Dividend Policy and Share Price Volatility in Nigeria. *Journal of Research in National Development*, *Vol. 9, No. 1,* pp. 202-210.
43. Pioch, J. (2015). Polityka dywidend i wykup akcji własnych. In: J.K. Bielecki, L. Pawłowicz (Eds.), *Zarządzanie wartością spółki kapitałowej* (pp. 405-444). Warszawa: CeDeWu.
44. Profilet, K.A. (2013). Dividend policy and stock price volatility in the US equity capital market. *Theses, Dissertations & Honors Papers*, *No. 145,* pp. 1-14.
45. Rashid, A., Rahman, A.Z.M.A. (2008). Dividend policy and stock price volatility: evidence from Bangladesh. *Journal of Applied Business and Economics*, *Vol. 8, No. 4,* pp. 71-81.

46. Rubin, H., Spaht, C.I. (2011). Financial Independence Through Dollar Cost Averaging and Dividend Reinvestments. *Journal of Applied Business and Economics*, *Vol. 12, No. 4*, pp. 11-19.
47. Shah, S.A., Noreen, U. (2016). *Stock Price Volatility and Role of Dividend Policy: Empirical Evidence from Pakistan*. *Vol. 6, No. 2,* pp. 461-472.
48. Skinner, D.J., Soltes, E. (2011). What do dividends tell us about earnings quality? *Review of Accounting Studies*, *Vol. 16, No. 1,* pp. 1-28. doi:10.1007/s11142-009-9113-8.
49. Skousen, M. (2011). *Inwestowanie w jednej lekcji*. Warszawa: Fijorr Publishing Company.
50. Williams, A., Miller, M. (2013). Do Stocks with Dividends Outperform the Market during Recessions? *Journal of Accounting and Finance*, *Vol. 13, No. 1,* pp. 58-69.
51. Zainudin, R., Mahdzan, N.S., Yet, C.H. (2018). Dividend policy and stock price volatility of industrial products firms in Malaysia. *International Journal of Emerging Markets*, *Vol. 13, No. 1,* pp. 203-217. doi:10.1108/IJoEM-09-2016-0250.
52. Zwolankowska, M. (2001). *Fraktalna geometria polskiego rynku akcji*. Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.

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# SOCIAL CAPITAL AS A FACTOR OF DEVELOPMENT OF A SMART CITY

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**Purpose:** Social capital constitutes an important factor in the development of a smart city. The adoption of this assumption facilitated the formulation three research questions: In what sphere do the city inhabitants participate in social networks? What is the level of trust shown to neighbours that create the local community? To what degree does the scope of information on the activities on behalf of the local community have an impact on their active participation?
**Design/methodology/approach**: The assumed goal was executed thanks to the application of the method of critical analysis of literary sources and the use of the survey method that served to identify the indicators of social capital in the context of the implementation of the principal assumptions of a smart city.
**Findings:** The findings of empirical research indicate that the level of social capital in the analysed city constitutes a significant barrier in terms of the development of a smart city. Structural capital in the form of neighbourly ties, which are usually restricted to five people, restricts the scope of neighbourly ties. Low relational capital, namely trust has a negative impact on the level of involvement of inhabitants in social initiatives. Engagement in urban social issues is dependent on the knowledge of social initiatives in the area of the district where they live. The application of information and communication technologies (ICT) increases the scope of information about projects and events organized in the city.
**Research limitations:** The acquired research findings with regard to their quantitative nature (survey research) constitutes the basis for the limited findings.
**Practical implications:** The research findings provide knowledge on the subject matter of the level of the existence of social capital and its barrier to development, which may serve the preparation of new solutions in the policies of a smart city.
**Social implications:** The research findings presented in this paper indicate the need to use information and communication technologies in the creation of social capital in the city.
**Originality/value:** The research findings, in a cognitive sense, lead to becoming familiar with the role of social capital in the development of a smart city.

**Keywords:** social capital, trust, social networks, smart city.

**Category of the paper:** Research article.

## 1. Introduction

Contemporary cities are searching for solutions in conditions of globalization and international competition that will ensure them of growth. One of these solutions is the concept of a smart city that has appeared over the last decade as a combination of ideas for this, such as information and communication technologies that can streamline the functioning of cities, while also increase their efficiency, improve their competitiveness and ensure new ways of counteracting poverty, deprivation and social pathology. Smart cities are not the future any more as we are already witnesses to their development. It is also envisaged that by 2040 the sector of smart cities will have created a market worth 400 billion dollars that will incorporate over 600 cities worldwide. These urban areas will constitute 60% of the worldwide GDP by 2025 (Duan, Nasiri, and Karamizadeh, 2019). Hence, it is worth following the factors determining their development. A smart city combines ICT with human and social capital, while also public institutions with the aim of dynamizing economic growth, as well as social and environmental development. Thus, a smart city is an intricate system that has divergent aims, needs and interests of various stakeholders. A smart city must meet these challenges by creating the ability to cooperate and co-create new competences in the spheres of innovativeness and competitiveness. Social capital may be useful in the attainment of these goals, as it constitutes its intangible value. Social capital is a notion that indicates the strength of ties between people both within and outside the urban community. It is a factor that facilitates the realization of the policy of the development of the urban community. With this aim in mind, the urban authorities should manage social capital appropriately, which is perceived as the process of shaping changes to its potential, namely its level and structure (planning, building and organizing resources), while also using the resources in its possession to achieve the assumed goals (Skawińska, 2012).

This paper develops new theoretical and empirical views of the subject matter of the impact of social capital on the implementation of the solutions of a smart city. The research was aimed at introducing two principal contributions in terms of the perception of the role of social capital in the development of a smart city. Firstly, the research led to the emphasis of the role of the attributes of social capital in the development of a smart city. Secondly, in this research the significance of the attributes of social capital were identified in terms of stimulating the civic activity of the city dwellers.

## 2. The concept of social capital

The notion of social capital was first introduced by Hanifan (1916) in his paper entitled "The Rural School Community Center". Social capital was acknowledged to be benevolence, friendship, mutual affection, while also close social ties and cooperation between individuals and families creating a social group. Only in the 1980s was the concept of social capital developed by Bourdieu (1986), who defined social capital as the entirety of actual and potential resources associated with the possession of a constant network of institutional ties based on mutual familiarity and acknowledgement. Since then, a multitude of researchers have developed the concept of social capital. In conducting a review of the definitions of capital, it is possible to indicate four ways of perceiving it. In the first way, it appears in the form of resources that an individual possesses as a result of participation in the differentiated social networks. According to Nahapiet and Ghoshal (1998, p. 23), social capital is "…the sum of the actual and potential resources embedded within, while also available by means of and derived from the network of ties in the possession of the individual entity or social unit". Embedding individuals in networks of social ties with other people creates the situation whereby cooperatives ties are formed on the basis of mutual trust and cooperation (Skiba, 2021). Such a network of cooperative ties created between citizens facilitates taking collective decisions (Brehm, and Rahn, 1997).

In the second perception of social capital, it is perceived to be collective properties – networks, values, norms and trust – which enable the members of society to achieve common goals. Fukuyama (1995) perceived social capital as the existence of a certain set of direct values or norms shared by the members of the group that facilitates their cooperation. One of the key values of social capital is that of trust. As noted by Stoll and Lewis (2002), cooperation and trust that are mutual, generalized and widespread are becoming the norms that influence decisions associated with everyday life. Mutual trust is the basic prerequisite and effect of group cooperation.

In the third notion, social capital is defined by its functions. As in the case of other forms of capital, social capital is productive and facilitates the achievement of goals. Its effects are the result of information, impact and solidarity, which makes it available for entities (Adler, and Kwon, 2002).

In the fourth notion, social capital is perceived as a network of ties characterizing the whole group and ensuring greater efficiency of its activities (Coleman, 1990). The quality of ties that facilitates cooperation among individuals and collective activities are based on the level of trust between people and the credibility of the public and political institutions.

For the purposes of this paper, the author at hand assumes that social capital signifies social ties and interactions which build trust and mutuality, while also strengthening the social activity of the city dwellers.

Social capital may take on a structural form, as well as relational and cognitive forms (Nahapiet and Ghoshal, 1998). Structural social capital relates to the properties of a social system and a network of ties in its entirety, while signifying the configuration and the pattern of communication between people that encompasses the role, principles and procedures as the expression of this configuration. The attribute of this capital is the number of ties with other people and its strength (Taylor, 2000). Relational social capital refers to personal ties, such as trust, respect and even friendship (Gooderham, 2007). A key attribute of relational capital is that of trust, which means the readiness of the parties to be subject to the activities of other parties on the basis of the expectation that the other party will conduct specified activities that are important for the trustee regardless of the ability to monitor or control (Mayer, Davis, and Schoorman, 1995). Cognitive social capital combines the resources that ensure joint representation, interpretation and systems of significance between the parties (Nahapiet, Ghoshal, 1998). They are cognitive schemes and systems of significance presented in a common dictionary and narrations that enable the understanding of the actions of actors.

In summing up the review of the principal theoretical approaches associated with social capital, it is possible to state that social capital is the result of the social relation and is based on the obligation or readiness of the connected actors to provide access to their own resources for the execution of common goals (Kabus, 2017). Hence, social capital signifies a component of the skills of cooperation and co-action of individuals within the framework of social groups, organizations and social institutions of various types for the realization of common goals (Januszek, 2005).

## 3. Social capital and concept of a smart city

The term smart city is a polysemous notion and is used in various contexts that are not always cohesive. It was used for the first time in the 1990s. In that time, there was a concentration on new information and communication technologies with relation to infrastructure in cities. The Californian Institute of Smart Communities was one of the first to search for answers as to how it is possible to design a city that avails of the implementation of information technologies (Alawadhi et al., 2012). In later years, researchers developed the concept of a smart city by focusing on the more effective use of the resources of a city (namely, in an innovative, creative or smart way). The role of teleinformation infrastructure was first and foremost analysed, albeit a lot of research on human capital, social capital and relational capital, while also the environmental issue was also conducted as they are important driving forces of the development of cities. Of the multiple definitions of a smart city, it would seem that the most accurate notion was formulated by Kourtit and Nijkamp (2012), who acknowledged that smart cities are the result of creative strategies that are based on knowledge aimed at socio-

economic strengthening, while also ecological, logistical and competitive enhancement of the cities (Dziadkiewicz, 2014). Such smart cities are based on the following: human capital (e.g. skilled workforce), infrastructural capital (e.g. modern communication facilities), social capital (e.g. intensive open network ties), while also entrepreneurial capital (e.g. creative and risky business activities). Apart from the concept of a smart city, the concept of Smart Sustainable Cities (SSC) is being developed, which, basing on modern technologies leads to the fulfilment of the current needs of the city dwellers, while simultaneously taking account of the development of the needs of future generations (Kuzior, and Sobotka, 2019).

In the analysis of the concept of a smart city, an important role is played by its dimensions. At the same time, there is no consensus with regard to the magnitude. A literary review reveals that most frequently six components of a smart city are enumerated as follows: smart economy, smart people, smart governance, smart mobility, smart environment, smart living (Lombardia et al., 2012). Nam and Pardo (2011) place emphasis on smart management that should offer an environment that is favourable towards the development of entrepreneurship that is available to all citizens and the factor of smart people which consists of the following: constant learning throughout life, social and ethnical pluralism, cosmopolitanism, creativity, openness and active participation in the life of the city. A description of the dimensions of a smart city was summed up by Albino, Berardi, and Dangelico (2015), who on the basis of the research available distinguished four of its dimensions as follows: a) the network infrastructure of the city that facilitates political and social efficiency, while also cultural development, b) emphasis on the business development of the city and the creative activities for the promotion of its development, c) social inclusion of various groups of city inhabitants and social capital in the development of a city, d) the natural environment as a strategic element of the future.

The concept of a smart city assumes the physical connection of the spatial areas of the city with the economic and social spheres. Some researchers focus on the analysis of the ties between the vision of a smart city and its social dimension. In analyzing the strategies of a smart city, Angelidou (2014) places emphasis on the social aims, namely a) the development of human capital: empowerment of citizens (informed, educated and participatory citizens) and the strengthening of intellectual capital, while also creating knowledge associated with its social dimension; b) development of social capital by means of the execution of sustainable social development and digitization of the citizens; c) change in the behaviour in terms of the growth of the feeling of self-agency and significance (namely, the feeling that all city inhabitants are owners and co-own their city); d) taking account of the humanistic approach that occurs along with the implementation of technologies that react to the needs, skills and interests of the users, while simultaneously respecting their differentiation and individuality.

Taking account of social capital is worthy of broader discussion as a factor of a smart city. A smart city is one that invests in human and social capital, traditional (transport) and ICT, in which sustainable economic growth and a high quality of life are associated with participatory management (Caragliu, Del Bo, and Nijkamp, 2011). The basis of smart cities is the connection of human capital (Olejniczak-Szuster, 2021), as well as social and informational capital with the use of ICT infrastructures with the aim of generating economic growth, improving the environment and the quality of life of people (De Guimarães et al., 2020). In planning smart cities, researchers pay attention to the need to create social capital. In analysing the potential impact of digital transformation in smart cities in terms of the citizens and citizenship, Fothat, Hudson-Smith, and Gifford (2016) adopted social capital (civic capital to be precise) as one of the evaluation indicators. In turn, A. Caragliui, and Del Bo (2019) argued that social capital strengthens the effect of the distribution of advanced technologies in the city and has a positive impact on the innovativeness of smart cities. In analysing the role of social capital in the policies of smart cities, Mackeat, Rubim Sarate, and de Atayde Moschen (2019) claimed that first of all, policies should be designed from the viewpoint of the neighbourhood with regard to the ease of the perception of common values, while secondly the feeling of a community should be taken into account in terms of policies on behalf of the sustainable smart city; thirdly, with relation to designing districts and cities it is necessary to treat social interactions as a priority with the aim of building social capital and facilitating the implementation of policies. The designs of a smart city include the need to create participatory behaviour patterns, which increases the level of social capital. Van Brussel and Huyse (2019) suggested that a project of civic participation should promote a change in behaviour and lead to the solution to environmental problems. Numerous research projects have indicated significant ties between social capital and public health. Ramirez-Rubio et al. (2019) built international decision-making tools (Sustainable Development Goals – SDGs) that were designed for city policies that promote public health. Within the framework of SDGs, the authors propagate the development of social capital, namely social networks that catalyze cooperation and facilitate better performance associated with health (social and/or economic). In this way, social capital became an important element of urbanistic policies.

## 4. Methods

In research projects, focus is placed on searching for answers to the following three questions: In what scope do the city inhabitants participate in social networks? What is the level of trust towards neighbours that constitute the local community? To what degree does the range of information about activities on behalf of the local community have an impact on their active participation? In the search for answers to these questions, a survey method was used with the

technique of an environmental survey. The research was conducted in Czestochowa within the framework of the project entitled "Old city – new life", which was co-financed by the EU within the framework of the European Social Fund. The research sample constituted 377 inhabitants of Czestochowa. The sample was selected on the basis of the stratified sampling method. The indicators of the research sample were as follows: level of trust – 95%, estimated magnitude of fraction – 0.5, error of estimation – 0.05. The research survey was participated in by 377 inhabitants of Czestochowa, who live in or frequent the district area of the Old City, of which 53.8% were women, while 46.2% were men, aged up to 18 – 8.6%, 18-29 years of age - 39%, 30-39 years of age – 12.2%, 40-49 years of age – 19.7%, 50 up to 59 years of age – 10.5%. In the analysed sample there were 13.6% of people with a higher level of education, 34.5% with secondary school and vocational school education, 32.9% with basic vocational school education, 19.0% with primary and middle school education, in which 46.9 % of people were active professionally, whereas pensioners and disability pensioners amounted to 19.10% and unemployed people totalled 24.9%.

## Results

Social capital in the concept of a smart city play a significant role as it signifies a component of the skills of cooperation and co-working of individuals within the framework of social groups, organizations and social institutions of various types for the realization of common goals. In this context, it is possible to mention the civic social capital, which encompasses informal networks and trust based on values and norms, while also participation in the associations and non-profit organizations that have an impact on the ability of individuals to act as a collective with the aim of achieving the common good (Knack, 2002). In the research on social capital in Częstochowa, the definition of capital formulated by Czapiński and Panka (2015) was adopted, according to which social capital is perceived as social networks regulated by moral norms or customs that connect an individual with society in a manner that facilitates cooperation with others for the common good. The resources of the social networks of inhabitants were adopted as indicators of such a perception of social capital, namely generalized interpersonal trust and voluntary participation in social activities on behalf of the urban community.

A significant attribute of social capital is the resources of social networks, their heterogeneity to be precise, namely mutual ties with other people. The so-called "density of interaction" is beneficial for the members of the community as its participant has ties with a multitude of beneficiaries that are offered by a social network (Sherchan, Nepal, and Paris, 2013). An indicator of the resources of social networks is the number of people with whom the individual makes contact for social or family purposes. The research reveals that first and

foremost, the inhabitants of Czestochowa create a network with acquaintances and friends, while subsequently with family members (Table 1). They usually maintain contact in the networks with a group of between two and five people (57.8%), while subsequently with one person (20.6%), or with a group constituting more than ten people (12.2%). Every tenth person analysed participates in social networks that constitute more than ten people. Social networks that are created in their immediate environment are important for the inhabitants. The research reveals that the inhabitants relatively seldom participate in expanded social networks. A mere one tenth of those analysed participate in networks of six or more people. Most frequently, the analysed inhabitants make contact with one neighbour (46.3%) or with a group of between two and five neighbours (39.6%). Sex type differentiates the analysed group in the case of the sense of belonging to more numerical social networks. Women frequently belong to neighbourly networks enumerating more than six people.

**Table 1.**
*Number of people in contact with those analysed for social and personal purposes in percentage form*

| Type of people with whom those analysed create social networks | | Women | | | | Men | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0-1 people | 2-5 people | 6-10 people | Over 10 people | 0-1 people | 2-5 people | 6-10 people | Over 10 people |
| 1. | From family circle | 22.0 | 47.8 | 17.6 | 12.6 | 27.8 | 50.0 | 14.8 | 7.4 |
| 2. | From circle of friends, work colleagues, from school | 18.5 | 53.8 | 14.9 | 12.8 | 28.7 | 56.3 | 9.8 | 5.2 |
| 3. | From circle of neighbours | 52.7 | 34.2 | 10.3 | 2.8 | 35.3 | 55.1 | 9.1 | 0.5 |

Source: Self-analysis.

For the inhabitants of Czestochowa, an important role is played by family ties. Simultaneously, broader family ties are more significant for women than for men. Positive ties between family members are the foundation of family ties, which have an impact on the feeling of belonging to the family on the part of its members. Research reveals that a significant number of families of the inhabitants are featured by strong family ties, while simultaneously the strongest ties of the inhabitants are with their closest family members (Fig. 1). The weakest ties are featured by families that maintain scarce contact with their family members, even the closest members. The lack of ties with family members is declared by every fifth person analysed.

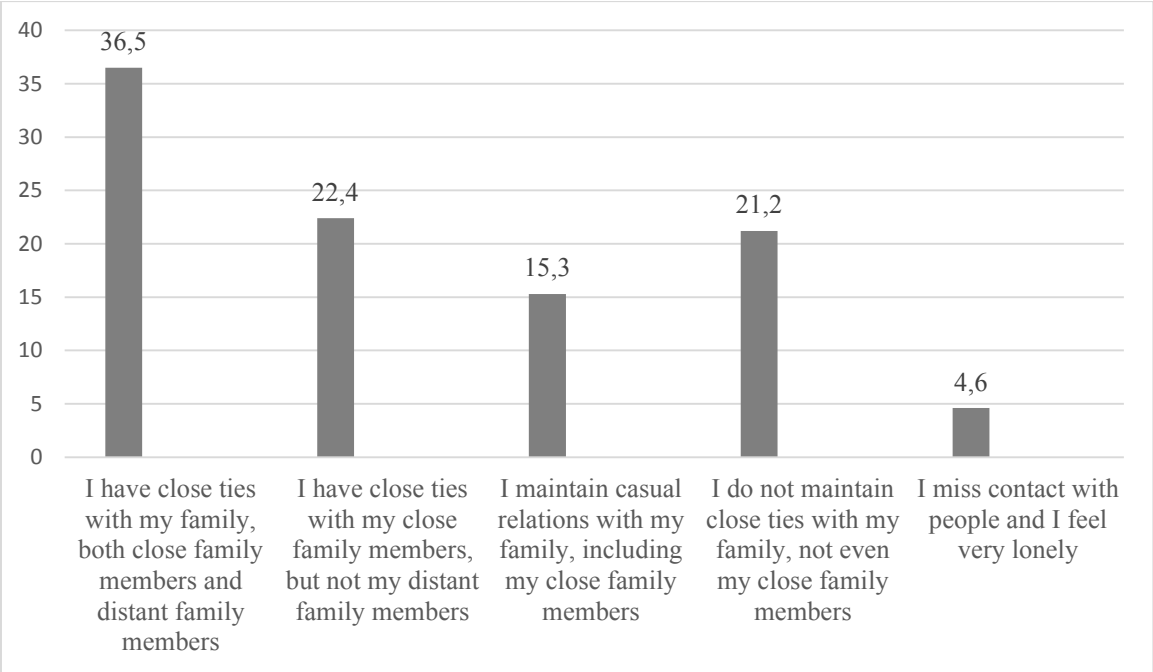


**Figure1.** Evaluation of family ties in percentage form. Source: Self-analysis.

In terms of the functioning of family ties, a significant role is played by the ties between the family members themselves. Their type and intensity has an impact on the cohesion of the family. Data analysis reveals that ties in families are usually based on mutual understanding, respect, trust and loyalty, which certifies to the appropriate functioning of these families (Fig. 2). Nevertheless, in every third family ties are usually based on conflict. This relates to conflict between the parents, between the parents and the children and between siblings. The relatively large group of respondents that does not have any knowledge of what is happening in the family as they fail to maintain any contact is curious. In the majority of cases, this refers to people who had poor contact due to its dispersion. To conclude, family networks are to a large extent based on mutual understanding, respect, trust and loyalty. However, some families base their ties on conflict, which is destructive in terms of their functioning.

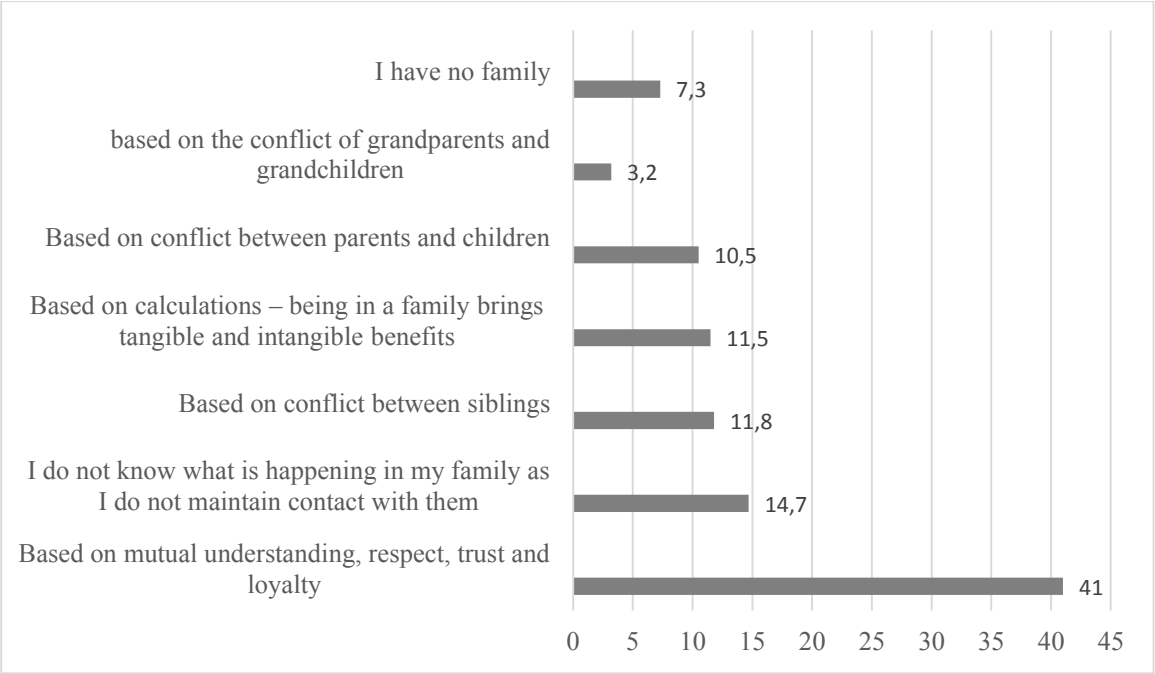


**Figure 2.** Type of relations between family members in percentage form. Source: Self-analysis.

The second attribute of social capital is that of trust. This signifies trust best shown towards other people. It is based on the principle of mutuality along the lines of what should be done for another person without expecting immediate gratification, yet in the hope that in the future this person, or someone else, will return the favour. Mutuality is a social relation that constitutes the main rule of social exchange, while also safeguarding the fulfilment of the social obligation with regard to the partner of exchange in the form of the promise of good, services or gratification. In the functioning of the city, the cooperation between the inhabitants based on trust is significant. A significant indicator of social trust in the city is that of interpersonal trust with regard to neighbours, thus creating the local community. Research shows that the level of trust towards neighbours is at a relatively low level as a mere 14.6% of people have absolute trust in their neighbours, albeit 26.6% of inhabitants trust their neighbours within certain limits (Table 2). A lack of trust is declared by 20.1% of those analysed. A large group of respondents indicated “Difficult to say” (38.6%) in the categories of responses, which signifies that they have no opinion on this matter, thus it is possible to state that they maintain a certain distance when it comes to closer ties with their neighbours. Detailed analysis of interpersonal trust in the city under analysis indicates that men, people aged between 30-39, as well as people with higher level education and professionally active show trust towards their neighbours more frequently.

**Table 2.**
*Level of social trust towards neighbours in percentage form*

| Type of variable | Majority of neighbours can be trusted | It is possible to trust the neighbours, but you can never be too careful | Neighbours cannot be trusted | Difficult to say |
|---|---|---|---|---|
| Sum | 14.6 | 26.6 | 20.1 | 38.6 |
| Sex type | | | | |
| Women | 14.2 | 26.0 | 20.1 | 39.7 |
| Men | 16.1 | 25.2 | 21.9 | 36.8 |
| Up to 18 years of age | 5.8 | 15.9 | 38.5 | 39.8 |
| 18-29 years of age | 8.5 | 19.2 | 32.3 | 40.0 |
| 30-39 years of age | 15.2 | 27.2 | 18.6 | 39.0 |
| 40-49 years of age | 15.8 | 28.1 | 17.2 | 38.9 |
| 50 years of age and older | 13.6 | 20.6 | 28.2 | 37.6 |
| Education | | | | |
| Higher | 15.3 | 27.9 | 21.1 | 35.7 |
| Secondary school | 10.2 | 22.8 | 28.4 | 38.6 |
| Technical school | 8.8 | 15.9 | 35.2 | 40.1 |
| Primary and middle school | 8.0 | 12 | 39.1 | 40.9 |
| Professional activity | | | | |
| Professionally active | 14.2 | 25.6 | 20.1 | 38.6 |
| Pensioners and disability pensioners | 8.5 | 18.9 | 34.0 | 38.6 |
| Non-working people | 7.2 | 16.5 | 37.7 | 38.6 |

Source: Self-analysis.

The lack of social trust, or its limited scope has a negative impact on social ties and on the cohesion of the local community. A high level of social trust restricts the occurrence of social conflicts, however a low level of social trust has an impact on their emergence. Research indicates that conflicts relatively frequently occur between inhabitants. Their high frequency was indicated by every tenth person analysed (11%). Nevertheless, one third of those analysed indicated that they come into conflicts from time to time (32%). More than half of the analysed inhabitants (57%) do not come into conflicts with their neighbours. In sum, the research findings illustrate significant ties between trust and coming into conflicts with neighbours. People who do not trust their neighbours frequently come into conflicts with them.

The third attribute of social capital is the activity of the inhabitants in public life. A manifestation of social activity is the degree of engagement in matters of other people and local communities. Detailed analysis of the scope of engagement of those analysed in local activities illustrates that the respondents declared involvement in the activities of local communities in terms of the civic budget and voluntary work. Simultaneously, the frequency of these activities was at a low level. If we take the general involvement in social activities at a local level into account, 42.1% participated in such activities in the neighbourly communities (Table 3). The inhabitants rarely take part in the other forms of activities. In sum, the civic activity of the inhabitants is at a relatively low level, while at the same time it does not diverge from the level of activity of people in Poland. According to research by Centrum Badania Opinii Społecznej (Centre of Research on Social Opinion -2018), in Poland activity on behalf of local communities is at a similar level. Only 23% of Polish people undertook activities on behalf of

the inhabitants of their own local communities, cities, districts or housing estates. In turn, every sixth person analysed claims that within the last two years they worked voluntarily on behalf of the local communities within the framework of non-governmental organizations, while also got involved as a voluntary worker in various types of social activities (14%), collected signatures for a petition or intervened in an administrative office with regard to a specific issue (13%), or conducted social activity in the local parish or other religious organization (10%). Breaking through the barrier of reluctance in terms of activities on behalf of the community is key in terms of enhancing the quality of life and building the social capital of the district.

**Table 3.**
*Frequency of engagement of those analysed in social activities in the city in percentage form*

| Type of activity | | Type of frequency | | | | | Sum |
|---|---|---|---|---|---|---|---|
| | | No | Rarely | Yes, from time to time | Yes, frequently | Yes, always or almost always | |
| 1. | Activities of neighbourhood community (e.g. clearing the backyard) | 57.9 | 18.7 | 17.1 | 5.1 | 1.2 | 100 |
| 2. | Activities of parish (e.g. clearing the church) | 76.9 | 8.4 | 10.7 | 1.7 | 2.3 | 100 |
| 3. | Activities of local non-governmental organizations | 67.2 | 14.0 | 12.3 | 5.2 | 1.3 | 100 |
| 4. | Participatory budget | 67.7 | 11.9 | 9.8 | 2.6 | 6.2 | 100 |
| 5. | Meetings of District Council | 81.0 | 10.6 | 6.1 | 1.0 | 1.1 | 100 |
| 6 | Other voluntary activities (e.g. non-profit) | 79.7 | 5.9 | 8.9 | 2.5 | 3.0 | 100 |

Source: Self-analysis.

Engagement in local issues grows when the inhabitants are informed about events and the activities undertaken in the area where they live. Research shows that the degree of information is varied depending on the range of activities undertaken (Table 4). The inhabitants possess the greatest knowledge in terms of enterprises and events organized in the close environs, e.g. in the district or backyard where they live and in the very building where they live. They possess relatively less knowledge about events and activities undertaken in the housing estate and in the city of Czestochowa as a whole.

**Table 4.**
*Degree of information about events and activities organized in local communities in percentage form*

| Type of place | | Type of degree | | | | Sum |
|---|---|---|---|---|---|---|
| | | High degree | Medium degree | Low degree | Not informed at all | |
| 1. | In Czestochowa | 11.1 | 28.3 | 48.6 | 12.0 | 100 |
| 2. | In the district where I live | 16.6 | 31.5 | 45.3 | 6.6 | 100 |
| 3. | In the housing estate/in the back yard where I live | 21.5 | 35.0 | 33.8 | 9.7 | 100 |
| 4. | In the building where I live | 19.2 | 32.3 | 33.7 | 14.8 | 100 |

Source: Self-analysis.

Although the inhabitants are informed about what is happening in the close environment, the problem is possessing information about events and activities undertaken in the entire housing estate in the city as a whole. Thus, the question arises as to whether they look for information with regard to events and activities organized in the area of the housing estate. Analysis of the research findings shows that a small number of those analysed (3.2%) search for such information on a regular basis. Relatively more people search for such information from time to time (16.6%), albeit 39.6 % of those analysed seldom search for such information. However, 40.6% of those analysed do not search for information about events and social activities at their place of abode at all.

The degree of information has an impact on the participation in activities on behalf of the local community. Detailed analysis of the ties between the level of engagement in social activities and the degree of information received about events and activities organized in local communities facilitated the definition of their relation. The Gamma correlation was availed of in order to analyse these relations. The degree of information received has first and foremost an impact on the activities of neighbourly communities (e.g. cleaning up the backyard) with relation to such events (Gamma indicator $\gamma = 0{,}405$, $p = 0{,}000$). Hence, the greater the degree of information received regarding social activities in the district, the more likely they are to participate in them. Likewise, the level of engagement of the inhabitants in initiatives undertaken by local non-governmental organizations is influenced by the degree of information received with regard to these initiatives (Gamma indicator $\gamma = 0{,}360$, $p = 0{,}0000$). A relatively lesser impact on active participation in the civic budget is exerted by the degree of information received ($\gamma = 0{,}243$, $p = 0{,}0004$), other voluntary activities (non-profit) ($\gamma = 0{,}236$, $p = 0{,}0008$) and activities of the local parish ($\gamma = 0{,}156$, $p = 0{,}0031$). Nevertheless, the ties between the degree of information received and participation in the meetings of the District Council and activities of the parish were not illustrated.

To conclude, informing the city inhabitants about events and activities undertaken in the area of the district and the city as a whole is an important task for the local authorities. The choice of form and tools applied for the purpose of passing on information is key. The local authorities can choose traditional sources in the form of placing information in the local mass media, or choose modern ways of communication. With relation to this fact, the recognition of the expectations of the inhabitants with regard to the type of medium for information to be passed on is relevant.

Research indicates that in the case of the inhabitants, this medium would be the district paper (44.3%), while subsequently notice boards (35.8%), specially dedicated websites for the events in the district (31.3%), while also applications on a smartphone and electronic forms of information by way of text messages (23.6%). In sum, the inhabitants first and foremost place emphasis on the traditional forms of providing information about events and activities in the housing district. They are interested in modern electronic media forms to a lesser extent. lease put here the acknowledgements for private individuals or institutions that contributed

significantly to the publication, as well as information about the projects in which the article was created. This section is optional and can be omitted by the author.

## Disscasion and Summary

In this research, the attributes of social capital that have an impact on the development of a smart city were identified. One of these is that of neighbourly networks. A cohesive neighbourhood strengthens the collective efficiency, which relates to the degree of which the neighbours are ready to "intervene on behalf of the common good" (Altschuler, Somkin, and Adler, 2004). Participation in the neighbourly networks has an impact on the level of engagement of the inhabitants in terms of activities aimed at greater social cohesion. The social engagement of inhabitants is to a significant extent dependent on the information received about the activities undertaken by others. The inhabitants have the most information about social initiatives undertaken in their closest neighbourhood, namely in the building or area where they live. However, they do not have information about social activities undertaken in the housing estate or in the city as a whole. Research indicates that the more information the inhabitants have about social activities in their district, the more they participate in them. Hence, it is possible to assume that neighbourly networks may help the solutions of a smart city effectively, yet knowledge about them is significant. Similar findings were acquired by Nakano and Washizu (2021), who during the course of analysing social capital in Minato Mirai 21, discovered that information about the social initiatives acquired from social networking services serves the inhabitants by way of enhancing their everyday life, while also intensifying the social ties in the district. With the aim of informing the participants of neighbourly networks better with regard to the various social initiatives, it is possible to avail of ICT. In particular, elderly people who avail of ICT may be more involved from a social viewpoint. ICT prevents their isolation in society and improves their social capital (Kokubun et al., 2022). Giatsoglouat et al. (2016) propose the building of a module platform of City Pulse, on the basis of the analysis of social data in the context of a city. This platform on the basis of a designed backend system, with the appropriate methodology of storage, aggregation and analysis of data, provides access to differentiated data by means of the interfaces of Internet services to stakeholders that serve the fulfillment of their needs. The research findings show that those who avail of the most modern means of communications have better social capital, which in turn translates to a greater feeling of well-being (Kokubun et al., 2022).

A further attribute of social capital that has an impact on the implementation of solutions of a smart city is that of trust, which is strongly connected with neighbourly and family ties. The increased interactions in networks builds trust, which in turn reduces social isolation and divergences in terms of the opportunities between the citizens of various categories of income,

while also increasing civic partnership (Mason, 2010). Research reveals that low trust constitutes a barrier to the development of a smart city in Czestochowa. Hence, it is worth undertaking activities aimed at building greater trust among neighbours, which would have a greater impact on the cohesion of the local communities and would also enhance the standard of living of the inhabitants.

In the implementation of the concept of a smart city, it is helpful to engage the inhabitants in activities on behalf of the city itself and the urban communities. Smart cities usually generate new solutions of hybrid management (Brandtner et al., 2017), in which the significant actors are the inhabitants who are involved both as collective actors organized into formal non-governmental organizations, as well as individual stakeholders. By engaging the members of the community in the creation of policies and becoming familiar with their opinions and viewpoints, the authorities acquire new and broader views of urbanistics, management and development while taking account of the real needs of the city inhabitants (Szarek-Iwaniuk, and Senetra, 2020). A smart city is based on understanding the development of smart cities as a common undertaking of the political authorities and other stakeholders, including the inhabitants themselves, which in turn is favourable towards the development of the "smart inhabitant" (Ros, Thiel, and Grabher, 2022). Research shows that the level of involvement in activities on behalf of the other inhabitants and the city of Czestochowa is at a low level, which is not divergent from other cities. If they do participate, it is most frequently in terms of activities of neighbourly communities, the civic budget and in voluntary work.

To sum up, research on the attributes of social capital in Czestochowa indicates a low level. Their enhancement would lead to the streamlining of the execution of self-government policies by means of strengthening the level of cooperation between the inhabitants. The increase in the level of social capital would help to implement the concept of a smart city in the city under analysis.

## References

1. Adler, P.S., and Kwon, S. (2002). Social Capital: Prospects for a New Concept, *Academy of Management Review, Vol. 27, Iss. 1,* pp.17-40. doi.org/10.2307/4134367.
2. Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J.R., Leung, S., Mellouli, S., Nam, T., Pardo, T.A., Scholl, H.J., and Walker, S. (2012). Building Understanding of Smart City Initiatives. *Lecture Notes in Computer Science, Vol. 7443 LNCS*, pp. 40-53, Retrieved from https://link.springer.com/content/pdf/10.1007/978-3-642-33489-4_4.pdf, 20.05.2022.
3. Albino, V., Berardi, U., and Dangelico, R.M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology, Vol. 22, Iss. 1*, pp. 3-21. doi.org/10.1080/10630732.2014.942092.

4. Altschuler, A., Somkin, C.P., and Adler, N.E. (2004). Local services and amenities, neighborhood social capital, and health. *Social Science & Medicine, Vol. 59, Iss. 6,* pp. 1219-1229. doi.org/10.1016/j.socscimed.2004.01.008.
5. Angelidou, M. (2015). Smart cities: A conjuncture of four forces. *Cities, Vol. 47, Iss. 4,* pp. 95-106. doi.org/10.1016/j.cities.2015.05.004.
6. Bourdieu, P. (1986). The forms of capital. In: J. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education* (pp.241-258). Westport, CT: Greenwood.
7. Brandtner, C., Höllerer, MA., Meyer, RE., and Kornberger, M. (2017). Enacting governance through strategy: a comparative study of governance configurations in Sydney and Vienna. *Urban Studies, Vol. 54, Iss. 5* pp. 1075-1091. doi.org/10.1177/0042098015624871.
8. Brehm, J., and Rahn, W. (1997). Individual-level evidence for the causes and consequences of social capital. *American Journal of Political Science, vol. 41*, *Iss. 3,* pp. 999-1023. doi.org/10.2307/2111684.
9. Caragliu, A., Del Bo, C., and Nijkamp, P. (2011). Smart Cities in Europe, *Journal of Urban Technology, Vol. 18, Iss. 2*, pp. 65–82. doi.org/10.1080/10630732.2011.601117.
10. Caragliu, A., Del Bo, C.F. (2019). Smart innovative cities: The impact of Smart City policies on urban innovation. *Technological Forecasting and Social Change, Vol. 142*, pp. 373-383. doi.org/10.1016/j.techfore.2018.07.022.
11. Centrum Badania Opinii Społecznej (2018). *Zaangażowanie Polaków na rzecz społeczności lokalnej*. Warszawa: CBOS.
12. Coleman, J.S. (1988). Social Capital in the Creation of Human Capital. *The American Journal of Sociology*, *Vol. 94*, Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure (1988), pp. S95-S120. Retrieved from: https://www.bebr.ufl.edu/sites/default/files/Coleman%20J.%20(1988)%20Social%20Capital%20in%20the%20Cration%20of%20Human%20Capital.pdf, 28.05.2022.
13. Czapiński, J., and Panek, T. (ed.) (2015). *Diagnoza społeczna 2015. Warunki i jakość życia Polaków*. Warszawa: Rada Monitoringu Społecznego.
14. De Guimarães, J.C.F., Severo, E.A., Júnior, L.A.F., Da Costa, W.P.L.B., and Salmoria, F.T. (2020). Governance and quality of life in smart cities: Towards sustainable development goals. *Journal of Cleaner Production, Vol. 253*, 119926. doi.org/10.1016/j.jclepro.2019.119926.
15. Duan, W.W., Nasiri, R., and Karamizadeh, S. (2019). *Smart City Concepts and Dimensions, ICIT 2019*. Proceedings of the 2019 7th International Conference on Information Technology: IoT and Smart City, pp. 488-492, doi.org/10.1145/3377170.3377189.
16. Dziadkiewicz, M. (2014). Centre of Social Integration as a tool of professional reintegration of the permanently unemployed in Czestochowa. *Polish Journal of Management Studies Vol. 9*, pp. 23-33.

17. Foth, M., Hudson-Smith, A., and Gifford, D. (2016). Smart cities, social capital, and citizens at play: A critique and a way forward. In: M., Zhegu, and F.X. Olleros (Eds.), *Research handbook on digital transformations (Research Handbooks in Business and Management)* (pp. 203-221). Cheltenham UK: Edward Elgar Publishing.
18. Fukuyama, F. (1995). *Trust. The social virtues and the creation of prosperity*. New York: The Free Press.
19. Giatsoglou, M., Chatzakou, D., Gkatziaki, Vakali, A., and Anthopoulos, L. (2016). CITYPULSE: A Platform Prototype for Smart City Social Data Mining. *Journal of the Knowledge Economy*, *Vol. 7, Iss. 2,* pp. 344-372. doi.org/10.1007/s13132-016-0370-z.
20. Gooderham, P.N. (2007). Enhancing Knowledge Transfer in Multinational Corporations: A Dynamic Capabilities Driven Model. *Knowledge Management Research & Practice, Vol. 5, Iss. 1,* pp. 34-43. doi.org/10.1057/palgrave.kmrp.8500119.
21. Hanifan, L.J. (1916). The rural school community centre, *The Annals of the American Academy of Political and Social Science, Vol. 67*, pp. 130-138. Retrieved from https://www.jstor.org/stable/pdf/1013498.pdf, 4.06.2022.
22. Januszek, H. (2005). Wprowadzenie. In: H. Januszek (ed.), *Kapitał społeczny we wspólnotach* (pp. 5-11). Poznań: Wyd. AE w Poznaniu.
23. Kabus, J. (2017). Development of Entrepreneurship with Support of Local Self-Governments, on the example of Belchatow County. *Zeszyty Naukowe Politechniki Częstochowskiej, Nr 27, t. 1*, pp. 162-171, DOI: 10.17512/znpcz.2017.3.1.14.
24. Knack, S. (2002). Social capital, growth and poverty: a survey of cross-country evidence. In: Ch. Grootaert and T. van Bastelaer (Eds.), *The Role of Social Capital in Development: An Empirical Assessment* (pp. 42-84). Cambridge, UK: Cambridge University Press.
25. Kokubun, K., Ogawa, T., Browne, R., Shinada, T., Granrath, L., Moeller, J., Tram, N., Wieching, R., and Taki, Y. (2022). Social Capital Mediates the Association between the ICT Usage and Well-Being of Older People in Japan: Implication for a New Design Paradigm. *Sustainability*, *Vol. 14, Iss. 7,* 4148. doi.org/10.3390/su14074148.
26. Kourtit, K., Nijkamp, P., and Arribas, D. (2012). Smart Cities in Perspective – A Comparative European Study by Means of Self-organizing Maps. *Innovation: The European Journal of Social Science Research, Vol. 25, Iss. 2,* pp. 229-246. doi.org/10.1080/13511610.2012.660330.
27. Kuzior, A., and Sobotka, B. (2019). The Role of Social Capital in the Development of Smart Cities. *Scientific Papers of the Silesian University of Technology, Organisation and Management Series*, *No. 134*, pp. 109-119. doi.org/10.29119/1641-3466.2019.134.9.
28. Lombardi, P., Giordano, S., Farouh, H., and Yousef, W. (2012). Modelling the Smart City Performance. *Innovation: The European Journal of Social Science Research, Vol. 25, Iss. 2,* pp. 137-149. doi.org/10.1080/13511610.2012.660325.

29. Macke, J., Rubim Sarate, J.A., de Atayde Moschen, S. (2019). Smart sustainable cities evaluation and sense of community. *Journal of Cleaner Production*, *Vol. 239*, 118103. doi.org/10.1016/j.jclepro.2019.118103.
30. Mason, S.G. (2010). Can community design build trust? A comparative study of design factors in Boise, Idaho neighborhoods. *Cities, Vol. 27, Iss. 6,* pp. 456-465. doi.org/10.1016/j.cities.2010.07.003.
31. Mateju, P. (2002). *Social Capital: Problems of its conceptualization and measurement in transforming societies.* UK Office for National Statistics and the OECD through the Centre for Educational Research and Innovation, and took place in London on 25-27 September, Retrieved from https://www.oecd.org/innovation/research/socialcapitalthechallengeofinternationalmeasurement25-27september2002londonuk.htm.
32. Mayer, R., Davis, J., and Schoorman, F. (1995). An integrative model of organizational trust. *Academy of Management Review*, *Vol. 20, Iss. 3,* pp. 709-739. doi.org/10.2307/258792.
33. Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital and the organizational Advantage. *Academy of Management Review*, *Vol. 23, Iss. 2*, pp.242-266. doi.org/10.2307/259373.
34. Nakano, S., and Washizu, A. (2021). Will smart cities enhance the social capital of residents? The importance of smart neighborhood management. *Cities, Vol. 115*, 103244. doi.org/10.1016/j.cities.2021.103244.
35. Nam, T., and Pardo, T.A. (2011). *Conceptualizing Smart City with Dimensions of Technology, People, and Institutions.* Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, College Park, 12-15, pp. 282-291. Retrieved from https://ctg.albany.edu/media/pubs/pdfs/dgo_2011_smartcity.pdf, 8.06. 2022.
36. Olejniczak-Szuster, K. (2021). *Przedsiębiorca społecznie odpowiedzialny: motywy strategie działania w dobie pandemii COVID-19*, Częstochowa: Wydawnictwo Politechniki Częstochowskiej.
37. Ramirez-Rubio, O., Daher, C., Fanjul, G., Gascon, M., Mueller, N., Pajín, L., Plasencia, A., Rojas-Rueda, D., Thondoo, M., and Nieuwenhuijsen, M.J. (2019). Urban health: An example of a "health in all policies". Approach in the context of SDGs implementation. *Globalization and Health*, *Vol. 15, Iss. 1,* 87. doi.org/10.1186/s12992-019-0529-z.
38. Rose, F.M., Thiel, J., and Grabher, G. (2022). Selective inclusion: Civil society involvement in the smart city ecology of Amsterdam. *European Urban and Regional Studies*, *Vol. 29, Iss. 3*, pp. 369-382. doi.org/10.1177/09697764221092587.
39. Sherchan, W., Nepal, S., and Paris, C. (2013). A survey of trust in social networks. *ACM Computing Surveys, 45, Article 47.* doi.org/10.1145/2501654.2501661.
40. Skawińska. E. (2012). Kapitał społeczny w świetle literatury. In: E. Skawińska (ed.), *Kapitał społeczny w rozwoju regionu* (pp. 9-16). Warszawa: PWN.

41. Skiba, Ł. (2021). Managing Employee Engagement in the Reality of Organisational Changes. *Polish Journal of Management Studies, 24(1)*, pp. 354-372.
42. Stolle, D., and Lewis, J. (2002). Social Capital—An Emerging Concept. In: B. Hobson, J. Lewis, B. Siim (Eds.), *Contested Concepts in Gender and European Social Politics* (pp. 195-229). Cheltenham: Edward Elgar Press.
43. Szarek-Iwaniuk, P., and Senetra, A. (2020). Access to ICT in Poland and the Co-Creation of Urban Space in the Process of Modern Social Participation in a Smart City - A Case Study. *Sustainability, Vol. 12,* 2136; doi:10.3390/su12052136.
44. Taylor, M. (2000). Communities in the lead: Power, organisational capacity and social capital. *Urban Studies*, *Vol. 37*, pp. 1019-1035. doi.org/10.1080/00420980050011217.
45. Van Brussel, S., and Huyse, H. (2019). Citizen science on speed? Realising the triple objective of scientific rigour, policy influence and deep citizen engagement in a large-scale citizen science project on ambient air quality in Antwerp. *Journal of Environmental Planning and Management*, *Vol. 62, Iss. 3*, pp. 534-551.

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# OPTIMIZATION OF TRANSPORT PROCESSES IN AN ENTERPRISE BY THE SMED METHOD

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**Objective:** The objective of the article was to present the basic issues related to the functioning of transport processes in an enterprise, getting acquainted with and analysing selected areas of transport of the observed enterprise and showing how the practical use of information on the existing transport processes in the enterprise using selected methods and research tools allows for process optimisation.
**Design/methodology/approach**: To determine the causes of the problem, it was decided to use quality management tools, i.e. the five whys analysis and fishbone diagram. In order to perform a detailed analysis, it was decided to use the SMED method to parameterise the implementation of the transport process.
**Findings: The** analysis carried out before and after the introduction of the changes allowed to determine whether the problem was solved and what benefits the company gained. Examining the time of individual transport processes allowed to implement a new IT system, which contributed to the development of the company and allowed to save a large amount of capital.
**Originality/value:** The results of the study can be used in strategic decisions of the company in the area of optimisation of transport processes.

**Keywords:** transport process, optimisation, SMED.

## 1. Introduction

The process is understood as consecutive and causally related defined changes (activities) (Twaróg, 2016, p. 26). The process is therefore a set of activities that transform the factors in the initial phase of the process into a result (starting factors) (Kubicki, Kuriata, 2000, p. 20).

According to the literature, "the transport process is understood as a set of organizational, executive and administrative activities carried out in a specific order in connection with the movement of loads by means of transport" (Jacyna, 2016).

Other definitions of the transport process appear in the literature on the subject, the meaning of which is identical to the definition presented above. One of them defines the transport process "as a series of coordinated executive, organizational and commercial activities that are to lead to the movement of cargo from one or more dispatch points, to one or more reception points, in the most efficient way possible using appropriate means of transport" (Zgutka, Rokicki, 2015, pp. 82-83).

In the simplest way, the transport process can be defined as a sequence of specific tasks interrelated with each other, as a result of which specific goods will be delivered to the indicated recipient (Starkowski, 2016, p. 1546).

S. Kauf in his work Transport and storage defined the transport process as a set of coordinated activities related to the time-space transformation of products and information, in accordance with the terms of a contract between the carrier and the customer (Kauf, 2016, p. 140).

The transport process itself consists of three stages: loading, actual transport and unloading, depending on the complexity of the transport process, these parts may be increased by additional processes such as: preparation of the goods for transport, storage, acceptance of the cargo along with its handling in cooperation with other means of transport or activities related to the forwarding service of the recipients (Goździewska, 2012, p. 754).

Organizational, executive and commercial activities are three basic activities that make up the transport process (Michalak, Staniewska, 2010, pp. 104-106). The organizational activities cover designing an appropriate transport route and preparing the necessary transport documentation. Executive activities are the transport of goods and other processes related to it, i.e. loading, movement and unloading. Each of these processes can be expanded with a number of operations related to the type of cargo, route length, etc.

## 2. Analysis and determination of the cause of the research problem

In order to achieve goals, the company decided to increase its scale of operations by implementing a larger number of transport orders, which resulted in the number of orders handled increasing by 20% per month. Such a situation resulted in problems with maintaining the deadlines of cargo delivery, which resulted in an increase in complaints by 13%. Therefore, the company decided to set up a team whose goal was to solve the problem. The team is composed of the following people:

- administration employee,
- logistics and transport specialist,

- driver,
- accountant.

To determine the causes of the problem, it was decided to use quality management tools, i.e. five whys analysis and fishbone diagram (Hubert, 2006, pp. 2-6). As shown by the five whys, the main reason for the increase in the level of complaints related to the increase in the scale of the organization's operation is the lack of IT adaptation to the large number of supported orders. During the meeting, the team members indicated that this is a clear problem due to the fact that the current management of orders takes place on the basis of an Excel sheet. A large number of data is the reason why very often drivers receive an inefficient route plan for delivery orders in a given period, which results in the fact that drivers often travel to one area several times causing delays in delivery, and an increase in the operating costs of the organization.

In order to present a wide range of problems that affect the delays in the execution of orders, it was also decided to conduct an analysis using the Ishikawa diagram. This tool allowed to see the real picture of problems occurring at various levels in the organization.

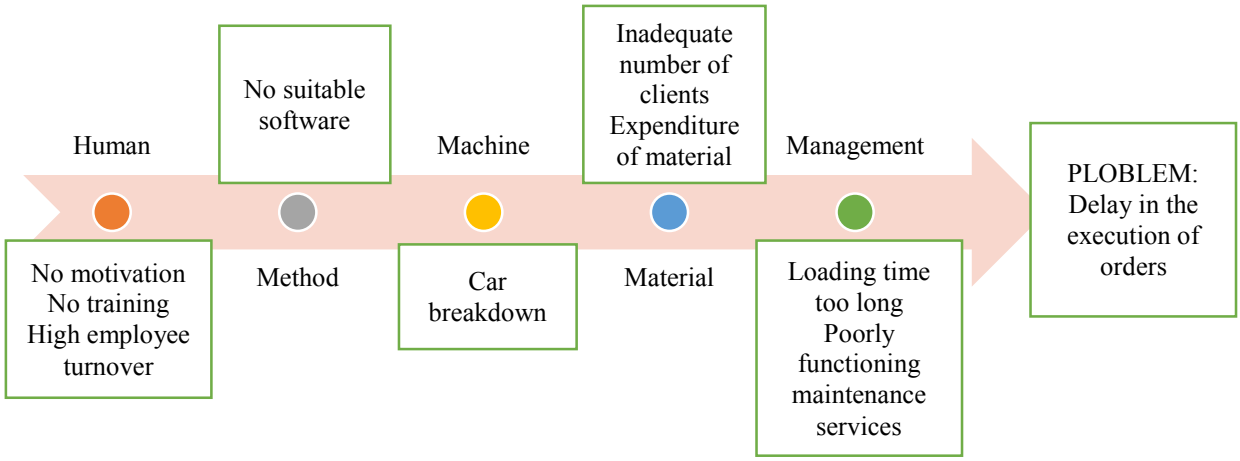


**Figure 1.** Ishikawa diagram showing the analysis of the examined problem. Source: Own study based on observations of a transport company.

The above analysis shows that there are more problems in the company that contribute to an increased number of complaints. The team members indicated a number of problems such as high employee rotation and thus the lack or ineffective training of the management staff. Again, it was pointed out that a big problem is the lack of an appropriate system for comprehensive order management, which affects the supervision of the vehicle fleet. The team members also pointed out the fact that it very often happens that vehicles fail, and the waiting time for repair extends quite significantly, which negatively affects the timeliness of deliveries.

The above study allowed to select areas that should be subjected to an in-depth analysis and to suggest activities that will allow for a more efficient implementation of the transport process.

In order to perform a detailed analysis, it was decided to use the SMED method to parameterize the implementation of the transport process. SMED (Single Minute Exchange of Die) is a method enabling comprehensive reduction of the time of machine and process

changeovers, as it turned out also in transport processes (Shigeo, 1986; Womack, 2001, pp. 10-15). It allows results to be achieved in a very short period, without having to bear heavy financial burdens. It consists of three stages: The first stage is the division of operations. The second stage is observation and analysis. The third stage is to implement the changes.

Time measurements were made by the logistics specialist when handling 2 transport orders on different days. The measurement results obtained in Tables 1, 2, 3 and 4 are presented below.

**Table 1.**
*Measurement results obtained during the first transport order*

| **TIME MEASUREMENT WORKSHEET** | | | | |
|---|---|---|---|---|
| **Change** | 1 | **Order number** | 2345987 | |
| **Date** | 17 November 2021 | **Order type** | recurring | |
| **Operation** | Transport | **Driver's number** | 1298 | |
| | | Prepared by | **Logistics and Transport Specialist** | |
| **Work item name** | **Start point** | **End point** | **Value expressed in minutes** | **Additional notes (non-cyclical operations)** |
| **1. Preparatory activities** | **06:00** | **10:30** | 163 | |
| Entering orders in the register | 06:00 | 07:13 | 73 | |
| Establishing a daily delivery schedule | 07:13 | 08:10 | 57 | 10 minutes waiting time for information from the sales department employee (incomplete information on the order) |
| Handing over the schedule for implementation | 08:10 | 08:25 | 15 | |
| Preparing transport units | 08:25 | 08:43 | 18 | |
| **2. Implementing the transport order** | **08:43** | **11:30** | 107 | |
| Arriving at the customer's | 08:43 | 9:20 | 37 | 13 min car refuelling |
| Waiting for loading | 9:20 | 09:35 | 15 | |
| Loading | 09:35 | 10:00 | 25 | |
| Securing the transport | 10:00 | 10:15 | 15 | 8 min problem with the belt clamp (tool blocking) |
| Waiting for documents to be issued | 10:15 | 10:30 | 15 | |
| Transport to the end customer | 10:30 | 11:30 | 60 | 25 min failure (overheated coolant)<br>21 min road accident |
| | | | | (waiting in traffic) |
| **3. Completing the transport order** | **11:30** | **12:20** | 50 | |
| Waiting for unloading | 11:30 | 11:43 | 13 | |
| Unloading | 11:43 | 12:05 | 22 | |
| Waiting for documents to be issued | 12:05 | 12:15 | 10 | |
| Closing the order | 12:15 | 12:20 | 5 | |

Source: Own study based on internal materials of a transport company.

**Table 2.**
*Sum of times and percentage of individual transport processes obtained during the first transport order*

| Operations | Time [min] | Share [%] |
|---|---|---|
| Preparatory activities | 163 | 51 |
| Execution of the transport order | 107 | 33 |
| Transport order completion | 50 | 16 |
| Total order time | 320 | 100 |

Source: Own study based on internal materials of a transport company.

**Table 3.**
*Measurement results obtained during the second transport order*

| TIME MEASUREMENT WORKSHEET | | | | |
|---|---|---|---|---|
| **Change** | 1 | **Order number** | 2346754 | |
| **Date** | 20 January 2022 | **Order type** | recurring | |
| **Operation** | Transport | **Driver's number** | 1298 | |
| | | Prepared by | **Logistics and Transport Specialist** | |
| **Work item name** | **Start point** | **End point** | **Value expressed in minutes** | **Additional notes (non-cyclical operations)** |
| **1. Preparatory activities** | **06:00** | **10:30** | 166 | |
| Entering orders in the register | 06:00 | 07:18 | 78 | |
| Establishing a daily delivery schedule | 07:18 | 08:15 | 53 | |
| Handing over the schedule for implementation | 08:15 | 08:31 | 16 | |
| Preparing transport units | 08:31 | 08:50 | 19 | No belts and tensioners available (waiting for delivery from a warehouse) |
| **2. Implementing the transport order** | **08:50** | **14:20** | 330 | |
| Arriving at the customer's | 08:50 | 9:30 | 40 | 20 min refuelling |
| Waiting for loading | 9:30 | 09:40 | 10 | |
| Loading | 09:40 | 10:00 | 20 | |
| Securing the transport | 10:00 | 10:08 | 8 | |
| Waiting for documents to be issued | 10:08 | 10:30 | 22 | |
| Transport to the end customer | 10:30 | 14:20 | 230 | 170 min failure (overheated coolant) |
| **3. Completing the transport order** | **14:20** | **12:20** | 85 | |
| Waiting for unloading | 14:20 | 15:00 | 40 | 30 minutes of extra waiting time for being late |
| Unloading | 15:00 | 15:30 | 30 | |
| Waiting for documents to be issued | 15:30 | 15:40 | 10 | |
| Closing the order | 15:40 | 15:45 | 5 | |

Source: Own study based on internal materials of a transport company.

**Table 4.**
*Sum of times and percentage of individual transport processes obtained during the second transport order*

| Operations | Time [min] | Share [%] |
|---|---|---|
| Preparatory activities | 166 | 29 |
| Execution of the transport order | 330 | 57 |
| Transport order completion | 85 | 14 |
| Total order time | 581 | 100 |

Source: Own study based on internal materials of a transport company.

In both cases, the preparatory activities took a similar amount of time of about 160 minutes. It was clearly observed that the order execution time was significantly different due to the occurrence of failures during transport. In both cases, there was a failure, in the first one it lasted 25 minutes. However, in the second one, it lasted as many as 170 minutes, which caused significant delays in delivery, by more than 3 hours. This also impacted the longer waiting time for unloading and thus the delay and waste of time expanded. During the measurements, a number of irregularities were observed, which significantly impacted the efficiency of the execution of orders, i.e.:

- waiting for information from sales department employees if the order is incomplete or inconsistent,
- refuelling the vehicle,
- vehicle failure,
- waiting in the queue for unloading due to a significant delay.

## 3. Implementing changes

The above analysis made it clear where the greatest losses of time occur in enterprise X and indicated the places that require changes to be introduced, thanks to which the transport process will be carried out faster and more effectively. The following table presents the tasks the implementation of which will increase the efficiency of transport orders.

**Table 5**.
*Register and status of implementation of tasks to be implemented in a transport company*

| No. | Task description | Date of execution | Person responsible | Implementation status |
|---|---|---|---|---|
| 1 | Tender announcement and selection of a system for comprehensive management of transport and vehicle fleet | by the end of May 2020 | Company owner | completed |
| 2 | Implementing system XXX | by the end of October 2020 | Representatives of the company implementing the system | completed |

Cont. table 5.

| | | | | |
|---|---|---|---|---|
| 3 | Training for employees regarding the use of system XXX | by 15 November 2020 | Representatives of the company implementing the system | completed |
| 4 | Introduction of TPM for the vehicle fleet | by the end of June 2020 | UR Master | completed |
| 5 | Introduction of SUR standby shifts | by the end of June 2020 | UR Master | completed |
| 6 | Purchase of new belts and clamps | by 1 April 2020 | Company owner | completed |
| 7 | Introduction of emergency instructions | by September 2021 | Logistics and Transport Specialist | completed |
| 8 | Signing a contract with a partner transport company for occasional execution of orders | by 1 January 2021 | Logistics and Transportation Specialist Company Owner | completed |

Source: Own study based on internal materials of a transport company.

Re. 1, 2, 3. In order to reduce the waiting time for entering orders into the system and waiting for the creation of a daily delivery plan, it was decided to purchase a system for comprehensive management of a transport company. The software is to be comprehensive and be able to remotely enter orders into the system, automatically generate a daily delivery plans based on the most optimum routes. An additional but a priority guideline is the possibility of comprehensive management of the vehicle fleet. It is expected that the system will contain information about drivers, mileage, condition of vehicles, current order in progress, fuel consumption, failures, delays. A very important guideline is that the system must have an advanced GPS that will determine effective routes and inform about delays on an ongoing basis. Completion of these tasks will eliminate time wasting and unnecessary operating costs.

Ad. 4, 5, 6. In order to avoid time losses related to vehicle breakdowns, it is recommended to introduce a prevention in SUR (Maintenance Service). Every day, according to the schedule, mechanics are obliged to carry out inspections and repairs of the vehicle fleet. Such actions will minimize losses associated with vehicle failures that are on the road, which is very expensive and causes a lot of problems. Early detection of failures will allow to respond faster.

Ad. 7. It was diagnosed that there is no instruction in the organization related to responding in emergency situations, when there is a shortage of vehicles as a result of accidents or failures, which causes delays in the execution of orders and, in the worst case, their cancellation, which adversely affects the company's image. The manual will clearly inform who needs to do what and when in order to maintain the continuity of deliveries.

Ad. 8. In order to protect the organization against various random events, i.e. the lack of available fleet in the event of failures or accidents, it was decided in reference to point 7, to establish a partnership with a transport company for occasional execution of orders in the case of different random situations occurring. Such an action will allow to maintain the continuity of execution of orders, and at the same time will allow to achieve success by the company.

## 4. Analysis and results after implementing changes

After implementing the changes described in the subsection, the company became orderly. Thanks to the rapid flow of information, the problem of transport delays has been minimized. This is evidenced by the fact that in February 2021, there was a decrease in complaints related to extensively long transport time by 8 percent, which allows to state that the change was effective.

In order to check to what extent the changes affected the execution of orders in March 2021, SMED analysis was carried out again, the following results were obtained.

**Table 6.**
*Measurement results obtained during a transport order after introducing changes*

| TIME MEASUREMENT WORKSHEET | | | | |
|---|---|---|---|---|
| **Change** | 1 | **Order number** | 2609584 | |
| **Date** | 2 March 2021 | **Order type** | recurring | |
| **Operation** | Transport | **Driver's number** | 1298 | |
| | | Prepared by | **Logistics and Transport Specialist** | |
| **Work item name** | **Start point** | **End point** | **Value expressed in minutes** | **Additional notes (non-cyclical operations)** |
| **1. Preparatory activities** | **06:00** | **06:32** | 42 | |
| Entering orders in the register | 06:00 | 06:05 | 5 | |
| Establishing a daily delivery schedule | 06:05 | 06:10 | 5 | report automatically generated by the system |
| Handing over the schedule for implementation | 06:10 | 06:12 | 2 | report sent automatically by the system |
| Preparing transport units | 06:12 | 06:32 | 30 | |
| **2. Implementing the transport order** | **06:32** | **08:30** | 118 | |
| Arriving at the customer's | 06:32 | 07:00 | 28 | |
| Waiting for loading | 07:00 | 07:10 | 10 | |
| Loading | 07:10 | 07:30 | 20 | |
| Securing the transport | 07:30 | 07:40 | 10 | |
| Waiting for documents to be issued | 07:40 | 07:50 | 10 | |
| Transport to the end customer | 07:50 | 08:30 | 40 | 10 min accident (no alternative route - system alert) |
| **3. Completing the transport order** | **08:30** | **09:16** | 46 | |
| Waiting for unloading | 08:30 | 08:40 | 10 | 30 minutes of extra waiting time for being late |
| Unloading | 08:40 | 09:00 | 20 | |
| Waiting for documents to be issued | 09:00 | 09:15 | 15 | |
| Closing the order | 09:15 | 09:16 | 1 | |

Source: Own study based on internal materials of a transport company.

**Table 6.**
*Sum of times and percentage of individual transport processes obtained during a transport order after implementing changes*

| Operations | Time [min] | Share [%] |
|---|---|---|
| Preparatory activities | 42 | 20 |
| Execution of the transport order | 118 | 57 |
| Transport order completion | 46 | 23 |
| Total order time | 206 | 100 |

Source: Own study based on internal materials of a transport company.

According to the SMED analysis, after implementing the changes, the execution time of orders decreased by about 45%, which is an excellent result for the company. The greatest time savings were achieved during preparatory activities, where the time was reduced by 120 minutes thanks to the use of an IT system to manage the organization, which automatically performs the work schedule based on the entered data and selects the most effective routes in real mode. The second very important process, which, thanks to optimization, brought the greatest time savings, was the operation of executing the transport order. Thanks to the introduction of vehicle fleet supervision by a special IT system and the implementation of daily TPMs for trucks, the failure rate decreased by more than 80%, as evidenced by the faster delivery time by more than 200 minutes.

Such a situation allowed to solve the research problem, because the level of complaints decreased by 8 percent. Due to the above, the company can grow on the transport services market. Due to the implemented changes, X recorded significant increases in revenues for completed orders. Due to eliminating losses, the costs of executing one transport order decreased by 30% (lower fuel consumption, no penalties for delays, lower operating costs of vehicles).

## References

1. Biniasz, D. (2014). Role and function of internal transport of small manufacturing enterprises – case study. *Logistics, 3*.
2. Goździewska, A. (2012). Analysis of transport processes at the construction of the pavement of selected motorways in the Netherlands. *Logistics, 6.*
3. Huber, Z. *Five Whys Methodology*, http://www.strefa-iso.pl/5-why.htm.
4. Jacyna, I. (2009). Organization of transport processes in a waste collection company. *Scientific Papers of the Warsaw University of Technology.* Warsaw.
5. Jacyna, I. (2009). The role of transport in the implementation of logistics processes of an enterprise. *Scientific Papers of the Warsaw University of Technology*, z. *69.* Warsaw.
6. Kauf, S. (2016). Transport and storage. In: S. Kauf (ed.), *Manual of logistics.* Warsaw: Difin.

7. Kubicki, J., Kuriata, A. (2000). *Logistic problems in modelling transport systems*. Warsaw: Wydawnictwo Komunikacji i Łączności Publishing House.
8. Mendyk, E. (2008). *Transport economics*. Poznan: University of Logistics.
9. Michalik, J., Staniewska, E. (2010). Transport processes at an enterprise. *Logistics, 4*.
10. Shigeo, S. (1985). A revolution in manufacturing: the SMED system. Portland, Oregon: Productivity Press.
11. Starkowski, D. (2017). Analysis of the transport process with an example of a selected transport and forwarding enterprise during transport of strawberries. Part two – theoretical principles of planning transport operations. *Buses, 6*.
12. Twaróg, S. (2016). Logistics system. In: S. Kauf (ed.), *Manual of logistics.* Warsaw: Difin.
13. Womack, J.P., Jones, D.T. (2001). *Slimming of Companies. Eliminating waste – the key to success.* Warsaw: Manager Information Centre.

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# HANDLING OF MEDICAL DEVICES' CUSTOMER COMPLAINTS ON THE EXAMPLE OF COMPANIES BASED IN POLAND

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**Purpose:** The main purpose of this article was to identify and analyze correction activities and corrective actions, taken by medical devices' companies, as a result of a customer complaint.
**Design/methodology/approach**: The article presents the results of the study conducted among medical devices' companies, operating on the Polish market. These companies have implemented and certified quality management system in accordance with the requirements of ISO 13485. In addition, these companies, as part of their activities, carry out various processes related to medical devices, but performing production process was the main criteria for qualifying the company for the study. On this basis, 209 companies, meeting these criteria, have been defined. The study was conducted using a survey questionnaire, available in electronic form. As part of the survey, 90 correctly completed survey questionnaires were received, what means that the response rate of surveys reached the level of 43%.
**Findings:** The most important correction activities, indicated by the surveyed companies, include verification of suspicious products throughout the whole supply chain and replacement of a defective product with a new one. From the corrective actions perspective almost 70% of respondents indicated trainings of production employees. This is strongly related to the identified root causes, by these companies, as operators' errors (50% of the causes lie with such errors). Almost 50% of respondents declared the update of work instructions as a corrective action, which is also related to the high number of indications for operator trainings.
**Originality/value:** The article presents main activities, that are taken by the medical devices' companies in Poland to increase the safety and performance of medical devices, if an abnormality occurs. The article may be treated as an benchmark for medical devices companies once reviewing their approach to implementing corrections and corrective actions.

**Keywords:** Customer complaint, medical device, containment, corrective actions.

**Category of the paper:** Research study.

## Introduction

Medical devices are key products for the provision of healthcare, both from the prevention and treatment side. Medical devices cover a wide range of products, from syringes to advanced diagnostic and surgical devices. Depending on the market, different devices may be classified as medical devices. It is assumed that there may be up to 2 million medical devices in the world (POLMED, 2022).

The medical devices industry is a very dynamically developing branch of industry, both on a global scale and in Poland. The development of the medical device market has been observed for many years, as well as the prospect of future, of at least 8 years, looks definitely promising. In 2021, the value of the global medical device market was estimated at USD 488.98 billion. In 2022, the market is projected to reach $495.46 billion and is projected to grow steadily to reach $718.92 billion in 2029. The growing market for medical devices is associated with a high demand for medical devices, and this demand is caused by many factors, such as: an aging society, the spread of chronic diseases, increasing emphasis on early diagnosis of diseases and preventive treatment. However, global turmoil, such as the global COVID-19 pandemic, is not without significance for the development of the market. It caused a decrease in the market of medical devices by 1.9% in 2020 compared to 2019 (Medical Market Research Report, 2022). On the one hand, there was a much higher demand for medical devices used to equip hospitals and the so-called temporary hospitals (e.g. medical beds), and on the other hand, there was visible decrease in demand for medical devices not related to the fight against the effects of the coronavirus. A smaller number of planned treatments and operations resulted in the cancellation or postponement of orders for medical devices for surgical, oncological or aesthetic medicine applications. Companies, belonging to the medical device industry, had to approach their activities in a very flexible way and revise them to meet current needs (Queen, 2021, pp. 247-248).

The value of the Polish medical devices market, measured by the revenues of enterprises in this sector, was estimated at PLN 17.5 billion in 2020 (POLMED, 2022). The cited value of the medical devices market in Poland is systematically growing, which can be seen basing on the comparison of this value with the value of the market from 2010, when it amounted to PLN 3.5 billion (Rutkowski, 2021). The POLMED report (2022) also specifies that in Poland there is a significant number of entities that are manufacturers, importers or distributors of medical devices, which was estimated at 5266 enterprises.

The need to develop diagnostic and treatment procedures, within the healthcare system, causes a dynamic development of the medical devices market, on a global scale, in Europe or in Poland, as mentioned above. However, this development not only brings opportunities for the development of enterprises in this industry, but also may bear the hallmarks of risk. These risks may be related to the high speed of introduction of new, innovative products on the

market, which are also designed and manufactured in a dynamic and changing environment. This, in turn, can cause defects of medical devices, that can appear at different stages of the device's life cycle, from the design phase of the device to the delivery, servicing and disposal phase of the device. The defects in question and the related irregularities in the functioning of the medical device are not limited to any type of medical device – it may concern any type of medical equipment. The consequences can be seen as a threat to the health or life of patients. Such a threat may occur in the form of infections, a longer time of conducting a medical procedure or the need to stop it while working (Wąsik, 2017).

Medical devices that do not meet their intended function (effectiveness) or are considered dangerous (device safety), in addition to local regulations on reporting medical incidents, are reported to the manufacturer (directly or indirectly) for the purpose of conducting a complaint procedure. The complaint procedure is aimed, above all, at the ongoing protection of users of medical devices and ultimately the introduction of such actions that will prevent the occurrence of a problem in the future, due to the identified root cause. Based on the above, purpose of this article is to identify and analyze corrections and corrective actions, taken by companies in the medical device industry in Poland, as a result of a complaint received regarding a medical device. One can assume than that properly planned and implemented corrections and corrective actions are an important element in ensuring the safety and effectiveness of medical devices.

## 2. Safety and effectiveness of medical devices

Medical devices, due to their use in the health care system, are treated as devices of particular importance. It is required that medical devices, when providing medical assistance, will be characterized by safety and effectiveness in relation to the patient and persons, performing medical procedures (Wąsik, 2017). Analyzing the historical and current European regulations in the field of medical devices, it can be concluded that the safety of medical devices means the absence of unacceptable risk when the device is used in accordance with its intended purpose, defined by the manufacturer (EU Regulation 2017/745; Feliczek, 2014). Analogous to the safety feature of a medical device, the second key parameter is the effectiveness of its functioning. In turn, performance should be understood as the ability of a device to achieve its intended use, while the product is used as defined by the manufacturer (EU Regulation 2017/745).

In order to ensure the safety and effectiveness of a medical device, laws and regulations are created and must be implemented, by companies involved in processes related to medical devices, to be able to offer such device on the market (release on the market). Requirements for companies related to medical devices, both from legislation and industry, concern not only the

technical aspects of devices, but also organizational issues of the company, such as implementation and maintenance of the quality assurance system.

Designing a medical device, producing a prototype, testing a trial series (including the implementation of clinical trials, if required) and placing the medical device on the market are only the implementation of the initial stages in the life cycle of the medical device, according to the scheme shown on figure 1.

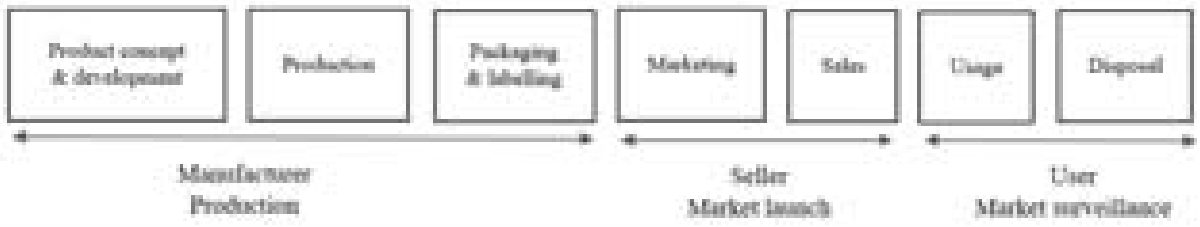


**Figure 1.** *Life cycle of a medical device.* Source: (Sakłak, 2016).

Market surveillance, which begins after the stage of placing a medical device on the market, occurs throughout the entire further life cycle of the device, up to its disposal, and consists in ongoing monitoring of the safety and effectiveness of the medical device (Sakłak, 2016). In the opinion of this article authors, market surveillance can be divided into two types, depending on the entity that conducts it. On the one hand, we have formal market surveillance, carried out by specialized and dedicated state administration units, and on the other hand, we have market surveillance carried out, in a natural way, by companies in the medical device industry.

An example of the first group conducting market surveillance is the American Food and Drug Administration (FDA), in the United States of America, and the Office for Registration of Medicinal Products, Medical Devices and Biocidal Products (abbreviation: URPL), which supervises the Polish market. Referring to the motto of the Polish URLP "Acting in the area of medicinal products, medical devices and biocidal products, we protect health and care about the safety of society" (URLP, 2022), periodic surveillance programs, over the medical devices market, are created. The currently available market surveillance program, from 2021, assumed the following activities of the Authority (URLP, 2022):

- collecting and analyzing information on the safety of devices,
- control of undertakings involved in processes relating to medical devices, including their subcontractors established in the territory of Poland,
- issuing administrative decisions concerning devices.

Analyzing the market surveillance program, it can be concluded that the implementation of proceedings against medical incidents (adverse events) and actions related to the safety of medical devices also plays a very important role. A medical incident will be perceived as abnormality concerning a medical device such as a malfunction, defect, deterioration of the characteristics or performance of the device, but also a abnormality in the marking or instructions. In order to fulfil the definition of a medical incident, another condition must still

be met, namely that the nonconformity in question may or could have led to the death or serious deterioration of the state of health of the patient or user of the device. In addition, this nonconformity initiates the launch, of the so-called, Field Safety Corrective Actions (FCSA). The goal of these external actions is to minimize serious deterioration of health or to minimize the risk of death (URLP, 2022). On this basis, it can be concluded that not every abnormality noticed will be a medical incident, which, in principle, is of interest to the URLP, within the framework of formal market surveillance, implementing the program of this surveillance. However, any abnormality noticed should be of interest to the relevant company, operating in the supply chain of the medical device industry.

As mentioned above, medical device companies also carry out some market surveillance, but in a less formal way. Companies involved in processes related to medical devices do not have a market surveillance program because this is not their core business. These undertakings, as part of their supervision, collect various information from the market, from those relating to the needs for the development of the product, the change of its design or functionality (as an entry into the design of new products or a change in the design of existing products) to the abnormalities of the product that have been noticed. If this non-compliance is not a medical incident, then all data, in this respect, remain with entities that are related to this abnormality (device design entity, component suppliers, device assembler, sterilization process supplier, etc.) and are not provided as part of formal market surveillance. Non-compliance with a product is usually considered as part of the company's internal complaint handling process and in accordance with the procedure adopted there. Procedures related to the handling of complaints are often based on requirements, in this respect, applicable on the market where the medical device is authorized for marketing and non-compliance has been noticed.

## 3. Process of handling customer complaints

According to the standard of ISO 13485:2016, which specifies requirements for quality management system, for companies in the medical device industry, a complaint is "a written, electronic or oral notice stating deficiencies related to the identity, quality, durability, reliability, usability, safety or performance of a medical device that has been exempted from the supervision of the organization, or related to a service that affects the operation of such medical devices" (ISO 13485:2016). Analyzing the mentioned definition of a medical device complaint and comparing it with the general definition of a complaint included in the ISO 9001:2015 standard, it can be concluded that it is quite detailed and wide in its scope. Taking this into account, it can be concluded that any noticed abnormality related to the medical device will be subject to complaint. The definition of a complaint, included in the ISO 13485:2016 standard, is not the only definition of a complaint within the medical device industry. Depending on the

market, the definitions of a medical device complaint may vary, sometimes even significantly. However, regardless of the definition of a medical device complaint, the most important thing is the process of dealing with complaints, including early identification whether the reported defect is really a non-compliance and endangering the health or life of the patient or user of the device[1].

The process of handling complaints is one of the processes functioning in the company, and begins with receiving information from an internal or external client. In this way, we distinguish two types of complaints, internal and external, where an external complaint is a report from outside the company about a noticed abnormality. Internal complaints, i.e. those coming from the interior of the company, should be of great importance for the organization, because defects are detected by employees who notice them themselves. The occurrence of internal complaints testifies to a well-designed and functioning internal quality control system and a high level of quality awareness of the company's employees. Complaints can also be classified due to the form of information received, i.e. official and unofficial complaints, due to the importance of the complaint (low, medium, high), as well as assuming the criteria of the subject of the complaint (component for the production of the product, semi-finished product, finished product) (Szczerba, Białecka, 2016). In the context of this article, the authors are interested in complaints received from external customers for a finished medical device, but the reason may of course be, for example, on the design side, components or production process.

After the stage of receiving information from an external customer, the next stages of the process of dealing with customer complaints, which are listed in Table 1, are implemented.

**Table 1.**
*Phases of complaints' handling process*

| Phase |
|---|
| Receiving information from an external customer and registering a complaint |
| Preliminary analysis of the reported abnormality and risk analysis |
| Introduction of corrections (if possible) |
| Analysis of the samples received (if required) and confirmation of nonconformity |
| Root Cause Analysis |
| Planning corrective actions |
| Implementation of corrective actions and verification of their effectiveness |
| Closing the complaint along with communication with the customer |

Source: Own study.

After receiving a report from the customer, the company makes a preliminary analysis of the reported abnormality and evaluates the level of risk associated with this abnormality. Depending on the defect, it is sometimes possible to confirm the nonconformity already on the basis of the evidence provided (e.g. photos, videos, descriptions), and thus quickly plan immediate corrections, aimed at protecting the customer on an ongoing basis against receiving defective products. Similarly, based on the information received, it is also possible to analyze

[1] A complaint is "an expression of dissatisfaction addressed to an organization related to its product or service, or the complaint handling process itself, where a response or solution is expected or required" (ISO 9001:2015).

the root cause and plan corrective actions that will eliminate the root cause of the problem, so that the defect does not occur in the future, due to this identified root cause.

However, if the information provided is insufficient, the customer is often expected to submit samples of defective products for further investigation. Only the conducted analysis leads to confirmation or rejection of nonconformity, and consequently starts or stops the further process of dealing with the complaint. One may be dealing with a defect that is revealed only under certain conditions, which cannot be verified on the basis of the preliminary information received. In this case, the company may introduce basic corrections (such as additional control in or after the production process), but the effectiveness of such actions may be limited. Therefore, it is important to be quick in cooperation between the customer and the company, in terms of providing the required information and samples, and this will additionally depend on the level of risk associated with the reported abnormality.

If the nonconformity of the product is confirmed, the company shall analyze the root cause of this nonconformity. This is one of the most important stage of the complaint handling process, because the proper identification of the root cause will determine whether corrective actions are properly planned, and thus whether the effectiveness of the complaint handling process will be achieved. Various quality management methods and techniques can be used to identify the root cause of nonconformity, such as 5 x Why, or the Ishikawa diagram or a combination thereof. The implemented corrective actions should be verified in terms of their effectiveness. Different methods of this verification are adopted, from simulating the occurrence of an error, after the implementation of corrective actions, to market surveillance consisting in observing whether customers continue to observe a given problem, within a given period. At the same time, only the confirmed effectiveness of corrective actions allows the company to resign from maintaining the introduced corrections (e.g. additional product control if such was introduced). Closing the customer complaint and appropriate communication with the customer, in this respect, carry out the last stage of the complaint handling process.

Two stages of the complaint handling process have been of particular interest in the context of the conducted research. This is the stage of corrections and the stage of corrective actions. It is these stages, that are aimed at the current and target protection of the customer against receiving nonconforming products, and thus ensure the safety and effectiveness of the product, already in the phases after the product has been released on a given market.

# 4. Corrections and corrective actions in the process of handling customer complaints of medical devices

## 4.1. Method of the study

The subject of the conducted study, regarding the type of corrections and corrective actions introduced, as a consequence of receiving a medical device's complaint, were companies in the medical device industry, operating on the Polish market. These companies have implemented and certified quality management system in accordance with the requirements of ISO 13485. In addition, these companies, as part of their activities, carry out various processes related to medical devices, but performing production process was the main criteria for qualifying the company for the study. Basing on the defined criteria, 209 companies, meeting these conditions, have been defined.

The study was conducted using a survey questionnaire, available in electronic form. As part of the survey, 90 correctly completed survey questionnaires were received, what means that the response rate of surveys reached the level of 43%.

The surveyed companies, to a large extent, also carry out other processes related to medical devices, apart from their production process. Almost 78% of companies distribute medical devices and almost 50% design medical devices. In particular, in the context of the simultaneous design and manufacture of medical devices, this is an important aspect from the point of view of implementing of corrective actions, aimed at changing the design of the device, if the root cause is in this respect. It can certainly be said that the process of changing the design of a product can be much faster, when the manufacturer of the product, at the same time, has a direct impact on its design. If the company is a so-called contract manufacturer (is responsible for the contract production process) then the process of changing the design of the product may be more complicated. At the same time, this may cause that the target corrective actions will be introduced longer, and thus corrections, temporarily securing the client, will need to last for a longer period.

Analyzing the organizational aspects of the surveyed companies, over 80% of organizations are large or medium-sized enterprises, operating in the form of a limited liability company. More than half of these companies have the advantage of foreign capital. Almost 70% of the surveyed companies, in addition to a certified quality management system according to the requirements of ISO 13485, also have an implemented and certified quality management system, according to the requirements of ISO 9001, and a quarter of these organizations also have a certified safety and environmental management system.

### 4.2. Identification of corrections – study results

The first area of interest, as part of the conducted study, were corrections taken as a response to the customer's complaint regarding medical device. As already indicated in this article, corrections may be introduced immediately after the receipt of a notification of abnormalities, but not in every case or not every time they will achieve the assumed effectiveness. This is particularly important in the case of non-obvious defects (e.g. related to electronic systems of medical devices). On figure 2 it is shown the distribution of responses to the question about corrections. Respondents indicated types of corrections that have been introduced in their companies.

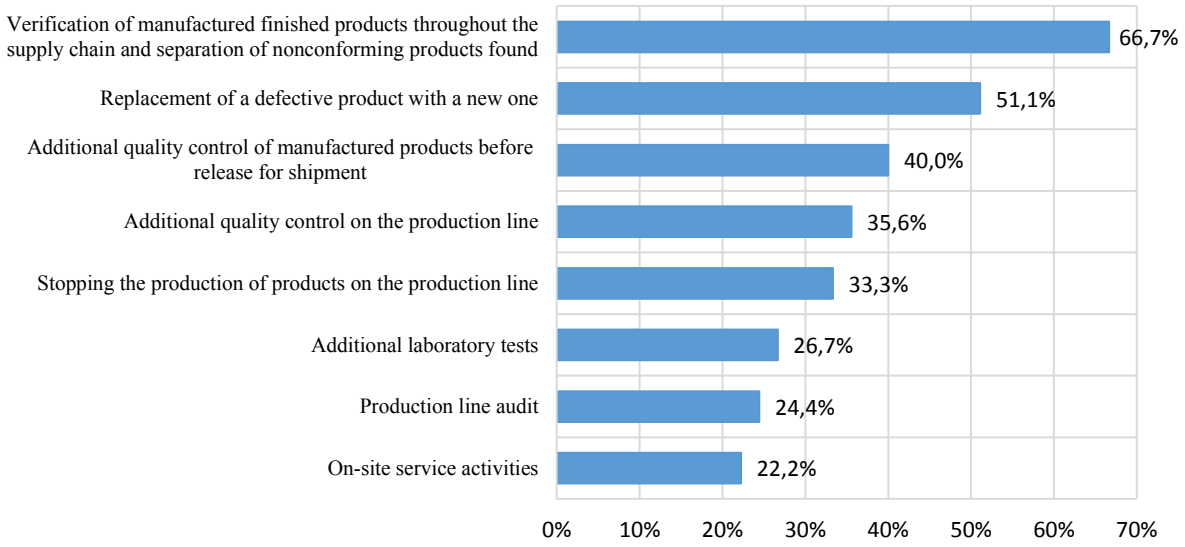


**Figure 2.** Corrections. Source: Own study.

Based on the answers presented on figure 1, it can be seen that almost 67% of respondents indicate a check of already manufactured products, throughout the supply chain and the separation of nonconforming products (suspicious – at this stage this is also how these products can be defined). The entire supply chain can mean for a company:

- stock levels of finished products within the organization itself or in external warehouses under the supervision of the company,
- medical devices in transport,
- medical devices in the customer's warehouse.

Regarding medical devices at the customer's site, such devices may also be on his production line if the device undergoes additional processes (e.g. sterilization). The task of the company, that received the complaint, as part of corrective action, is to carry out an inspection of the products, in accordance with the defined instruction or requirements, specified in another form. To carry out inspections, in particular of products in transport and at the customer's site, companies often involve specialized companies, that provide such inspection services. In this case, it seems even more important to properly prepare and pass the requirements for such a check. An alternative to carrying out an inspection of products at the customer's site is

the transport of the customer's inventory to the company. However, the customer's needs, including temporary ones, should be taken into account here.

The next most frequently indicated answer, in terms of corrections, is the replacement of a defective medical device with a new one, what was indicated by over 50% of respondents.

Additional quality control of manufactured products, before release for shipment, is an activity indicated by 40% of the surveyed companies. The difference between the most frequently indicated corrective action and the currently discussed one is that it concerns products that have not yet been transferred to the warehouse in the company, i.e. they are in the production area, which does not mean, however, that the products are still going through some production processes. In this case, however, precise requirements should also be indicated for carrying out additional control and handling products that do not meet the required parameters.

Slightly less indications were given to the answer regarding additional quality control on the production line (35.6%) - in this case, medical devices are still subject to production processes, i.e. we can determine that, at this stage, they are semi-finished products.

Stoppage the production of the medical device was given as another correction activity (33.3%). This may mean that the company is not able to continue the production of the product with the assurance that the requirements for the product are met.

Additional laboratory tests, production line audit or service activities at the customer's site were indicated, as part of the study, by about a quarter of the surveyed companies. Referring to additional laboratory tests, it can be stated that it is also a kind of control of semi-finished products or finished products (as discussed earlier), but in a different, specialized environment, using dedicated control and measurement equipment.

Respondents were also asked to indicate whether similar corrective actions are also taken for other types of products, manufactured on the same production line as the claimed product. A significant proportion of companies (almost 70%) answered positively the question asked. This proves the high level of quality awareness of people who supervise the process of dealing with customer complaints. Focus is given not only on the claimed product, but also on potential other devices, in order to minimize the risk of further abnormalities, including those related to the safety and effectiveness of the medical device.

### 4.3. Corrective actions – study results

As part of the survey, respondents indicated corrective actions that they take in connection with the received complaint regarding medical device, after confirming the nonconformity and after analyzing the root cause, causing this nonconformity. Figure 3 shows the indications of the companies examined.

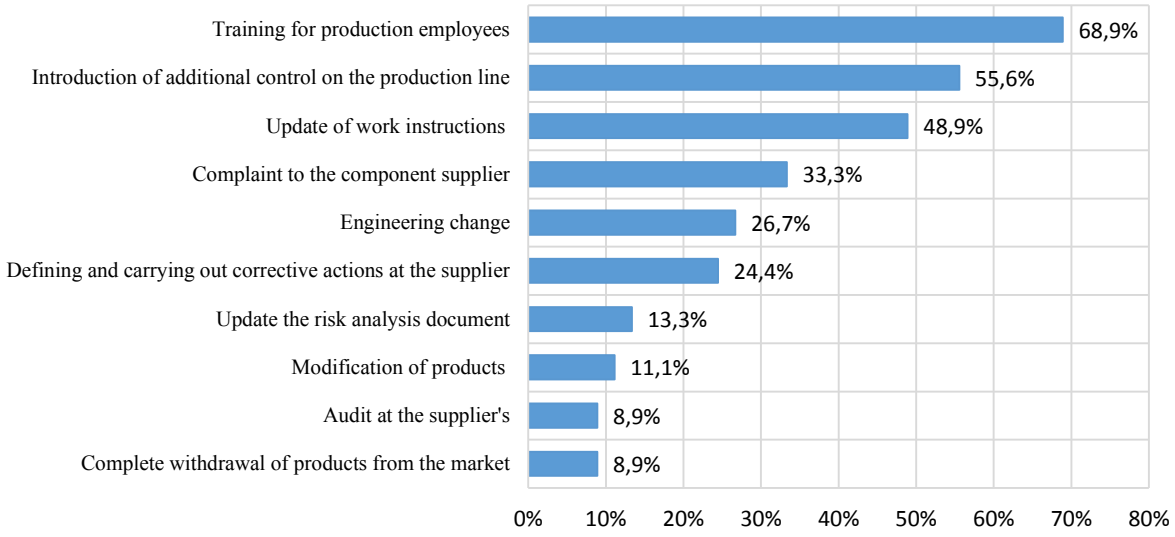


**Figure 3.** Corrective actions. Source: Own study.

Around 70% of the companies indicated that within the corrective actions taken there are trainings for direct production employees. Training is a very important element of the quality management system in the medical device industry, and employees should be aware of the nonconformities generated in production processes. A well-designed and implemented training system can bring measurable results in the company. However, such a high share of employees' trainings may come as a surprise, as usually the most desirable solutions are permanent solutions of a technical nature (e.g. machines, process parameters). Such solutions, as a rule, are to ensure that the abnormality that caused the complaint does not occur again, due to the identified cause. By analyzing the answers to additional questions asked to respondents, it is possible to explain the reason for such a high level of response related to trainings. Almost 50% of the root causes of complaints lie on the side of operator errors, according to the declaration of the surveyed companies. At the same time, this may mean that among the surveyed companies in the medical device industry, a significant part of the organizations are characterized by manual production processes, where the operator's participation plays a very important role and there is also a high level of probability of making a mistake (Feliczek, 2022). Probably increasing the level of automation, also as part of corrective actions and making the production process independent from the direct influence of the operator, is a direction of reducing the number of operators' errors.

The introduction of additional control on the production line is another corrective action taken by the surveyed companies in terms of the share of indications (55.6%). It can be observed that the additional control of the products was also an important correction activity. This, in turn, may mean that corrections turn into corrective actions over time. Such decisions can be made, by company, in a situation where the root cause cannot be properly identified or there is no possibility, at a certain moment, of introducing another type of corrective action. Additional control on the production line will often also be associated with a change in the production instructions and with operator training, as described above.

The third, in order, corrective action is the update of work instructions, what was indicated by almost 50% of respondents. This corrective action seems to be very much related to the action of operator trainings. If the need to update the documentation is identified in the company, then it is natural to conduct training on the new content of the updated instructions. On this basis, it can be concluded that these 50% of companies, updating documentation, at the same time train operators. The remaining almost 20% of companies (out of 68.9%) train operators without making changes to the instructions, i.e. remind employees of the principles described in the applicable documentation.

Engineering change, indicated by 26.7% of respondents, is an action that is taken primarily due to the fact that the current design of the process generates abnormalities. This is a type of corrective action, which is strongly desirable due to its durability and definitely less dependence on the human factor.

Historical analyses of medical device recalls, from the US market, have shown that defects generated by suppliers of components or services for the production of medical devices accounted for a significant share, immediately after defects related to the design and production of the finished product (Feliczek, 2013). The current research shows that almost a quarter of corrective actions also concern suppliers. In the case of defects, where the source is related to suppliers, the complaint handling process is additionally difficult, for example due to the time frame, where after confirming the nonconformity of the product, the topic is redirected to the supplier. Then it is best to ensure immediate corrective actions on the part of both the company and its supplier.

Analysis of the risk evaluation document, product modification, audit at the supplier and complete recall of the product from the market are the following corrective actions with a share of 13.3%, 11.1%, 8.9% and 8.9% respectively.

On the basis of the above-presented responses from the companies, in the scope of corrective actions taken, it can be concluded that these activities concern many aspects of the organization's functioning, from the design of the device, suppliers of components and services, to the production of the medical devices itself. It should be noted, however, that several actions can be implemented simultaneously, in particular when the defect of the medical device is of a complicated nature or the organization is not able to clearly determine the root cause of the abnormality. Then the implemented corrective actions eliminate various potential causes.

## 5. Conclusions

Level of medical devices quality is represented by the parameter of safety and effectiveness of the device. The point is that a device, that is used in the case of a person already affected by some form of injury, impairment or other, requiring medical intervention, does not generate an unacceptable risk and fulfills its intended purpose (Feliczek, 2014).

In the supply chain of products of every industry, abnormalities in the functioning of products appear, and can be caused by the design of the product, suppliers of components and services or the production process of the finished product itself. Similarly it is in the dynamically developing medical device industry, with the consequences of abnormalities threatening the health or life of people.

Any abnormality requires an appropriate response and analysis, including analysis for medical incident reporting. Reporting the product nonconformity from an external customer triggers the complaint handling process. As part of this process, corrections are taken to protect the customer on an ongoing basis against receiving nonconforming products and corrective actions, within the framework of which the company tries to eliminate the root cause of the resulting nonconformity. The ultimate goal of the company, in this regard, is not to receive a complaint in the future for the same defect, generated by the identified cause.

As part of the survey, among the medical devices' companies in Poland, carrying out the production processes, the most common corrections and corrective actions were indicated. In response to the received product complaint. It should be emphasized that the actions taken should always be adequate to the level of risk that a given irregularity represents.

The most important correction activities (over 50% of indications) include verification of suspicious products throughout the whole supply chain and replacement of a defective product with a new one. Verification of finished products, throughout the supply chain, seems to be quite demanding (in particular in the case of many places where products are stored), but at the same time necessary.

When it comes to corrective actions that are implemented by the companies, almost 70% of respondents indicated training of production employees. This is strongly related to the identified root causes, by these companies, and related to operator errors (50% of the causes lie with such errors). In addition, almost 50% of respondents declared the update of work instructions as a corrective action, which is also related to the high number of indications for operator trainings (to a large extent, training is made based on updating documentation). More than 50% of the surveyed companies determined that additional control of products on the production line is also a corrective action for them. This may mean that the corrections, in this form, transforms into a target corrective action, with it being difficult to say that such an action eliminates the root cause of the nonconformity.

## References


1. Feliczek, P. (2013). Supplier management in medical devices industry. *Towaroznawcze Problemy Jakości, 2(35).* Radom: Wydawnictwo Uniwersytetu Technologiczno-Humanistycznego im. K. Pułaskiego, Wydawnictwo Naukowe Instytutu Technologii Eksploatacji – PIB.
2. Feliczek, P. (2014). *Determinanty skuteczności systemu zarządzania jakością w przedsiębiorstwach branży wyrobów medycznych. Praca doktorska*. Uniwersytet Ekonomiczny w Poznaniu.
3. Feliczek, P. (2022). Ocena świadomości wpływu pracowników branży motoryzacyjnej na kształtowanie jakości wyrobu. *Problemy jakości, 3.* Wydawnictwo SIGMA-NOT.
4. Medical Market Research Report 2022, https://www.fortunebusinessinsights.com/enquiry/request-sample-pdf/medical-devices-market-100085, 7.08.2022.
5. PN-EN ISO 13458:2016 – Wyroby medyczne – Systemy zarządzania jakością – Wymagania do celów przepisów prawnych.
6. PN-EN ISO 9000:2015-10 – Systemy zarządzania jakością – Podstawy i terminologia.
7. Queen, D. (2021). Impact of COVID-19 on the medical device companies who serve wound care. *International Wound Journal, 18(3),* 247-248.
8. Rozporządzenie Parlamentu Europejskiego i Rady (UE) 2017/745 z dnia 5 kwietnia 2017 r. w sprawie wyrobów medycznych, zmiany dyrektywy 2001/83/WE, rozporządzenia (WE) nr 178/2002 i rozporządzenia (WE) nr 1223/2009 oraz uchylenia dyrektyw Rady 90/385/EWG i 93/42/EWG.
9. Rutkowski, E. (b.d.). *Rynek urządzeń i sprzętu medycznego w Polsce*, https://medical.trade.gov.pl, 8.08.2022.
10. Sakłak, M. (2016). *Zarządzanie ryzykiem w procesie wytwarzania aktywnych wyrobów medycznych*, https://ruj.uj.edu.pl/xmlui/bitstream/handle/item/150510/saklak_zarzadzanie_ryzykiem_w_procesie_wytwarzania_2016.pdf?sequence=1&isAllowed=y, 22.08.2022.
11. *Sektor wyrobów medycznych w Polsce. Wielkość, oddziaływanie, znaczenie. Raport Polmed 2022*.
12. Szczerba, B., Białecka, B. (2016). Ogólne założenia do budowy systemu zarządzania reklamacjami. *Systemy Wspomagania w Inżynierii Produkcji, 4(16).* Wydawnictwo STE Group.
13. Urząd Rejestracji Produktów Leczniczych, Wyrobów Medycznych i Produktów Biobójczych, https://www.urpl.gov.pl/pl/wyroby-medyczne/nadz%C3%B3r-rynku/program-nadzoru-rynku, 20.08.2022.
14. Wąsik, D. (2017). Prawnokarne aspekty wytwarzania i obrotu wyrobami medycznymi. *Prokuratura i Prawo, 9.* Wydawnictwo Prokuratury Krajowej.

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# DIRECTIONS FOR IMPROVING REPORTS ON ENVIRONMENTAL COSTS BY MINING COMPANIES

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**Purpose:** Recent years have brought a very dynamic increase in the importance of the environmental aspects of the activities conducted by enterprises in the mining industry. This is mainly due to the currently binding legal requirements in the field of environmental protection, which impose a number of obligations on business entities, aimed at limiting the impact of activities on the natural environment, removing effects, as well as rehabilitating areas affected by this activity. In order to be able to fully manage the environmental costs incurred by companies in connection with pro-ecological activities, it is necessary to provide appropriate tools and enable people dealing with the above-mentioned issues to raise their qualifications. In the article, in addition to the literature review, an attempt was made to present the issues related to the reporting of environmental costs in the mining sector, both in terms of creating reports, classification of costs and the knowledge of employees dealing with the above mentioned issue and identification of areas requiring improvement. For this purpose, a specially created questionnaire was used, the results of which were also presented in the article.
**Design/methodology/approach**: The article presents the results of a survey on the awareness of environmental costs in people who deal with the above-mentioned costs. The test results are presented by means of graphs.
**Findings:** The most important problems related to environmental cost reporting by mining companies include: reporting only those costs that are required by law, insufficient knowledge of environmental costs among employees preparing reports, lack of a detailed classification of environmental costs dedicated to the mining sector. As part of the survey, problems related to reporting of environmental costs by mining plants were identified. They were mainly related to the knowledge of the concept of environmental costs by those responsible for reporting them and adequate training in the field of these costs. Additionally, the level of employee interest in participation in conferences and courses related to environmental costs was examined.
**Originality/value:** This article is dedicated to employees of the mining sector and students of mining faculties. The article presents a change in the perception of environmental costs incurred by hard coal mines as only negative, and the extension of environmental reports to include costs incurred, inter alia, for preventive measures and the use of questionnaire surveys as a method of measuring employees' awareness of environmental costs was proposed.

**Keywords:** environmental costs, management, mining, survey, environmental reports.

## 1. Introduction

Over the last several years, there has been a dynamic increase in the significance of environmental aspects observed in the activities of mining companies. This is mainly due to the currently binding legal requirements related to environmental protection, which impose on economic entities a number of obligations aimed at limiting the impact of their activities on the environment, removing consequences, and reclaiming areas affected by such activities. Due to the fact that mining companies are characterized by activities that strongly interfere with the natural environment, they are required to present data on costs incurred for the environment in the form of the so-called environmental reports.

Another significant aspect is the dependence of companies' value on their actions in favor of the environment. It should be noted that with the development of pro environmental awareness of companies, it has become a tool determining their value both on the domestic and global market, and thus companies are required not only to meet the economic objectives of their activities, but also to respect the laws of nature. Therefore, it is necessary to reliably present all environmental protection activities undertaken by companies. The implementation of the concept of sustainable development in a company requires, among other things, the creation of a financial information system on the environment, which will meet the needs of rational management of a company and the environment (Kryk, 2008).

Due to the fact that mining companies are, to a large extent, associated with activities that strongly interfere with the natural environment, in many cases, there are concerns about disclosing the actual amount of environmental costs for fear that these activities will be negatively perceived by society or even used in a manner unfavorable to the property of a given institution. At present, environmental reports prepared by mining companies contain required information pursuant to valid legal regulations. They are dominated by descriptions of undertaken pro ecological actions as well as charges paid for using the environment. Oftentimes, however, many facts tend to be omitted, such as those related to prevention activities within the conducted activity and ensuring safety to employees. In some cases, this is also due to the lack of legally structured system of classifying environmental costs, and the divisions used are based only on literature (Ferens, 2016; Szadziewska, 2006; Małecki, Urbaniec, 2014; Hansen, Mowen, Guang, 2007). A significant group of authors in their scientific publications, including: Piontek (1999); Miłaszewski (2009); Kamieniecka, Nóżka (2016); Famielec, Stępień (2005); Borowiec (2013); Jaruga, Szychta (1997); Kijewska, Bluszcz (2016); Paszkiewicz, Szadziewska (2011), draws attention to the need to prepare reliable and accurate environmental reports

As part of the work, a review of the literature on the environmental costs incurred by hard coal mines in Poland was carried out, which confirmed the need for further development of the concept, the procedure for creating environmental reports was characterized, problems related

to reporting these costs were presented, and the use of questionnaire surveys as a tool for measuring knowledge and employee awareness of the environmental costs they deal with.

## 2. Materials and methods

### 2.1. General characteristics of problems related to environmental costs in the mining sector – the concept of environmental costs

Both national and international literature provides many explanations of this concept. The definitions of environmental costs formulated by different authors can be divided into four groups (Dimitroff-Regatschnig, Schnitzer, Jasch, 2002; Ferens, 2016):

- definitions that restrict their scope to the environmental costs incurred by an entity in an operating activity,
- definitions including all environmental costs incurred by an entity as a result of its business activity and extraordinary events,
- definitions broadening their scope by considering the costs incurred during a product's life cycle,
- definitions based on the assumption that environmental costs should be interpreted as economic costs (explicit, hidden).

This means that, as of the date of this article, there is no concept that would strictly define which costs incurred by mining companies are environmental costs and which are not. Therefore, a necessity arises to create a reporting system that would capture, to the largest extent possible, all costs incurred by mining companies within the framework of a broadly defined pro-environmental activity. In addition, it is worth pointing out to the fact that many of these costs may be overlooked due to wrong interpretation of the term, which in turn emphasizes the need to raise awareness in this area among all employees.

When analyzing expenses that mining companies incur during their operations, it is possible to distinguish the following groups of environmental costs (Ferens, 2016):

a. For environmental use:
    - water consumption and electricity,
    - disposal of waste and gangue,
    - operation and concession,
    - consumption of environmental resources,
    - transport of fuels and environmental raw materials,
    - groundwater discharge.

b. For prevention:
   - consumption of fixed assets used for the prevention of environmental pollution,
   - monitoring of pollution levels,
   - training in efficient resource management,
   - operation of emission measurement equipment,
   - measurement of noise level concentrations in facilities,
   - introduction of acoustic protection system,
   - measurement of pollution from gangue dumps.
c. For pollution reduction:
   - pollutant exports,
   - investments related to minimization of CO2 emissions, etc.,
   - management of post-mining waste,
   - disposal and utilization of other waste,
   - methane accumulation,
   - damage caused by mining activities.
d. For restitution:
   - emission of gases and dust into the air,
   - charges to an external entity for coal recovery,
   - subsidies for pro-environmental activities.
e. For environmental management:
   - ISO training,
   - ISO development,
   - improvement of monitoring methods.

The environmental costs listed above are the most frequent charges incurred by companies in the mining sector as part of their environmental activities. In the case of mining companies, the most extensive group of environmental costs are those related to environmental use and prevention. Despite the relatively high level of specificity, it should be noted that the presented breakdown does not include all types of charges.

Among the environmental costs that are not included in the cited breakdown, it is also worth considering expenses for:

- improving employees' qualifications in environmental awareness,
- employees' participation in conferences, seminars, etc. on environmental issues,
- constructing installations for the economic use of methane,
- industrial use of coke-oven gas,
- investments in environmentally friendly materials,
- projects concerning the possibility of using mine workings to store waste,
- monitoring inactive workings,

- striving for maximum energy independence of mining plants and using alternative energy sources,
- reusing underground water,
- locating smoke dust in underground workings,
- reclaiming waste dumps and areas degraded by the activity of mining plants,
- participating in pro-environmental projects.

## 2.2. Legal conditions concerning the preparation of environmental reports

Pursuant to the Environmental Protection Act (Poniewski, 2018), an author of such a report (in the case of a team, the requirements apply to a team leader) is required to have graduated from at least first-degree (a bachelor's degree) or second-degree (a master's degree) studies, or from uniform master's studies, in the following fields of education:

- exact sciences like chemical sciences,
- natural sciences like biological sciences and earth sciences,
- technical sciences from the following disciplines: biotechnology, mining and engineering geology, environmental engineering,
- agricultural, forestry and veterinary sciences.

Another very important aspect concerning environmental reports is the specificity of the documentation in question. According to the Environmental Act, a correctly prepared report should, in particular (Poniewski, 2018):

- describe the planned project,
- characterize natural components of the environment within the range of the predicted impact of the planned project on the environment,
- describe monuments protected under the provisions on the Protection and Care of Monuments,
- describe predicted effects on the environment in the case of project's inaction,
- describe variants, taking into account the specific characteristics of the project or its impact,
- determine the predicted impact of analyzed variants on the environment, including the case of a serious industrial breakdown, as well as a possible cross-border impact on the environment,
- justify the variant proposed by an applicant, with the indication of its impact on the environment,
- describe forecasting methods applied by an applicant and the predicted significant environmental impact of the planned project together with possible time variants,
- describe predicted actions aimed at prevention, limitation or natural compensation of negative environmental impact, etc.

When making an environmental report, considering all the above elements is the first step to predict the initial magnitude of environmental costs.

### 2.3. Benefits of a robust environmental reporting system

Due to the lack of guidelines on how to report, the information contained in the first environmental reports was mainly qualitative and covered a limited range, resulting, for the most part, from the existing solutions of information systems of business entities (Paszkiewicz, Szadziewska, 2011). Among the factors that have an impact on the development of environmental reporting system, the following can be distinguished:

- increasing degradation of the natural environment,
- limited natural resources and the lack of possibilities for their renewal,
- assumptions of sustainable development policy as a possibility of further economic development,
- continuous development of international regulations and standards related to environmental protection and their strict enforcement,
- environmental activity as a new measure of company value,
- increasing environmental awareness of the public, and social demands placed on businesses regarding their impact on the local environment,
- development of reporting guidelines for many organizations,
- development of management systems that incorporate the pursuit of both the long- and short-term environmental objectives in the strategy of entities.

Despite the change in attitude towards the notion of environmental costs, it is still possible to observe a reluctance to share the discussed type of information. The factors responsible for this state of affairs may be as follows:

- lack of unification of legal acts normalizing aspects of environmental reporting,
- misconception of low interest in a given type of information among external stakeholders,
- management's assessment of activities related to the preparation of this information as a costly process that requires great effort and commitment from employees,
- conviction of the management about the lack of benefits and impact on the demand for services provided by a given company,
- deficiencies in systems supporting the reporting system,
- fear of this information being used to tarnish the reputation of an institution, particularly by competitors, and of potential litigation,
- fear of customers and other stakeholders turning away from a company,
- belief that a company has taken sufficient action and that it has a positive image in the profession,
- dependence of actions taken by owners on the actions of competitors.

## 2.4. Surveying as a tool to improve the environmental cost reporting system in mining plants

It should be remembered that apart from using the most extensive reporting systems, equipping employees with modern tools and computer programs, and even continuous updating of legal regulations governing environmental aspects by competent authorities, the most important factor is the man himself, on whose shoulders rests the preparation of such documentation. On the other hand, an entrepreneur, and therefore an employer, is required to provide employees with all necessary means to work with environmental issues and the possibility of continuous extension of knowledge in this field.

Currently, for mining companies, one of the biggest challenges turns out to be the cooperation between employers and employees. This is due to the following reasons, e.g.:

- employers focus solely on profit from the employee's actions,
- employees are afraid of employers,
- employers believe that they have done enough in providing adequate facilities for their employees,
- employees are reluctant to share their opinions on a given topic due to fear of unnecessary employer-employee conflict,
- lack of employer's involvement in employees' activities and subsequent criticism of their actions (employers often leave the freedom of action to their teams, while requiring the implementation of tasks according to their ideas),
- work under constant time pressure both for employees and employers,
- employees are reluctant to perform the tasks entrusted to them,
- employees are assigned tasks while being imposed an impossible deadline for completion,
- prejudices between employees and employers,
- lack of mutual respect.

The reasons for difficulties in the relationship between these two positions, outlined above, also affect the quality of a company's environmental documentation. Surveys can be a helpful tool for investigating (and identifying) reporting issues. The use of questionnaire methods or surveys successfully fulfills its task in companies, for example, in the case of analyzing the issue of employer-employee relations, because their main advantage is anonymity. With regard to relationship issues, material from such studies relates to many aspects of an organization. Also, it provides data on the relationship between an employee and an employer. Questions about management include information flow, delegation of tasks, training opportunities, clarity of criteria for rewards and reprimands. Employees are asked about managers' competencies and skills. Such questionnaires also include items that deal directly with communication and team relations as well as trust that employees have in their supervisors.

Based on the experience of companies that have introduced questionnaires, for example, for the purpose of controlling relations among employees, it is proposed to create a questionnaire system related to the widely understood issue of environmental reporting. The task of such questionnaires would be to control the following issues:

- opportunities and willingness to participate in additional trainings, courses, etc., in order to broaden skills in environmental aspects,
- possibilities and willingness to participate in conferences, seminars, symposia in order to share developed methods and broaden knowledge,
- previous qualifications and internship in the environmental field,
- tools facilitating work with environmental costs and environmental reports,
- knowledge of people responsible for preparing reports at a given site,
- help received while preparing reports,
- computer programs used,
- cooperation with a person responsible for collecting information on the report in a given department,
- completed reports.

In order to conduct research aimed at examining the knowledge of the environmental costs of employees of hard coal mines, a questionnaire was used, which was anonymous for all respondents. Tables 1, 2, and 3 present in detail questions and a response scale selected for them. The questionnaire was divided into 2 parts. Part I relates to opportunities to participate in trainings, conferences and qualifications or education part II relates to work with environmental issues. People employed in hard coal mines in Poland, who occupy various positions and have various years of service, participated in the survey. Due to the anonymity of the aforementioned survey, the percentage of respondents was not analyzed, taking into account the workplace where the employee is employed. In total, 250 people took part in the study, each of whom received one copy of the questionnaire. The research was conducted either by live contact with employees or by e-mail between January and March 2022.

**Table 1.**
*Data of a surveyed person*

| Metrics |
|---|
| **1. Education**<br>□ basic vocational (basic vocational school)<br>□ sectorial vocational (sectorial vocational school)<br>□ secondary sectorial vocational (secondary technical school)<br>□ secondary<br>□ higher technical<br>□ higher non-technical |
| **2. Position held**<br>□ manual work underground<br>□ manual work on the ground<br>□ non-manual work underground<br>□ non-manual work on the ground |

Cont. table 1.

| | |
|---|---|
| **3. Department** | |
| □ administration | □ blasting technology |
| □ OHS and training | □ rockburst and casing |
| □ surveying and geology | □ Ventilation |
| □ production preparation | □ Energomechanics |
| □ environmental protection | □ mechanical processing |
| □ economy and finance | □ materials management and procurement |
| □ mining | |
| **4. Total work experience (if applicable - not just at a mine)** | |
| Please specify in years…….. | |
| **5. How many years of experience do you have working with environmental costs?** | |
| □ 1 – 3 years | |
| □ 3 – 5 years | |
| □ over 5 years | |
| **6. Do you have documented qualifications (certificates, diplomas, etc.) in the field of environmental engineering?** | |
| □ Yes | |
| □ No | |

**Table 2.**

*Information regarding the employee's environmental courses/training and attendance at conferences*

| Questions about participation in environmental courses/conferences |
|---|
| **1. Would you be interested in taking environmental courses/training?** |
| □ Very much |
| □ Quite |
| □ Not at all |
| **2. How often do you receive proposals from your supervisors to attend environmental courses/training?** |
| □ Often |
| □ Rarely |
| □ Never |
| **3. How often does the management agree to your participation in environmental trainings/courses?** |
| □ Often |
| □ Rarely |
| □ Never |
| **4. How interested would you be in attending environmental conferences/seminars?** |
| □ Very much |
| □ Quite |
| □ Not at all |
| **5. How often do you receive proposals from your supervisors to attend environmental conferences/seminars?** |
| □ Often |
| □ Rarely |
| □ Never |
| **6. How often does the management agree to your participation in environmental conferences/seminars?** |
| □ Often |
| □ Rarely |
| □ Never |

**Table 3.**
*Questions about the environmental cost issue in the employee's department*

| Questions about working with environmental costs |
|---|
| **1. Do you have tools to facilitate environmental cost reporting (software, legislation, etc.)? And do you use them when preparing necessary documentation.** |
| □ Yes, and I use them often |
| □ Yes, but I do not use them |
| □ I do not have this type of tool |
| **2. Have you been trained to prepare documentation for environmental costs and how often do you receive such training?** |
| □ Yes, trainings take place regularly |
| □ Yes, but trainings take place infrequently |
| □ I have not been trained; trainings do not take place |
| **3. What do you think about computer programs used to prepare environmental cost reports?** |
| □ The computer program(s) is/are very easy/easy to use |
| □ The computer program(s) is/are average in use |
| □ The computer program(s) is/are difficult to use, or the department does not have this type of computer program |
| **4. What do you think about the flow of information regarding environmental costs among the staff responsible for reports?** |
| □ The flow of information re environmental costs between employees is very good and information is collected on time |
| □ The flow of information re environmental costs among employees is average and information is partly collected on time |
| □ The flow of information re environmental costs among employees is very bad and information is rarely collected on time |
| **5. Is there a person in your department responsible for departmental cost accounting (coordinator)?** |
| □ Yes, there is such a person |
| □ No, there is no such person |
| □ I do not know anything about such a person |

## 3. Discussion of results

The questionnaire was open to all willing mine employees working for two leading mining companies in Silesia – PGG S.A. and JSW S.A. It was completely anonymous and in no way identified employees with their company. The results are presented in Figures 1 to 14.

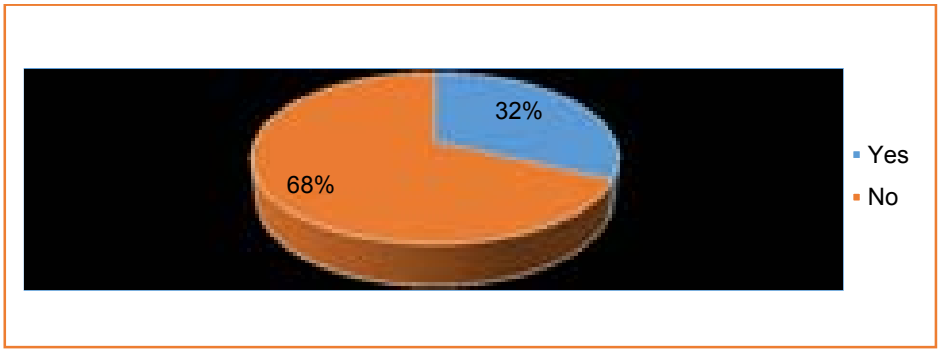


**Figure 1.** Documented qualifications in the field of environmental engineering.

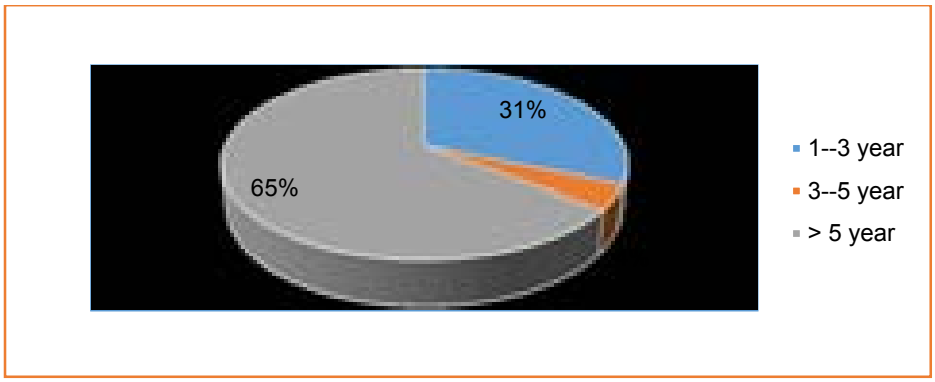


**Figure 2.** Experience in working with environmental costs in years.

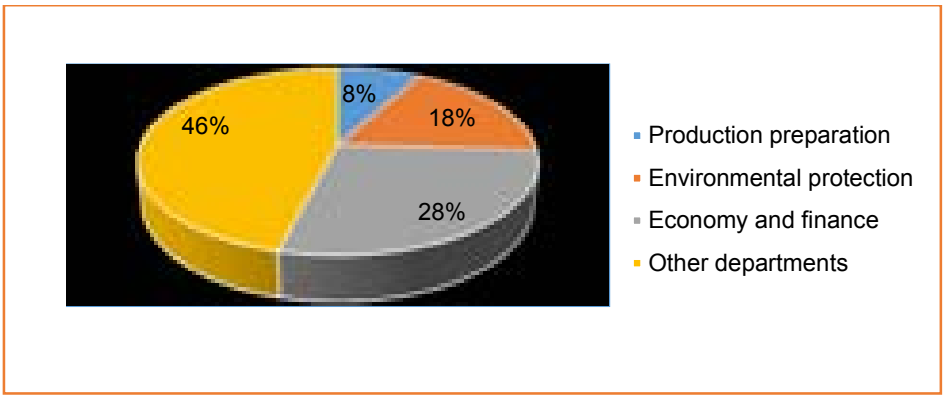


**Figure 3.** Percentage of people participating in participation in selected events.

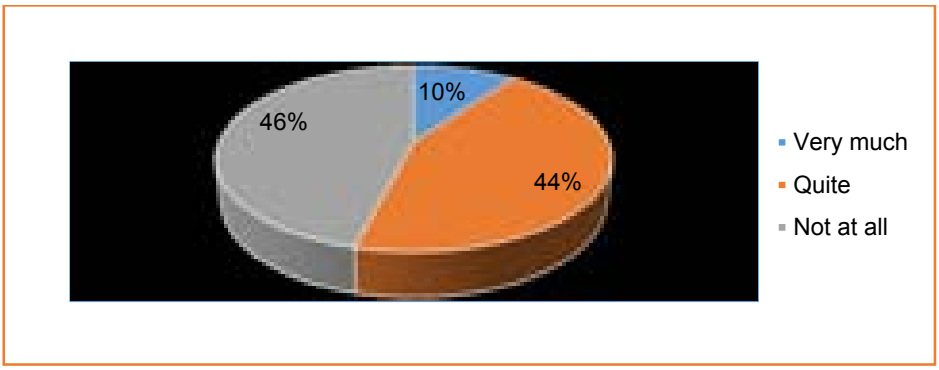


**Figure 4.** Interest in attending courses on environmental issues.

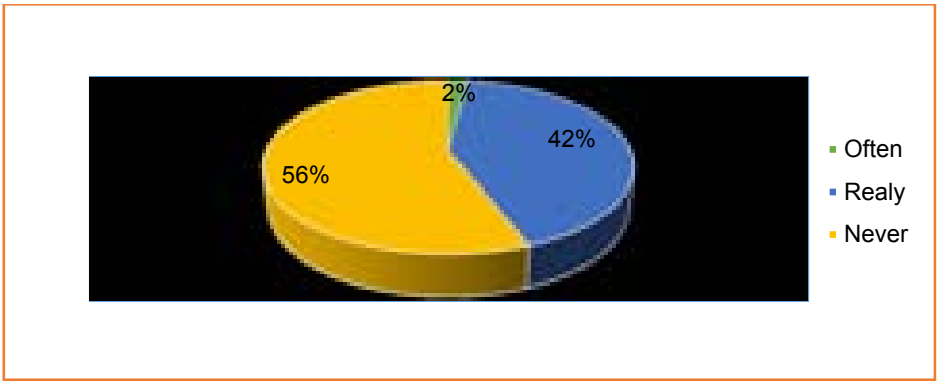


**Figure 5.** Management approvals for the participation of employees in courses on environmental aspects.

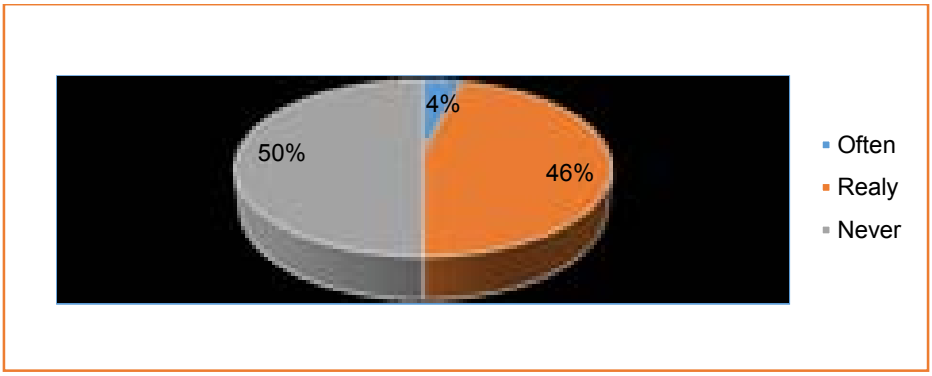


**Figure 6.** The frequency of proposals for employee participation in environmental protection courses by the management.

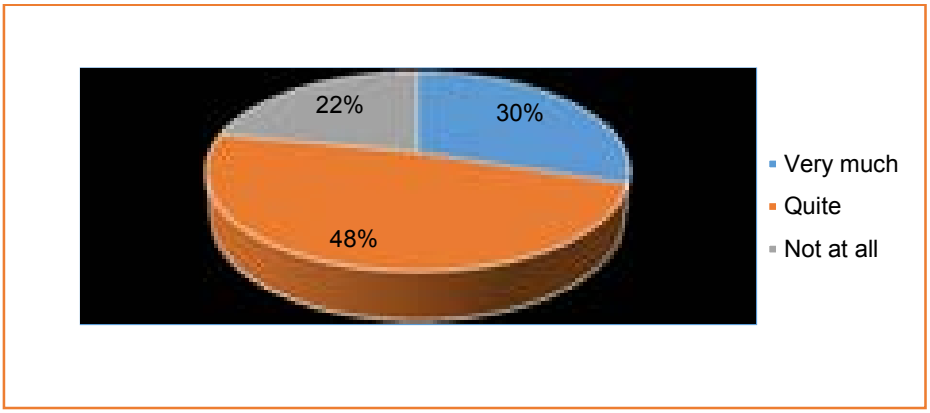


**Figure 7.** Percentage of employees regarding the willingness to participate in conferences on environmental aspects.

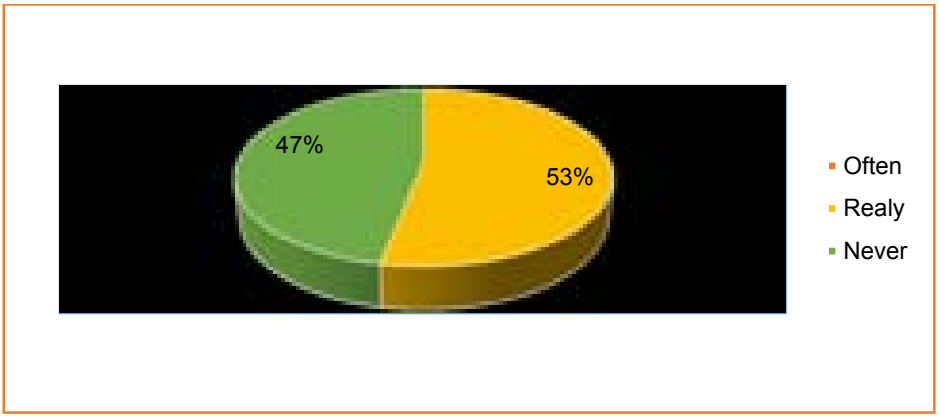


**Figure 8.** Management approvals for the participation of employees in conferences or seminars in the field of environmental protection.

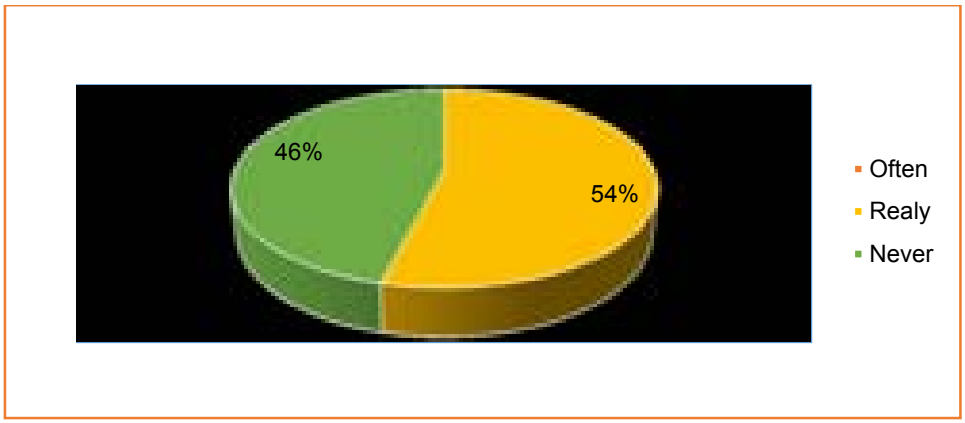


**Figure 9.** The frequency of proposals for employee participation in conferences or seminars from the management.

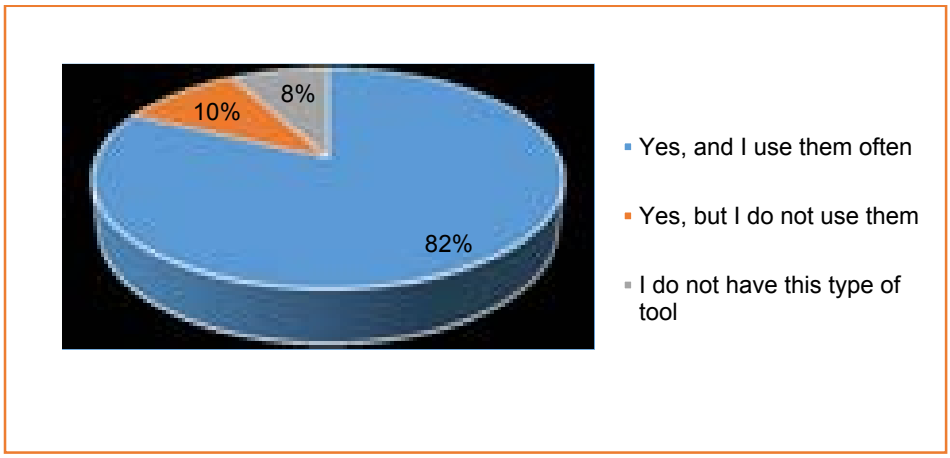


**Figure 10.** Availability of tools to help you work with environmental costs.

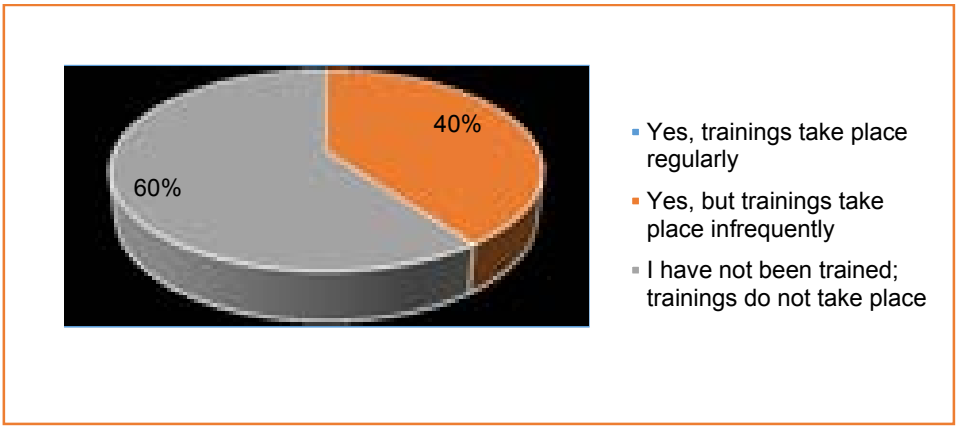


**Figure 11.** Courses and training to start working with environmental costs.

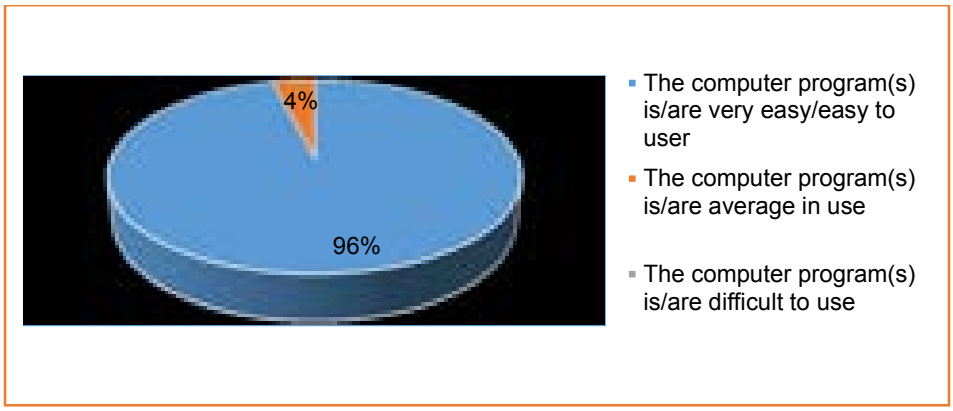


**Figure 12.** Difficulty using computer software to create environmental cost reports.

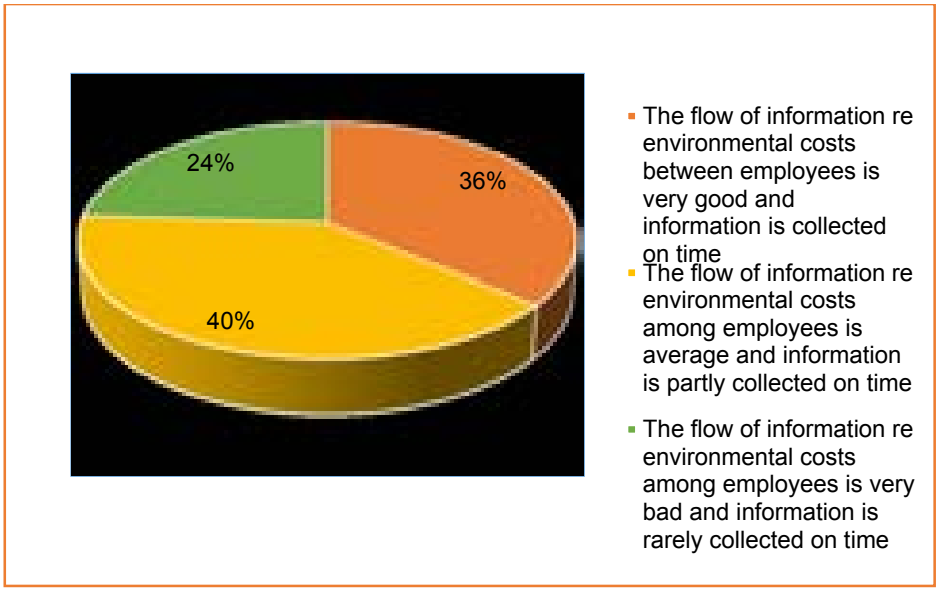


**Figure 13.** Question about about the flow of information regarding environmental costs among the staff responsible for reports.

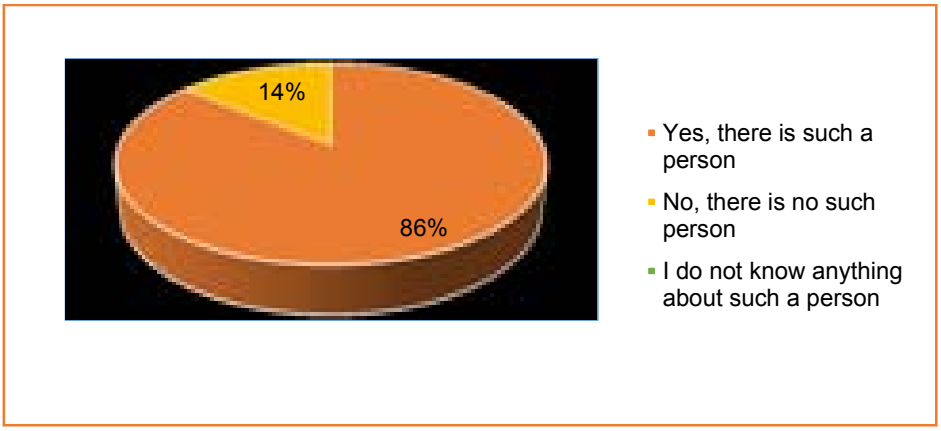


**Figure 14.** Question about person in department responsible for departmental cost accounting.

When compiling the information gathered during the questionnaire, the first step was to analyze the data contained in part I. The main focus was placed on questions about documented qualifications in environmental protection, experience in work related to environmental costs, as well as information in which department the survey participant was employed. In the case of the question (Fig. 1) concerning documented qualifications in environmental engineering such as diplomas, certificates, etc., it was found that less than 35% of the respondents had such documentation, while more than 60% of the respondents did not have such documentation. It should be remembered that in the case of people who do not deal with environmental reports daily or are only members of a team for environmental reports, they are not obliged to have such documents; however, knowledge gained through obtaining such diplomas can be very helpful, for example, when working with environmental costs or carrying out tasks in the field of environmental protection. With regard to possessed experience in environmental costs (Fig. 2), more than 60% of the respondents indicated at least 5 years of experience in this area, of which 31% were people whose practice was from 1 to 3 years. The last question that was paid special attention to in the first part of the questionnaire was the employment department (Fig. 3). The analysis showed that the highest number of respondents dealing with costs and environmental reports were employed in the following departments: environmental protection and economy and finance. For other departments, there were one or two respondents at most (most frequently, it was the head of the department, or a person appointed by him/her).

The second part of the questionnaire focused on the participation in environmental courses and conferences. The first three questions concerned courses or trainings in environmental protection. With regard to the interest in participating in such courses or trainings, 10% of the respondents expressed their willingness, 44% of the respondents were moderately interested and 46% did not express interest in such opportunities (Fig. 4). As for proposals for participation in courses or trainings by the management, the following results were obtained: only 2% of the respondents admitted that they often obtained consent for participation in the above-mentioned forms of expanding knowledge of environmental protection, 42% claimed that such consent was granted rarely, and 56% had not obtained such consent back then (Fig. 5). As for the proposal of employees' participation in courses from their superiors, only 4% of the respondents declared that they often received such proposals, 46% rarely received such proposals, and 50% admitted that they had not received such proposals at all (Fig. 6). With regard to the participation in conferences or seminars of employees dealing daily with environmental protection issues and environmental costs, answers were found to be very similar to the previous question. The willingness to participate in conferences or seminars was declared by 30% of the respondents, average interest was shown by 48% of the respondents, and no interest was shown by 22% of the subjects (Fig. 7). When analyzing answers related to the proposals and superiors' consent for employees' participation in the discussed events, 54% of the respondents admitted that they rarely received such proposals, while 46% had not received such a proposal at all (Fig. 9). With regard to the consent, 53% of the respondents

rarely received such a consent, while 47% had not received such a consent at all (Fig. 8). It is worth noting that although burdened with costs, both improving the knowledge of employees through allowing them to participate in such trainings and presenting the achievements of a company at various conferences can bring benefits presented at the beginning of this article.

The last part of the questionnaire was related to working with environmental costs. The questions were designed to capture problems with the reporting system itself. The first question referred to access to tools that can facilitate working with environmental costs and the frequency of their use by employees. In this case, 82% of the respondents admitted that they had access to these tools and used them in their work, 10% indicated that they did not use tools to facilitate the creation of cost reports and 8% did not have this type of facilitation (Fig. 10). The next question concerned trainings in preparing documentation related to environmental costs and their frequency. None of the respondents marked the answer concerning regular trainings, 40% of the respondents admitted that trainings took place rarely and the remaining 60% had not had the opportunity to take part in such trainings (Fig. 11). The third question referred to the ease of use of computer programs, which are utilized by employees when creating such documentation. In this case, 96% of the respondents admitted that the programs were very easy to use, only 4% said that the use of available computer tools was average (Fig. 12). The last two questions dealt with the flow of information related to the mentioned costs and the persons responsible for the departmental cost accounting. In the case of information flow, 36% of the respondents confirmed that the information flow was very good, and the data was collected on time, 40% indicated that the information flow was average, and according to 24%, the information flow was bad, and the information was not collected on time (Fig. 13). As it was mentioned before, the last question concerned persons responsible for departmental cost accounting. Here, 86% of the employees admitted that there was such a person in the department, whereas 14% stated that there was no person responsible for departmental cost accounting (Fig. 14).

To sum up the results, it is worth emphasizing that the aspect of environmental costs and environmental reports will undergo further dynamic development over the next few years. The results of the authors (Ferens, 2016; Piontek, 1999; Paszkiewicz, Szadziewska, 2011) research so far have focused mainly on the description of the issue of environmental costs, their classification and, to a lesser extent, on measures aimed at introducing changes. The article presents a survey as a tool helpful in identifying problems related to reporting at the company level, as evidenced by the results presented. As a result, there is a need for continuous improvement of knowledge and skills of employees responsible for these aspects of a company's operations. Unfortunately, enabling further development of employees through trainings or opportunities to participate in conferences as well as providing appropriate working facilities are often neglected as an important aspect of a company's activity. Even if it entails quite high costs or even difficulties in its functioning, the profit in the form of a highly qualified team significantly outweighs the losses and ensures stability of a company's functioning in the

field of environmental protection, for example, at the moment when additional requirements appear or when the existing requirements become stricter. On the other hand, the low interest of employees may result from the fact that employers constantly reject the possibility of such participation and the lack of benefits resulting from broadening their skills, yet these do not always have to be material benefits.

## 4. Conclusion

It is commonly known that environmental protection is currently a crucial element of company's activity, which is taken into account in both global and national economy as well as more and more often decides about its value and innovativeness. The more companies are oriented towards pro ecological actions and their activity is designed in such a way as to have the least possible negative impact on the environment, the greater the value of such companies on the European or world market.

As part of the article, attention was drawn to the need to develop a breakdown of environmental costs dedicated to the mining sector and proposed examples of costs that could be classified as these costs, as well as the most important problems related to reporting.

This paper, in addition to reviewing the most important literature information on the analyzed issue, paid special attention to employees, whose task is to create both reports for the environment and the balance of environmental costs. For this purpose, an appropriate questionnaire was created, with two parts focused on working with environmental costs, the possibility of development and sharing of knowledge acquired in the field of environmental protection and environmental costs. It should be noted here that in order to be able to move smoothly between these two concepts, it is necessary to have thorough understanding of them in equal measure. The basic problem that was pointed out in the questionnaire was the low possibility of participation in trainings or conferences in the discussed scope. It is worth emphasizing that employees with sufficient knowledge will not only be able to perform their duties well but additionally will be able to properly use the tools used for e.g., environmental cost reporting. Moreover, enabling employees to take part in conferences dedicated to the discussed issue and sharing the acquired skills is a very good opportunity to broaden the existing knowledge and improve the systems currently functioning in a company.

Strengthening the background connected with the environmental protection and environmental costs in companies from the mining sector through highly specialized personnel, properly developed reporting systems or tools facilitating the work within these issues will certainly not bring huge financial benefits in a very short period of time. Fines imposed on companies in connection with noncompliance with the introduced regulations as well as mistakes resulting from insufficient knowledge of employees in this scope will significantly outweigh the costs connected with the reinforcement of the said facilities.

## References


1. Borowiec, L. (2013). *Rola rachunkowości w raportowaniu Społecznej Odpowiedzialności Biznesu (CSR)*. Studia i Prace Kolegium Zarządzania i Finansów. Warszawa: Wyższa Szkoła Finansów i Zarządzania, Szkoła Główna Handlowa.
2. Dimitroff-Regatschnig, H., Schnitzer, H., Jasch, Ch. (2002). *Manual for Environmental Cost Ac-counting: Effects on the Resource and Energy Efficiency of Production*. Paper provided by European Regional Science Association in its series ERSA.
3. Famielec, J., Stępień, M. (2005). *Informacja ekologiczna w ujęciu finansowym*. Kraków: Wydawnictwo Akademii Ekonomicznej.
4. Ferens, A. (2016). Systematyka kosztów środowiskowych w przedsiębiorstwie branży energetycznej do celów decyzyjnych. *Zeszyty Teoretyczne Rachunkowości, Tom 86.* Warszawa: Stowarzyszenie Księgowych w Polsce.
5. Hansen, D.R, Mowen, M.M., Guang, L. (2007). *Cost Management*. Accounting & Control. Thomson – South Western, Mason, Ohio.
6. Jaruga, A., Szychta, A. (1997). *Zarządzanie kosztami w praktyce światowej*. Gdańsk: ODDK.
7. Kamieniecka, M., Nóżka, A. (2016). *Źródła i zakres raportów środowiskowych oraz ocena możliwości ich integracji ze sprawozdaniem finansowym*. Studia Ekonomiczne. Katowice: Wydawnictwo Uniwersytetu Ekonomicznego.
8. Kijewska, A., Bluszcz, A. (2016). Kierunki zmian sprawozdawczości przedsiębiorstw górniczych. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, Nr 267*, Katowice: Wydawnictwo Uniwersytetu Ekonomicznego.
9. Kryk, B. (2008). The Account of Costs of Environmental Protection as the Element of a System of Financial Information about the Environment. *Polish Journal of Environmental Studies, vol. 17, no. 3B*.
10. Małecki, P.P., Urbaniec, M. (2014). Koszty środowiskowe w Polsce w ujęciu teoretycznym i statystycznym. *Optimum Studia Ekonomiczne, nr 3(69*). Białystok.
11. Miłaszewski, R. (2009). Metody określania kosztów środowiskowych i zasobowych spowodowanych użytkowaniem wód. *Rocznik Ochrona Środowiska, Tom 11*. Koszalin: Politechnika Koszalińska.
12. Paszkiewicz, A., Szadziewska, A. (2011). Raportowanie ekologicznych aspektów działalności w przedsiębiorstwach energetycznych i chemicznych. *Zeszyty Naukowe Uniwersytetu Szczecińskiego, Nr 625*. Szczecin.
13. Piontek, B. (1999). Koszty środowiskowe w rachunku kosztów funkcjonowania kopalń węgla kamiennego. *Rocznik Ochrona Środowiska, Tom 1*. Koszalin: Politechnika Koszalińska.
14. Poniewski, F. (2018). *Ochrona środowiska w firmie*. Gdańsk: ODDK.

15. Szadziewska, A. (2006). Koszty środowiskowe i ich ujęcie systemie rachunku kosztów przedsiębiorstwa. *Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego, No. 4*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
16. Szadziewska, A. (2008). Identyfikacja i pomiar kosztów środowiskowych w systemach rachunku kosztów polskich przedsiębiorstw dostarczających energię elektryczną, gaz i wodę – wyniki badań empirycznych. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia, z. 9*. Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.

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# STEEL COMPANY IN INDUSTRY 4.0: DIAGNOSIS OF CHANGES IN DIRECTION TO SMART MANUFACTURING BASED ON CASE STUDY

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**Purpose:** The reason for writing the paper was the strong trend of development of the concept of Industry 4.0. Companies have started their journey to smart manufacturing by applying the key technologies (pillars) of Industry 4.0. A decade has passed since 2011, when the idea of Industry 4.0 emerged as a form of industrial development based on the achievements of the fourth industrial revolution. During this decade, companies have become convinced by the idea of Industry 4.0 and have embarked on projects (investments) that fit into smart manufacturing. The aim of the research was presentation of the key fields of changes in the steel company towards smart manufacturing.
**Design/methodology/approach**: The author used a case study to achieve the research aim. The subject of the research was one of the largest steel companies, which has a strong position in the global steel market. The presented areas of change of the company fit into the scope of changes belonging to smart manufacturing. In the study, following the company's statement, it was assumed that the implemented investments will create "smarter manufacturing" no "smart manufacturing" because their number and scope does not entitle either the company itself or the author of this paper to state that the changes made already at this stage create smart manufacturing in the steel company.
**Findings:** The result of the case study is a model – a general concept – for the introduction of smart manufacturing in an enterprise. The term model was used for popular scientific purposes, as a form of generalisation of the presented scope of changes in the studied enterprise.
**Research limitations:** The author is aware that the company used for the research may not constitute a sufficient area of research to formulate generalisation constructs on its basis, but she points out that the article is a part of a broader research, and the presented fragment of the research was used for the purpose of popularising knowledge on changes taking place in Industry 4.0.
**Practical implications:** The paper promotes smart manufacturing projects in the steel sector. The practical implication of the paper is a proposal for a pathway to build smart manufacturing, which has constructs that are versatile enough to be used to create company pathways in other industry sectors of the economy.

**Originality/value**: The article is part of the very topical theme of Industry 4.0, which has already been popularised to such an extent that it has become a reality and not just a proposal (future) for industrial development under the conditions of the Fourth Industrial Revolution. The paper describes actual projects for building smart manufacturing in the steel company.

**Keywords:** steel company, smart manufacturing, smarter steel.

**Category of the paper:** case study.

## 1. Introduction

Industry 4.0, as a new direction for many of the world's economies in the fourth industrial revolution, has accelerated the development of companies. Today, there are already enterprises that have introduced advanced technologies that create smart manufacturing. The accession of companies to the creation of Industry 4.0 is carried out according to the requirements of the new development concept, which are: personalisation of products, cyber-physical production systems, artificial intelligence, augmented and virtual reality, Big Data, IoT, ubiquitous integration (Kagermann et al., 2013). For the success of companies that adopt the co-creation of Industry 4.0 as their development direction, it is necessary to invest in technologies that combine physical objects with virtual solutions. The rapid development of advanced technologies is conditioning changes in manufacturing systems that are agile enough to deliver products tailored to their individual customers' needs (Arora et al., 2008). Companies in Industry 4.0 are making changes to be smart. There is no single solution that can be considered to lead the changes that build smart manufacturing. The form of the complexity of change can be seen, for example, in the RAMI 4.0 model with many processes and technologies (Resman et al., 2019). Innovations and investments in enterprises are made both in core processes, which include production, and in supporting processes, with a particular focus on logistical processes outside the enterprise. The development of enterprises in Industry 4.0 is a set of many technological, organisational and human resource changes, all of which make up the smart environment within and around companies (Rüßmann et al., 2015; Santos et al., 2017, Davis, 2012).

The nature of each company is its development in Industry 4.0. The development is based on business improvement under the conditions of the Fourth Industrial Revolution. Each company is made up of an organisational structure, human resources and technology that provide opportunities for growth. The key directions of change that a company adopts are enshrined in its development strategy. By adopting Chandler's rule, the company will follow the strategy, not the other way around. At the stage of building smart manufacturing, it is important to determine the key areas of change and the key processes in which the changes

will be implemented in companies on their development paths in Industry 4.0 (Gajdzik, 2022a, 2022b, 2022c).

The main problem for companies starting to implement a development strategy based on the pillars of Industry 4.0 is to find areas with the potential to create a smart manufacturing. Przedsiębiorstwa nie mogą przeinwestować lub nie doinwestować strategicznych obszarów biznesu. Companies cannot over-invest or under-invest in strategic business areas. New fully automatic technologies and artificial intelligence are very expensive. The choice of areas for change in companies towards Industry 4.0 is an individual decision by top management. Not all companies will reach Industry 4.0 as part of their development, some companies will not build a smart environment. It is easier to make changes for very large and large enterprises belonging to strong capital groups, very often with many years of experience in business. The variation in the degree of investment in high technology also applies to industrial sectors. In many economies around the world there are sectors (industries) where smart solutions are easier to introduce, if only because of the type of production and type of customers. Such sectors include the automotive, footwear, computer (electronics) and food sectors. In contrast, it is more difficult to introduce changes towards Industry 4.0 in the mining, fuel, chemical and metallurgical industries. Despite some difficulties in building Industry 4.0 in all industries, each industry is attempting to set its own development path in reaching the goal of being a participant in the cyber-physical systems (Gajdzik et al., 2021a; Deloitte, 2018).

On the basis of the above introduction about the company development in Industry 4.0, the following research objective was adopted: to establish a path of action in the process of transformation of steel industry enterprises in Industry 4.0 by building smart manufacturing. This study is part of a larger research project on the transformation of the steel producers sector in Poland together with business-related enterprises under the conditions of the ongoing fourth industrial revolution. The presented research part is based on a case study of a global steel producer, where the process of development towards Industry 4.0 is most visible.

The structure of the paper consists of a literature part and a research part. The literature part aims to present the essence of knowledge about Industry 4.0. The concept of Industry 4.0 has been strongly popularised by political, business and scientific circles since 2011. Many scientific studies and research reports have already been written on Industry 4.0In the Web of Science scientific database, more than 17,000 publications searched for the keyword 'Industry 4.0' were registered between 2011 and 2021. The research part is the result of an analysis of investment projects implemented in a steel company. The analysis was carried out on the basis of publicly available information, using reports published by the surveyed company on investments carried out as part of the company's development strategy (resulting from the development strategy) for the coming years. The work concludes with a summary of the stages of steel design (construction). This summary of implemented changes became the basis for

determining the entity's path in Industry 4.0 based on smart manufacturing. The usefulness of the research results presented in the paper for building knowledge about the transformation of steel enterprises in the conditions of Industry 4.0 is due to the purposeful selection of the entity for the case study, which was the largest steel producer (until 2019, it occupied the first position in the world ranking of steel producers conducted by the World Steel Association).

## 2. Industry 4.0 – the key information about the industrial development

A consequence of the fourth industrial revolution is Industry 4.0, which is being introduced in many economies around the world. The term Industry 4.0 (Industrie 4.0 – a nomenclature from German)- abbreviated to I 4.0 was coined by German business and government circles. The term 'Industrie 4.0' appeared at the Hanover Electronics Fair in 2011. Since 2012, the name 'Industry 4.0' has become very popular. The pillars of Industry 4.0 are: autonomous robots, Internet of Things, cloud computing, huge data sets (Big Data), augmented and virtual reality, interoperable technologies, IT-computer process support systems, additive (incremental) manufacturing, machine-to-machine (M2M) communication technologies, artificial intelligence and autonomous robots, data transfer security support technologies (Kagremann et al., 2013). Industry 4.0 is developing towards the flexible and intelligent manufacturing of products - Smart Manufacturing, (SM). The word 'smart' is used to emphasise (expose) the interaction of the real and virtual worlds, with a particular focus on artificial intelligence (AI), which is being introduced in manufacturing companies to optimise processes and provide 'agility' to the enterprise through device access to IoT (Dais, 2014; Davis, 2012). New advanced (high) manufacturing technologies offer the opportunity to increase production efficiency and minimise production 'delays' resulting from the unreliability (weakness) of the human factor and traditional machinery (Schwab, 2016). Autonomous robots and collaborative technologies are opening up new possibilities for manufacturing products. High technologies have the ability to monitor and transmit data from devices to decision-making centres on an ongoing basis and control devices autonomously through AI algorithms, which affects the speed and flexibility of production (Wiesmüller, 2014; Wang et al., 2016).

In Industry 4.0, a significant part of production is carried out by means of intelligent and digital technologies that control processes in companies. Computerised manufacturing systems are equipped with network links with digital twins that communicate with other facilities and systems, transmitting information about the operation of equipment (machines) in real time and improving their technical performance via internet links. The interconnection of the structures of all manufacturing systems leads to the emergence of cyber-physical production systems (CPPS), in which high technology communicates via networks. Manufacturing is highly

autonomous. Intelligent technologies work without humans or with very limited human input. The structures of cyber-physical systems are extensive. The cyber-physical system is made up of intelligent machines, autonomous robots, storage systems, ICT, autonomous technologies, intelligent objects, etc. The Industrial Internet of Things (IIoT) facilitates the transfer of information from device sensors (machines) to a decision-making centre, as well as improving machine-to-machine (M2M) and machine-to-product (M2P) communication. Cyber-physical systems operate in real time, sending data to a local server or cloud server, where data analysis takes place and predictive models used for process optimisation and machine learning are built (Hermann et al., 2015; Branca et al., 2020).

Industry 4.0 technologies are so popular that companies have embraced them because the smart environment creates additional business benefits. Companies with smart technologies report productivity gains and lower manufacturing costs, higher product quality (manufacturing accuracy) and higher customer satisfaction with personalised products. In resource consumption, companies report decreases in raw material and energy consumption. In addition, new technologies emit less pollution and waste and improve occupational safety (BCG report, 2018). Market and scientific researchers confirm that the larger the company, the greater the visible impact of new technologies on the listed set of benefits (Czupryna-Nowak, 2020; Göll and Gracel, 2017). The quoted statement was the main argument (for the author of the publication) for choosing the largest steel producer for the case study in the empirical part of the work.

At the stage of change so far, companies have not developed a universal path for the implementation of the technologies that make up Industry 4.0. Decisions by companies to implement next-generation technologies are the result of analyses of the methods and techniques used to date to handle processes, as well as existing IT solutions and the possibility of their expansion in existing business structures (Kuhn, 2015). It is only possible to identify a few common stages, the beginning of which is the adoption of a development strategy based on smart technologies and the establishment of units (departments) for the digitisation of business and high technology manufacturing. Subsequent stages depend on decisions on pilot investments planned for the coming years in the company. The investment projects implemented, based on the pillars of Industry 4.0, will create smart manufacturing. The implementation of solutions starts with a few selected scopes of technological innovation up to the next. The number of projects is increasing, resulting in smart environments within cyber-physical manufacturing systems to smart factories (Gajdzik et al., 2021, Soldaty, 2018). When building a smart environment, companies use the specialist services of the IT industry. The IT industry designs full or fragmented digital business models according to the requirements of different industry sectors. The IT solutions available on the market are not

universal, even though certain modules are repetitive, and therefore need to be tailored to the company's specific operations, organisational structure and business process scopes.

The lack of a universal pathway in Industry 4.0, in the form of a methodology for enterprises that have embarked on building a smart environment, was the inspiration for the preparation of the empirical part of this article. The choice of the steel sector as the industry used to perform the analysis is dictated by the author's scientific area, which she has been dealing with for years by researching and describing changes in the steel industry in Poland. The capital group used in the case study operates a company in Poland, which is, in this country, the largest steel producer. The case study analysis therefore has a double utility. The first arises from the fact that the capital group is a benchmark in the global steel market and the second arises from the fact that it operates in Poland through one of its companies, which is, in turn, a benchmark in the Polish steel industry.

## 3. Direction on smart manufacturing in steel company – the case study

### Methodology

A case study is a detailed description of a phenomenon or process, carried out to identify causes and conditions and interactions with other phenomena, as well as the effects of change. The analysis of a multiple case study helps to clarify the mechanisms of the activities under study and assess their effects (Czakon, 2011). The case study outlines a picture of the phenomenon or process under investigation in the context of existing enterprise capabilities and business conditions. The information for the case study comes from the enterprise under study (Apanowicz, 2020). A case study consists of the following stages: (i) determination of the research topic and research objective (ii) presentation of the analysed enterprise this stage also called enterprise characteristics opens the case study; (iii) discussion of the researched topic and its description by information about changes in the analysed enterprise, (iv) evaluation of the extent of changes and formulation of final conclusions or models in relation to the research objective. The results of the case study are model processes or best solutions or a methodology of operation On the basis of the case study, conclusions relevant to other companies can be drawn (Apanowicz, 2020).

Referring to the presented methodological steps for the execution of the case study, a research topic was established (in line with the first step), which is changes towards smart manufacturing in a steel company. The aim is to outline a path for the introduction of smart steel production. The scope of the research concerned technological and organisational changes implemented in a strong steel group in the global steel market. The manufacturer produces

around 10% of the world's steel production annually. The information presented in the article was from studies (reports) available on the web pages of the steel company under study.

**Object of the case study**

The analysed capital group has been one of the world's leading steel producers for years. The mills in the analysed capital group produce approximately 10% of the world's steel production annually. The group operates in 60 countries on three continents. In terms of steel production, the capital group is a leader not only in the world steel market, but also in the European market. The Capital Group acquired steel mills that were being restructured in Central and Eastern European countries, including Poland. The restructuring process of the steel industry in Poland was carried out with the participation of foreign capital (Gajdzik, 2012). Foreign capital, including the analysed group, strengthened its position in the global steel market through strategic mergers (Gajdzik, and Sroka, 2012). The group in question is the result of a merger between two large capital groups. The group owns both the steel mills and the companies that make up the supply chain (coking plants, mines, logistics centres). The groups has a research and development (R&D) centre and analytical laboratories.

**Smarter manufacturing – key projects based on case study**

The analysed group adopted an action strategy, which is described by the slogans: smarter future, smarter manufacturing and smarter steel. Citing these slogans, the author wondered: Why does the company under study use the statement 'smarter' and not 'smart'? The answer was formulated based on the results of the research – a case study. The group's action strategy with the adopted statements: "smarter future", "smarter manufacturing" and "smarter steel" is the first stage of changes on the company's way to participate in the development of Industry 4.0. The provisions introduced in the strategy set new directions of development, which in the future will create smart manufacturing in the whole group of companies belonging to this owner.

The steel company invests in smart steel manufacturing based on three business pillars, which are:

- protection of the natural environment through the use of new steelmaking technologies, including among the priorities: reducing emissions of atmospheric pollutants, especially CO2; limiting the use of electricity generated from coal in steelmaking processes,
- improving steelmaking processes through the implementation of artificial intelligence (AI) and advanced automation in all processes of the business,
- personalising steel products for key customers, which in the case studuy are the automotive and construction sectors, using the latest generation of technologies and co-creating technologies with participants in the value chain.

These key areas of change, together with the provisions for smarter manufacturing in the development strategy, are implemented through technological investments, organisational and process changes, accompanied by changes from the area of human factor reorganisation.

The case study presentation summarises four areas of change:

Field 1: Key technological changes.

Field 2: Process improvement.

Field 3: Organisational level of change.

Field 4: Human factor reorganisation.

The selected fields of change are implemented simultaneously at the same time. Changes are implemented at multiple levels of the organisation. The selected areas (stages) of change organise the scope of the changes implemented in the capital group under case study.

Field 1: Key technological changes. The company has developed a holistic vision of digitalisation that includes the Internet of Things (IoT), Big Data and Artificial Intelligence (AI). The synergy of these three areas requires a lot of technology and process investment. Key areas of change include digitalisation, manufacturing robotics, data analytics and Big Data, nanotechnologies, 3D metallurgy and the circular economy. Business digitalisation projects are steered by the Centre of Digital supported by data collection technologies and ICT thematic platforms. Technological improvements through automation of operations are being made in production, delivery and warehousing. Autonomous cranes and overhead cranes with election identification functions, drones, sensors on process plants, sensors for measuring the efficiency of technology, autonomous vehicles, among others, have been used to automate work. The scope of operations of each technology has been established and presented in the investment projects. Example of drone tasks: (i) assessing the maintenance needs of in-service facilities, technologies and transport networks in companies, (ii) minimising risks to employees who would have to work on high structures to determine the condition of a facility, (iii) tracking energy consumption – drones with infrared cameras moving at a fixed height measure the energy intensity of facilities and technologies. Example of AI tasks: (i) product image recognition, (ii) model creation – digital twinning – a set of models used to optimise physical assets and production processes using data collected from equipment sensors (installations), (iii) machine learning. Example of digital twinning: sensors create a digital imprint of a product to be delivered to the next process. AI is used for product quality control and process control. An example of the application of AI in a steel rolling process: the production decision to release a weld in a hot rolling mill is made on the basis of image recognition of the width of the cold coil. The operator has applied the latest in product parameter control to improve product quality. In scaling the technical parameters, control algorithms were applied according to the requirements of customers in the automotive and construction industries - these industries are the consumers of steel products manufactured in the entity under study. In improving the

performance of steel products, the steel mills produce lightweight products for the cars of the future, unique products for structures and skyscrapers, railway rails for high-speed transport, steel sheets for equipment and facilities operating in extreme weather conditions and introduces many other innovations in steel products. Technological innovations, including the use of high technologies, are supported by dedicated IT and computer applications in the form of a catalogue of steel solutions to serve the automotive and construction markets by launching thematic programmes in the area of cooperation during the design, manufacture and delivery of products.

The company is constantly implementing maintenance improvements. New technology – 3D printers are used to produce spare parts for machines. In accordance with the TPM concept, companies in the group optimise the operation of technologies – parameterisation of technology operation, measurement of machine (technology) performance, prevention of machine failures. 3D printers with the highest product accuracy parameters are used to manufacture steel products for customer markets (3D metallurgy).

Building the holistic model of steel production requires the installation of thousands of intelligent sensors and sensors to transmit data from the machines to the decision-making centre. Basic technological installations, e.g. the blast furnace together with continuous steel casting equipment, are controlled using advanced information and computer systems. The company is constantly improving its IT and computer systems and communication servers. The manufacturer processes large sets of data (Big Data) across the entire network of capital links in the supply chain, from the sourcing of raw materials to the production of steel to the distribution of final products. The capital group has a central system for decision-making and process monitoring across all plants. One element of process control is product life cycle analysis and circular economy.

Field 2: Process improvement. The processes are improved according to the principle of 'process-based product development'. Investment in the area of: process improvement is the responsibility of the process research team, which works closely with individual units across the company. The aim of the projects is to improve technology reliability and process efficiency. In process improvement, the company uses the ACO algorithm (Ant Colony Optimization). The algorithms involve finding paths to reach a destination in realizing processes. At the beginning of the path is the individual customer order (suction system). Process tracking is implemented through computer vision (CV) systems, which provide a picture of the entire production environment. The algorithms determine selected paths for process optimisation. At the end of the path are the products that customers have ordered. The first fully commissioned AI-based project was the recognition of wagon numbers at raw material plants. Further projects are in the pipeline with algorithms to recognise the type of material moved by cranes or to recognise the level at which liquid metal fills a tub. In improving

processes – by optimising activities and parameters - the manufacturer has applied the following principles: (i) full standardisation and modularisation of processes (ii) flexible modular combination of technologies and processes (iii) networking of processes within the group and in supply chains (iv) computer optimisation and virtualisation of process flows and simulation of planned changes (v) continuous development of processes in a whole product life cycle (LC) arrangement, (vi) cooperation of humans and robots (vii) identity of components and machines in communication in cyberspace (viii) integration of everything (machines, ICT, processes). The companies in the study group have mobile inspection teams (inspections) which, using information and computer systems, check the work of the equipment. Inspections are carried out by professional maintenance (PM) services and autonomous maintenance (AM) operators. The services have a computer application installed on their phones, each employee scans a QR code placed on the facility and confirms that the task has been completed after the inspection. Data from the mobile devices of the operators of each machine and process plant is sent directly to the ERP system.

Integrated IT and computer systems for tracking the production of steel products have been installed at steel mills. The solution makes it possible to view the current status of production, increase the throughput of the production line, speed up the quality acceptance of products and reduce the risk of human error. In addition, the manufacturer used a system of communication of operators with machines and technological installations in the cyber-physical space – employyees (equipment operators), instead of computer keyboards and control panels, use smart helmets and glasses, which are a new form of communication with machines.

A steel product defect detection system has been introduced to steel mills with smart technologies, including: (i) the roll defect detection system supports the hot mill grinder – the latest generation of measurement systems used in the system contributes to the effective detection of surface cracks and defects hidden deep beneath the surface, including cracks under other metal, (ii) a radar measurement system to determine the filling level of the coke chamber after backfilling with coal mixture and levelling, based on the data obtained, the chamber backfilling operations can be better carried out while reducing emissions to the environment.

Field 3: Organisational level of change. The company has business digitalisation units at senior management level. The company has a global R&D centre. Process improvement is handled by process research teams. Technology development, on the other hand, is the research area of the digital excellence centres. The group has its own research laboratories. At top management level, there are directors of business digitalisation and directors of advanced technology and AI. Top management works with the business digitalisation staff and the Global R&D Centre with research laboratories. Supporting the digitisation teams are the Research and Development (R&D) Departments and the segment managers for information and data at IT department (division) level, located in the company's divisions and manufacturing processes.

At group management (directorate) level, there is an office: Global R&D, which is the main driver of change for the entire corporation. The entity has its own research laboratories, which collaborate with the engineering divisions to accelerate plant automation projects and the implementation of advanced AI technologies. The entity also has digital laboratories that act as training and innovation centres for employees, students and local startups.

Field 4: Human factor reorganisation. The capital group is focused on human resources development. For more than a decade, the group has used the 70/20/10 model to build staff competence (Gajdzik, 2016). In European countries, the group struggles with the generation gap and controls staff turnover (Gajdzik, and Szymszal, 2016). The company needs young engineers with digital skills. The number of employees with digital skills is increasing year on year, with IT specialists making up between 10% and 20% of the workforce. The IC systems department, as part of its Design Thinking activities, supports the company during the building of the cyber-physical modules of the manufacturing system, including the definition of processes and provides tools to create a risk analysis during system implementation. In addition, the IT Departments support the development of a timetable for the next stages of implementation and the methodology for working on advanced technologies in group companies. The latest virtual simulation technologies are used in the training of staff, particularly in the area of safety and improving working methods. The manufacturer, for many years now, has been betting on the development of soft skills, the share of which in the total number of training courses is constantly increasing (Gajdzik, Wolniak, 2022a, 2022b).

The list of changes cited, in the four areas cited, is open-ended, and the changes implemented do not exhaust the broad scope of building smart steel production in mills (Gajdzik, 2022b, 2022c). The companies belonging to the capital group in question differ in their degree of maturity to operate under the conditions of I 4.0. In the Polish market, this level can be defined as 3.5, on a scale from 1 to 5, where 1 is the lowest assessment of the advancement of changes towards the creation of smart steel production (Gajdzik, 2022a).

**The way of steel company to smart manufacturing – the first steps**

On the basis of the presented case study, the company's path towards achieving the requirements of Industry 4.0 and building smart manufacturing was determined. Changes are introduced at all levels of the organisation and are initiated by the provisions of the enterprise development strategy. The enterprise development strategy is the main document (plan), for all enterprises in the group, for building smart manufacturing. Regardless of the location of the enterprises, the adopted directions of development, are the signposts of change in Industry 4.0. In the analysed enterprise, the directions concern three technological areas, which make up the holistic business model (Figure 1).

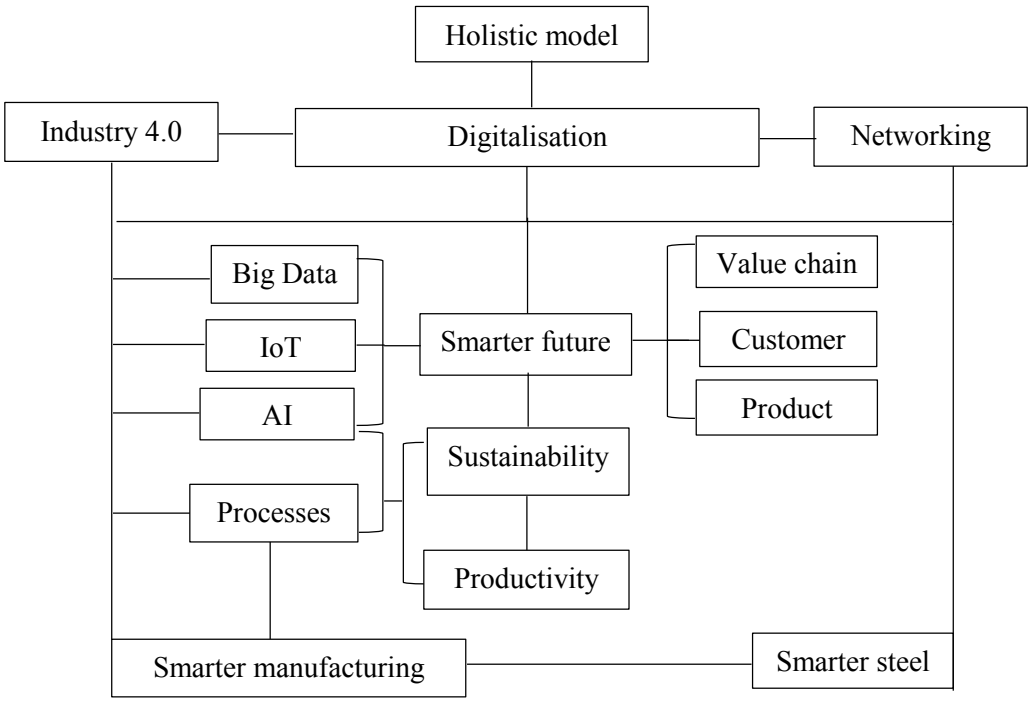


**Figure 1.** Holistic vision of business in Industry 4.0. Own elaboration.

Three Industry 4.0 technologies are leading the way in building the smart manufacturing: Big Data, IoT, and AI. Improving manufacturing and other processes requires: the use of standardisation and modularity, integration of IT and computer systems, introduction of procedures and systems for personalising products, investment in concurrent technologies, expansion of autonomous IT and computer systems for process control and decision-making, 3D printing of spare parts to ensure continuity of production and achieve higher efficiency of machines under TPM, full automation of activities and an increasing number of activities performed by robots. Technological changes are accompanied by organisational changes. The plants of the studied ownership group are creating additional Top Management positions in the rank of directors for business digitisation and smart manufacturing, who are responsible for the company's strategic projects in Industry 4.0. New positions are also being created at lower levels of the organisation, assuming that the company has a process structure that facilitates the company in building a smart environment. A strong support for companies implementing smart manufacturing projects are internal R&D departments and research laboratories.

Parallel to the technological and organisational changes, a reorganisation of the human factor in the study group is taking place. In Industry 4.0 there is an increasing demand for staff with digital skills. Companies are following two parallel paths: (i) development of the company's staff (training, recruitment, redeployment) (ii) purchase of IT services from external digital service providers. The development of basic digital skills among employees is important. Employees in production positions are required to operate ICT equipment and have IT knowledge. In addition to employees with basic digital skills, the company has a demand for

employees with advanced digital skills, which it recruits externally. The existing arrangement of durable (technical) and soft (social) skills is strongly reinforced by digital skills (Grebski, Gajdzik, 2022).

The presented model of building smart manufacturing in the analysed metallurgical company (Fig. 2) is a generalised form of planned and implemented investment projects of the studied enterprise. The presented model can be used to determine the path of conduct of enterprises of other industries at the stage of determining the smart enterprise strategy. However, the author emphasises that the analysed group (steel company) calls the degree of preparation for functioning in Industry 4.0 as 'smarter' and not 'smart'. It can be expected that in the future the scope of change will intensify and the company will introduce the notation 'smart manufacturing' in its development strategy.

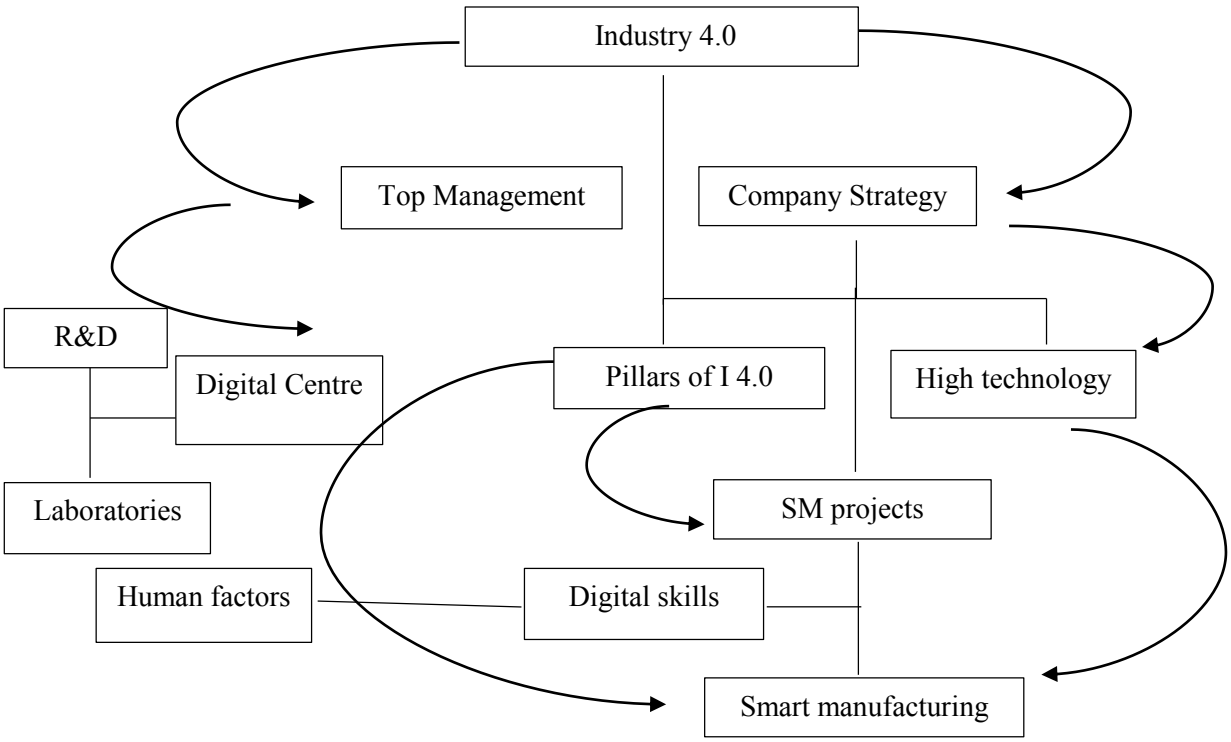


**Figure 2.** The development way of the company in Industry 4.0 – the key phases and fields of the transformation model. Own elaboration.

## Conclusion

The paper is based on the case study, which was the steel company in the global market. The analysed company is a recognised benchmark in the global steel market. The extent of the changes implemented by the company based on the requirements of Industry 4.0 is the beginning of its long road to the smart steel manufacturing. The number of projects will increase

and the improved internal processes will be strongly linked to those of key customers in the market. It is noteworthy that in the holistic vision of the digitalisation of the enterprise, the three technologies of Industry 4.0, which are Big Data, IoT and AI, are placed at the centre of change. These technologies are new and strongly popularised in the concept of Industry 4.0. The triad of technological symbiosis (Big Data, IoT and AI) is the core achievement of the Fourth Industrial Revolution. In addition to these technologies, the company continues to make technological investments based on the achievements of the third industrial revolution. Such investments include a package of projects in the area of business digitalisation. The digitalisation of industry started several years ago (1990s) and is still ongoing. In the new business model, plants of the analysed group link business digitalisation with the integration of business processes and with internal and supply chain technologies. Such the setup, further supported by the presented triad of technologies: Big Data, IoT and AI, provides the foundation for building the smart steel manufacturing.

The three pillars of change towards smart manufacturing identified in the case study are among the key pillars of Industry 4.0 reported in the literature. Although, here too, there are differences in the number of pillars (Industry 4.0 technologies) identified by authors or organisations. G. Erboz (2017) describes four pillars of Industry 4.0: CPS, IoT, cloud computing and cognitive computing. S. Greengard (2015) focuses on cyber-physical systems (connections between the real and virtual worlds), the Internet of Things (IoT) which increases the data available as different products can be connected to the Internet, the Internet of Services (IoS) and the smart factory. C. Senn (2019) and B. Sniderman (2016) characterise nine technologies of Industry 4.0. Eleven components of Industry 4.0 are studied by the Boston Consulting Group (Rüßmann et. al., 2017). The broadest typification of Industry 4.0 technologies includes: Big Data, augmented reality, 3D printing, cloud computing, autonomous robots, cyber-security technologies, computer simulation technologies, system software, process visualisation technologies, integrated technologies and building environments for vertical and horizontal integration, IIoT. The set of technologies that make up Industry 4.0 is an open and constantly expanding set. Smart manufacturing (SM) projects based on collaborative technologies of Industry 4.0 and real-time management of processes in enterprises and in the whole supply chain. SM integrates the latest information and communication technologies (ICT) into manufacturing systems to enable real-time response to changing demands and conditions in the factory, in the supply network, and in customer needs. In this new paradigm, the Internet of Things (IoT), the digital factory, and cloud computing technology play major roles in transforming the rigid hierarchical architecture into a flexible style (Kulvatunyou, 2016). Smart manufacturing projects in specific enterprises vary in scope of change, size, type. Each enterprise develops and implements projects according to its capabilities and development goals. The technological solutions of Industry 4.0 are a key

component of the new business models that are created in Industry 4.0 on the basis of the implemented changes in enterprises. In addition to key technologies, the architecture of the model is formed by human resources, organisational structure, decision-making powers and management systems (Grabowska, 2022). The foundation of the model is business processes, which, supported by new technologies, are continuously optimised. Data from equipment is collected in real time, performance metrics are collected and used to control processes, which are visualised and optimised in real time. Quality, efficiency and optimisation are embedded in smart technology algorithms and process control systems (Gajdzik, 2022a). Business models created in Industry 4.0 are strongly customer-oriented through product personalisation. Personalisation is a key paradigm of Industry 4.0 (Grabowska, 2022; Grabowska, and Sanik, 2022). Each enterprise needs to be tailored to the customers' area of activity. Large enterprises are divided into divisions that create value for customer segments of different industries. In the digital transformation taking place, more and more companies are also attaching importance to shortening supply chains (Hwang, and Rau, 2006). Industry 4.0 technologies, on the one hand, represent an opportunity to modernise business and, on the other hand, a challenge for companies to invest in reducing their Carbon Trust and carbon-based energy intensity. Industry 4.0 companies cannot ignore the assumptions of the New Green Deal. Today's companies, even more than a few years ago, are striving to strike a balance between technology development and improving the quality of life and the quality of the environment. The new technologies of Industry 4.0 are an opportunity for companies to develop their business in line with the development of societies and economies. (Gajdzik et al., 2021b).

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## References


1. Apanowicz, J. (2002). *Metodologia ogólna*. Gdynia: Wydawnictwo Diecezji Pelplińskiej „Bernardium".
2. Arora, N., Dreze, X., Ghose, A., Hess, J.D., Iyengar, R., Bing, J., Joshi, Y., Kumar, V., Lurie, N., Neslin, S., Sajeesh, S., Su, M., Niladri, S., Thomas, J., Zhang, Z.J. (2008). Putting one-to-one marketing to work: Personalization, customization, and choice. *Science & Business Media.* Springer, p. 310.
3. BCG: The Boston Consulting Group (2018). *Przemysł 4.0 PL. Szansa czy zagrożenie dla rozwoju innowacyjnej gospodarki?* Retrieved from http://image-src.bcg.com/Images/BCG-Przemysl-4-PL_tcm78-123996.pdf, 2018.04.20.
4. Branca, T.A., Fornai, B., Murri, M., Streppa, E., Schröder, A.J. (2020). The Challenge of Digitalization in the Steel Sector. *Metals*, *10*(*2*), 288. https://doi.org/10.3390/met10020288.
5. Czakon, W. (2011). Metodyka systematycznego przeglądu literatury. *Przegląd Organizacji*, *3*, 57-62.
6. Czupryna-Nowak, A. (2020). Grupa przedsiębiorstw wdrażających koncepcję Przemysłu 4.0 sektora MŚP w Polsce. In: A. Michna, J. Kaźmierczak (Eds), *Przemysł 4.0 w organizacjach*. *Wyzwania i szanse dla mikro, małych i średnich przedsiębiorstw* (pp. 29-45). Warszawa: CeDeWu.
7. Dais, S. (2014). Industrie 4.0 – Anstoß, Vision, Vorgehen. In: T. Bauernhansl, M. ten Hompel, B. Vogel-Heuser (Eds.), *Industrie 4.0 in Produktion, Automatisierung und Logistik*. Anwendung, Technologien und Migration, 625-634.
8. Davis, J., Edgar, T., Porter, J., Bernaden, J., Sarli, M. (2012). *Smart manufacturing, manufacturing intelligence and demand-dynamic performance*. FOCAPO, 47.
9. Deloitte Insights (2018). *The Industry 4.0 paradox. Overcoming disconnects on the path to digital transformation*. Deloitte Development LLC. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/energy-resources/deloitte-cn-er-industry-4.0-paradox-overcoming-disconnects-en-full-report-190225.pdf, 2020.09.09.
10. Erboz, G. (2017). *How To Define Industry 4.0: Main Pillars of Industry 4.0.* 7th International Conference on Management (ICoM 2017). Nitra, Slovakia, November 2017. Retrieved from https://www.researchgate.net/publication/326557388_How_To_Define_Industry_40_Main_Pillars_Of_Industry_40, 2019.06.09.
11. Gajdzik, B. (2022b). How Steel Mills Transform into Smart Mills: Digital Changes and Development Determinants in the Polish Steel Industry. *European Research Studies, 25(1),* 27-42. doi: 10.35808/ersj/2827.

12. Gajdzik, B, Grabowska, S., Saniuk, S. (2021b). Key socio-economic megatrends and trends in the context of the industry 4.0 framework. *Forum Sci. Oecon.,* 9(3) 5-21. DOI: 10.23762/fso_VoL9_no3_1 http://ojs.wsb.edu.pl/index.php/fso/article/view/407/276.
13. Gajdzik, B. (2012). *Przedsiębiorstwo hutnicze po restrukturyzacji*. *Dynamika zmian w krajowym sektorze hutniczym w latach 1992-2010.* Gliwice*:* Wydawnictwo Politechniki Śląskiej.
14. Gajdzik, B. (2016). Zastosowanie metody 70-20-10 w przedsiębiorstwie produkcyjnym. *Zarządzanie Przedsiębiorstwem*, *19(1),* 8-12.
15. Gajdzik, B. (2022a). Frameworks of the Maturity Model for Industry 4.0 with Assessment of Maturity Levels on the Example of the Segment of Steel Enterprises in Poland. *J. Open Innov. Technol. Mark. Complex*., *8*, *77*. doi.org/10.3390/joitmc8020077.
16. Gajdzik, B. (2022c). Key directions in changes from steelworks 3.0 to steelworks 4.0 with analysis of selected technologies of digitalizing the steel industry in Poland. *Management Systems in Production Engineering*, *30(1),* 46-53.doi 10.2478/mspe-2022-0006.
17. Gajdzik, B., Szymszal, J. (2015). Generation gap management in restructured metallurgical enterprises in Poland. *International Journal of Management and Economics*, *No. 47, July-September,* 107-120.
18. Gajdzik, B., Wolniak R. (2022b). Smart Production Workers in Terms of Creativity and Innovation: The Implication for Open Innovation. *J. Open Innov. Technol. Mark. Complex*., *8,* 68. Retrieved from https://doi.org/10.3390/joitmc8020068.
19. Gajdzik, B., Grabowska, S., Saniuk, S. (2021a). A Theoretical Framework for Industry 4.0 and Its Implementation with Selected Practical Schedules. *Energies*, *14(4),* 1-24, 940. Retrieved from https://doi.org/ 10.3390/en14040940, doi: 10.3390/en14040940.
20. Gajdzik, B., Wolniak, R. (2022a). Influence of Industry 4.0 Projects on Business Operations: Literature and Empirical Pilot Studies Based on Case Studies in Poland. *J. Open Innov. Technol. Mark. Complex., 8,* 44. https://doi.org/10.3390/ joitmc8010044.
21. Gajdzik, B., Sroka, W. (2012). Analytic study of the capital restructuring process in metallurgical enterprises around the World and in Poland. *Metalurgija*, *51(2),* 265-268.
22. Gölll, M., Gracel, J. (2017). Przemysł czwartej generacji – wyzwania dla badań w kontekście międzynarodowym. *KNUV, 1(51).*
23. Grabowska, S. (2022). *Modele biznesu 4.0. Architektura, tworzenie wartości, ocean konkurencyjności i efektywności.* Toruń: TNOiK, ISBN 978-83-7285-982-2.
24. Grabowska, S., Saniuk, S. (2022). Development of Business Models in the Fourth Industrial Revolution: Conditions in the Context of Empirical Research on Worldwide Scope Companies Located in Poland. *J. Open Innov. Technol. Mark. Complex*., *8,* 86. https://doi.org/ 10.3390/joitmc8020086.
25. Grebski, M.E., Gajdzik, B. (2022). Psychological safety of employees (necessity or option). *Zeszyty Naukowe Politechniki Śląskiej, Seria Organizacja i Zarządzanie, 157,* 145-155. DOI:10.29119/1641-3466.2022.157.9.

26. Greengard, S. (2015). *The Internet of Things*. Cambridge-London: MIT Press.
27. Hermann, M., Pentek T., Otto, B. (2015). Design Principles for Industrie 4.0 Scenarios. A literature review. *Working Paper, No. 01*. Technische Universität Dortmund Fakultät Maschinenbau. Retrieved from: http://www.iim.mb.tu-dortmund.de/cms/de/forschung/ Arbeitsberichte/Design Principles-for-Industrie-4_0-Scenarios.pdf.
28. Hwang, M.-H., Rau, H. (2006). Development of strategies for shortening supply chain and demand chain. *Human Systems Management, 25(4)*. DOI: 10.3233/HSM-2006-25404.
29. Kagermann, H., Wahlster, W., Helbig, J. (Eds.) (2013). *Recommendations for implementing the strategic initiative Industrie 4.0: Final report of the Industrie 4.0*. Working Group: Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution, VDI-Nachrichten, Acatech-National Academy of Science and Engineering: München, Germany. Retrieved from http://forschungsunion.de/pdf/industrie_4_0_final_report.pdf, 2022.06.20.
30. Kuhn, A. (2015). On the way towards Industry 4.0: Solutions from the top cluster it's OWL – Intelligent Technical Systems East Westphalia-Lippe [Auf dem weg zu Industrie 4.0: Lösungen aus dem spitzencluster it's OWL – intelligente technische systeme ostwestfalen Lippe]. *ZWF Zeitschrift für Wirtschaftlichen Fabrikbetrieb, 110(1-2),* p. 8.
31. Kulvatunyou, B., Ivezic, N., Srinivasan, V. (2016). On Architecting and Composing Engineering Information Services to Enable Smart Manufacturing. *J. Comput. Inf. Sci. Eng. 16*(*3*).
32. Resman, M., Pipan, M., Šimic, M. (2019). A new architecture model for smart manufacturing: A performance analysis and comparison with the RAMI 4.0 reference model. *Adv. Prod. Eng. Mang*.
33. Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., Harnisch, M. (2015). *Industry 4.0. The Future of Productivity and Growth in Manufacturing Industries*. The Boston Consulting Group (Issue April). Retrieved from: http://image-src.bcg.com/Images/BCG-Przemysl-4-PL_tcm78-123996.pdf.
34. Santos, C., Mehrsai, A., Barros, A.C., Araújo, M., Ares, E. (2017). *Towards Industry 4.0: an overview of European strategic roadmaps.* Manufacturing Engineering Society International Conference, MESIC 2017, 28-30 June 2017, Vigo (Pontevedra), Spain.
35. Schwab, K. (2016). *The Fourth Industrial Revolution*. Cologny, Switzerland: World Economic Forum. Przekład na język polski: A.D. Kamińska. Czwarta rewolucja przemysłowa (2018). Publikacja powstała przy współpracy firmy Deloitte. Warszawa: Wydawnictwo Studio Emka.
36. Senn, C. (2019). *The nine pillars of Industry 4.0.* Retrieved from: https://www.idashboards.com/ blog/ 2019/07/31/the-pillars-of-industry-4-0/, 2019.02.07.
37. Sniderman B., Mahto, M., Cotteleerm, M.J. (2016). *Industry 4.0 and manufacturing ecosystems Exploring the world of connected enterprises.* Deloitte Development LLC, pp. 1-24, Retrieved from: https://www2.deloitte.com/content/dam/insights/us/articles/

manufacturing-ecosystems-exploring-world-connected-enterprises/DUP_2898_Industry4.0ManufacturingEcosystems.pdf.

38. Soldaty, A. (2018). Droga do urzeczywistnienia wizji Przemysłu 4.0. *Napędy i Sterowanie*, *6,* 74-79.
39. Wang, S., Wanm J., Li, D., Zhang, C. (2016). Implementing smart factory of Industrie 4.0: an outlook. *International Journal of Distributed Sensor Networks*, *12(1),* 3159805.
40. Wiesmüller, M. (2014). Industrie 4.0: surfing the wave? E&I *Elektrotechnik und Informationstechnik*, *1*.

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# ANALYSIS OF PRO-ENVIRONMENTAL AWARENESS AND APPROACH TO MAKING DECISIONS IN THE CONTEXT OF SUSTAINABILITY

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**Purpose:** The aim of the study is to analyze environmental awareness among employees of companies producing plastics, and subsequently to draw conclusions about the level of their pro-environmental awareness. The motive for the implementation of pro-environmental awareness research in plastics-producing plants was their harmful impact on the environment.
**Design/methodology/approach**: The research was a survey that was carried out among 44 workers of plastics enterprises located in south-eastern Poland in the first quarter of 2018. During the selection of companies for research, it was included: their location (south-eastern Poland), long-term operation (more than 30 years), the same type of activity (production of plastics), and whether pro-environmental activities were practiced.
**Findings:** It was concluded that the level of awareness of the employees of plastic industry employees was on a low level.
**Research limitations/implications**: The research sample is only a preliminary sample. It is planned to obtain data from a larger number of companies and verify the data.
**Practical implications:** Enterprises should focus on meeting customer needs and maintaining high-quality products, but taking into account pro-environmental measures that should be a priority. This is possible if pro-environmental awareness is continually shaped.
**Social implications:** The pro-environmental awareness is small among employees from the enterprises, in which pro-environmental actions were not practiced. Employees do not know how the processes are carried out in the company and whether they have any impact on the natural environment. Additionally, the employees of companies not used pro-environmental activities are unaware of the threats resulting from the activities of their company and do not know that other companies about the same activities already apply such activities.
**Originality/value:** These results will allow better decisions in the context of sustainability and improvement actions to achieve a higher level of awareness among the plastic production companies' employees.

**Keywords:** sustainability, production engineering, pro-environmental awareness.

**Category of the paper:** Research paper.

## 1. Introduction

The concept of sustainable development consists of striving to fully satisfy the needs of present customers along with maintaining the potential for the next generations. The foundation of the main idea of balanced thinking is to maintain a balance between the social, economic, and ecological dimensions (Aguilar-Salinas, et al., 2017; Armeanu et al. 2017). It is in particular important for the factors that cause increasingly use of natural resources, which are hardly renewable, for example, the evolution of civilization, massive population growth, or high demand of recipients (Pacana, Siwiec, Bednárová, 2020; Pacana et al., 2014; Lumnitzer et al., 2018). Currently, activities are related, among others, to the use of renewable energy sources, the use of ecological materials, or the strict adherence to the principles of recycling. A favorable phenomenon is the growth of companies that are certified in accordance with applicable environmental protection programs (Malindzak et al., 2017; PN-EN ISO 14001:2015). One of the stages that occur in the process of evolution of environmental management in Poland is: dilution, filtration, cleaner production, product life cycle management, as well as renewable energy and environmental management strategies (Armeanu et al. 2017; Pacana, Siwiec, Bednárová, 2020; Lumnitzer et al., 2018; Gherghina, Vintilă, 2016). These actions are realized according to the philosophy of sustainable development under which popular techniques are practiced for example, Clean Production (CP) and EMAS systems (Eco-Management and Audit Scheme) (Budynek et al., 2014; Siwiec, Pacana, 2021a, 2021b; Masternak, 2009). The mission of the continuously improved global Cleaner Production Program is to meet the challenges of, for example, well-considered management of natural resources, the evolution of biotechnology, the optimal use of energy, and the strengthening of industrial production (Lin et al., 2017; Gajdzik, 2007; Siwiec, Pacana, 2021d). The Cleaner Production System is based on the principle of sustainable development, which is based on minimization of pollution at the source of its formation (Lin et al., 2017; Pacana et al. 2019; Pacana, Siwiec, 2021). Next, an essential pro-environmental activity is the EMAS eco-management and audit system (Eco-Management and Audit Scheme, EMAS). EMAS is the first European standard that has an international character and scope. It is based on the philosophy of continuous improvement of environmental areas according to the Deming cycle (Budynek et al., 2014). It includes the strategy of the company, which, on a voluntary basis and taking into account the capabilities and needs of the company, sets goals and measures (Siwiec, Pacana, 2021b, 2022a). Through the ever-growing popularity of the environmental management system, its effectiveness is improving. The use of pro-environmental activities in organizations brings many benefits, both on the company's and the environment's side in the 21st century, the issue of environmental protection in the world is becoming increasingly important (Cichy, Szafraniec, 2015; Díaz-Siefer et al., 2015; Górzycki, 2002; Siwiec, Pacana, 2022b). Given the increasing environmental pollution and unexpected climate changes, it can be assumed that pro-environmental activities will be the foundation of

the leading organizations on the market. The publicity of threats resulting from noncompliance with pro-environmental principles means that responsible and caring customers are increasingly looking for products and services that have proven and credible ecological quality (Gajdzik, 2007; Galeja, 2006; Pacana, Siwiec, 2022; Pacana et al., 2015; Siwiec, Pacana, 2021c; Siwiec et al., 2019; Wolniak, Skotnicka-Zasadzien, 2014; Dumitrescu et al., 2015). That is why it is so important to make people aware of behavior within the framework of pro-ecological activities, and it is also important to check whether this awareness is at the appropriate level.

The review of the selected positions of the subject literature on the awareness of pro-environmental activities was carried out. It was concluded that in order to explore the relationship between ecological awareness and pro-environment behavior, surveys were made (Fu et al., 2018; Afonso et al., 2016). The influence of factors on the consumer behavior was explored in view of pro-ecological activities, in the context of the reduce the waste and reducing climate changes (Kim, Hall, 2019), disaster awareness, value and attachment to the place of residence (Zhang et al., 2014), environmental sensitivity and personal standards (Wu, 2018), health awareness (Shimoda et al., 2020) and education in the context of ecological activities. It was also checked if there are differences in pro-ecological awareness among consumers from different countries (Jotanovic et al., 2017). The impact of various pro-ecological behaviors on life satisfaction was studied (Schmitt et al., 2018), and the impact of financial and pro-ecological behavior in the context of behavior to satisfy material values and its maximize was analyzed (Helm et al., 2019) and also the factors that testify about the behavior of pro-ecological were identified (Jagers et al., 2016). The results of the surveys showed that the relationship between social media, attachment to the place attachment, and pro-ecological behavior was analyzed, and the impact of social interactions on pro-ecological public behavior and its mechanisms was studied (Janmaimool, Khajohnmanee, 2019). In addition, an analysis of the impact of employee behavior in managerial positions in the context of pro-ecological behavior was carried out (Fatoki, 2019), and the relationship between knowledge of the environment and environmental attitudes, as well as knowledge about the environment and pro-ecological behavior (Ostasz et al., 2022).

After the literature review, it was concluded that the topics of pro-environmental awareness and pro-environmental activities are being analyzed, as well as being an important area of research. However, the issues that made up the analyzed area of research (environmental awareness among employees of companies producing plastics) were not analyzed. Plastic production companies are a branch of industry that largely impacts the environment. In addition, as part of raising pro-environmental awareness among employees of the organization, achieving many benefits, which is another aspect affecting the efficiency of raising pro-environmental awareness. Selected benefits from practicing the pro-ecological actions in organizations are the strengthening their position on the market or acquiring a new market. In addition, modern business management is practically a guarantee of maintaining a high level of quality of products and services offered to customers. Pro-ecological activity

strengthens the relations of the organization with institutions providing financial and insurance services and enables enterprises to develop uniform technological development and introduce new and innovative projects. Employees will be more likely to identify with the organization in which they operate and possibly also to improve their motivation and relationship with the company's environment. At the moment when the enterprise introduces and applies environmental activities, it is positively perceived by the authorities and the local society, and thus improves the image of the organization, gaining the favor of the environment (Siwiec, Pacana, 2021a; Cichy, Szafraniec, 2015). Therefore, the motivation was to analyze the level at which ecological awareness is shaped among employees of selected enterprises. The aim of the study is to analyze environmental awareness among employees of companies producing plastics, and subsequently to draw conclusions about the level of their pro-environmental awareness. The article analyzes selected pro-environmental activities and policies as well as benefits from them. An analysis of the results of preliminary questionnaire surveys conducted among 44 employees of plastics producing companies was carried out.

## 2. Method

The purpose of the research was to analyze environmental awareness among employees of plastics producing plants. The research was carried out in a questionnaire among 44 plastics located in south-eastern Poland. The research was carried out in January and February 2018.

The motive for the implementation of pro-environmental awareness research in plastics-producing plants was their harmful impact on the environment. During the selection of companies for research, it was included: their location (south-eastern Poland), long-term operation (more than 30 years), the same type of activity (production of plastics) and whether pro-environmental activities were practiced.

Because this research, was the pilot research the manner of selecting the respondents to the survey was random; however, the respondents had to include managerial and administrative positions. And, it was included: age (18-25; 26-35; 36-45 and over 45 years of age), place of residence (city and village), and period of work (less than 1 year; 2-5 years; over 5 years).

Statistical tests were carried out to check whether there are statistically significant differences between the employees of the companies involved in the environmental awareness survey. The statistical test was made using the Minitab program. It was defined as follows:

- number of respondents (y),
- location of the enterprise (x1),
- the average number of all employees of the company (x2),
- implemented pro-environmental activities (x3),
- the average period of activity (x4).

Depending on the number of employees surveyed (y – continuous data), the ANOVA one-way test for x3 (attribute data) and two correlation tests for x2 and x4 (continuous data) were performed.

For the one-way ANOVA test, it was assumed that when the significance level p-Value > 0.05, it was concluded that there is no statistically valid difference between the analyzed variables, i.e. the null hypothesis ($H_0$) was accepted and when p-Value < 0.05 it was concluded that there is a statistically justified difference between the analyzed variables, i.e. an alternative hypothesis was accepted ($H_1$). In the case of the first ANOVA one-way statistical test, it was analyzed whether there is a statistically significant difference between the number from respondents of three companies and the environmental activities implemented in the company (Figure 1).

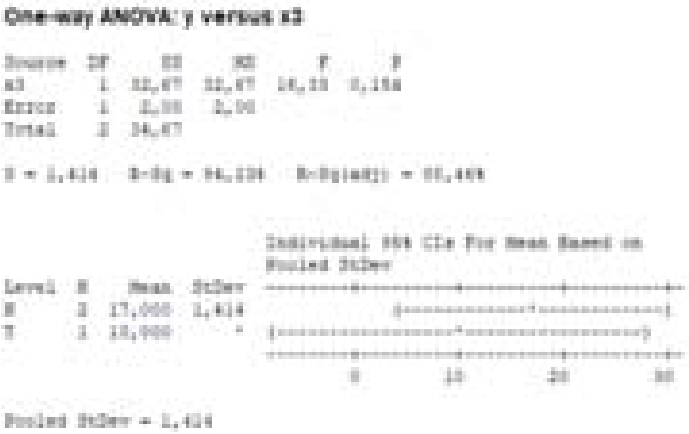



**Figure 1.** The result of the ANOVA One-way test for y depending on x3.

For this analysis the value of the p-value was greater than 0.05, therefore hypothesis H0 was adopted, which indicates that there is no statistically significant difference between the number of respondents from the companies analyzed. Subsequently, two tests were performed for x2 and x4 (Figure 2) using correlation analysis. In the correlation analysis, it was assumed that when the p-Value > 0.01 was reached, it was concluded that there was no statistically valid difference between the variables analyzed, that is, the null hypothesis was accepted (H0). When the p-value < 0.01, it was concluded that there is a statistically valid difference between the variables analyzed, that is, an alternative hypothesis (H1) was accepted.

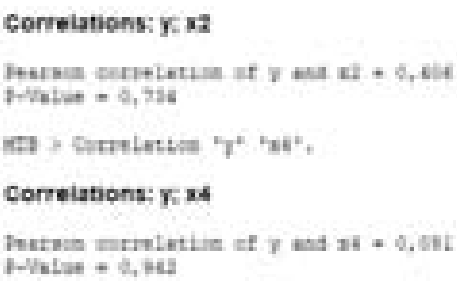



**Figure 2.** The result of the correlation analysis y depending on x2 and x4.

The value of p-value in two cases was greater than 0.01, so there was no correlation between the number to respondents of the enterprises and the number of all employees of the enterprises, as well as the period of activity. The analyses showed that there are no significant differences between the employees of the companies in which the research was carried out, therefore, for further analysis, it was assumed that in terms of statistics, the obtained results for the analyzed groups of respondents are equal.

After a literature review, the survey was created, and the results were analyzed in the next part of the study.

## 3. Results

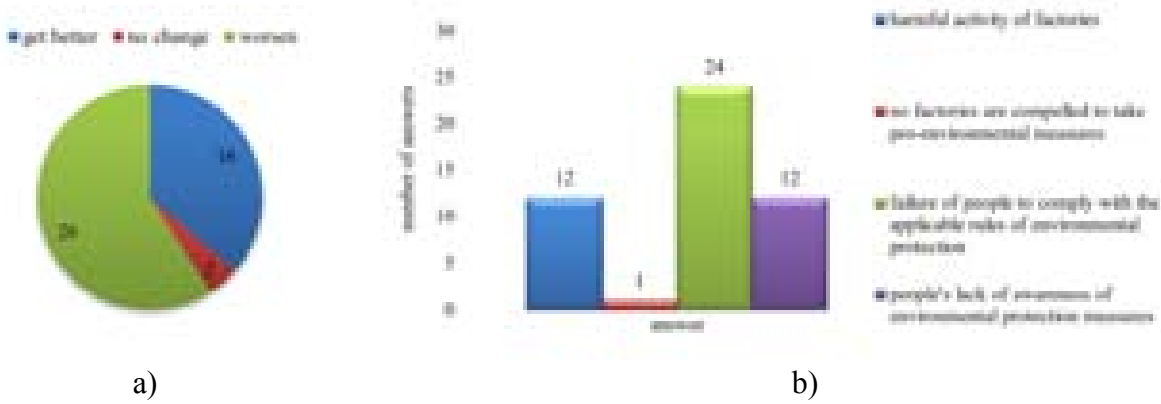
Analyzing the responses, it was noticed that respondents predominantly declared that they know more than three companies with pro-environmental activities such as EMAS or ISO 14001. Most of respondents replied that when purchasing products, they pay attention to their environmental performance. The results of respondents of enterprises that have not implemented pro-environment actions yet show that these respondents do not know any company that uses pro-environmental activities. A large number of respondents believe that the natural environment in their area of residence is highly polluted (Figure 3).

a) b)

**Figure 3.** Answers to Questions: a) What extent do you think the local (town and surrounding area) is polluted? a) What extent does the activity of the workplace where you work affect the deterioration of the natural environment?

In addition, a very large number of respondents claim that the company in which they work affects the deterioration of the environment. Most of the respondents admitted that the state of the environment has deteriorated over the last 10 years (Figure 4a). Moreover, a large number of respondents recognized that the condition of the natural environment improved and much fewer people said that the state of the environment for the last 10 years has not changed.

The respondents in most responded that the greatest impact on the deterioration of the local environment can be caused by the lack of compliance with applicable environmental protection rules and the lack of awareness of people about activities the protection of the natural environment (Figure 4b).

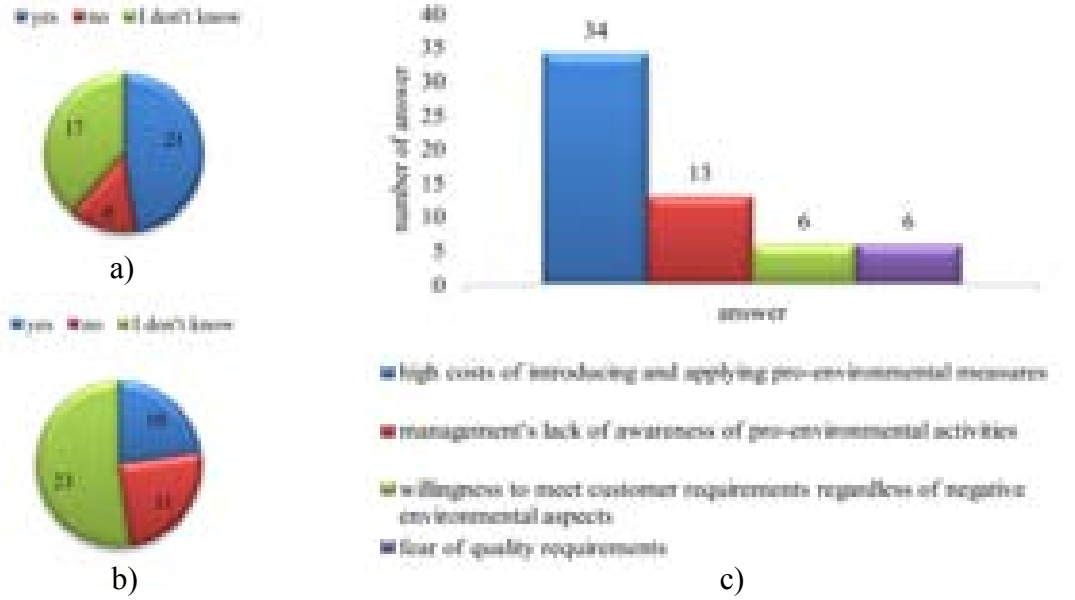



a) b)

**Figure 4.** Answer of Questions: a) Opinion of the state of the natural environment for the last 10 years, b) Opinion of the respondents about factors that may affect the deterioration of the local environment.

The employees claim that the lack of compulsion to introduce and apply pro-environmental actions and harmful activities of factories that have the greatest impact on the deterioration of the state of the local environment in companies is irrelevant to the deterioration of the natural environment.

In the company, where certified pro-environmental activities are applied, employees in 80% know that when designing products and services at their workplace, they apply activities to ensure the protection of the natural environment. The responses of other employees show that they do not know if such activities are practiced (Figure 5).




a) b) c)

**Figure 5.** Answer of Questions: a) use of pro-environmental activities in enterprises, b) application of activities that protect the environment during project activities, c) influence of factors on taking pro-environmental activities in everyday life.

In response to the question whether pro-environmental activities are applied in the workplace, employees of the organization which practiced the pro-environmental actions were aware of what organization are used and most of them were able to name examples, such as actions in accordance with ISO 14001, waste reduction, waste segregation, or reduction of consumption natural waste and monitoring of environmental indicators. The respondents who worked in enterprises which not practiced pro-environmental activities, in the vast majority did not know whether pro-environmental activities are applied. Only a small number of people answered yes, and some people could give an example, using the heat generated on the production floor for heating office space or segregation of rubbish and practicing material recovery. A large number of respondents did not know whether such activities are used. Additionally, for the question about waste segregation in the workplace, 99% of all respondents answered in the affirmative. The respondents indicated that when taking environmental action in their everyday life, they are mainly guided by the fear of their health and the health of other people and are aware of possible threats.

Also, all answers of the organization that practiced the pro-environment actions to Question 19 were affirmative, where the respondents acknowledged that the highest management and employees are aware of the possible harmful impacts on the business environment of the enterprise in which they work. A large degree evaluate the motivation of management and employees to making changes to improve the natural environment. For others, the majority of responses were negative, and in case of the evaluation of the motivation of the management and employees as to make changes to improve the natural environment, the score was negligible and small extent.

Additionality, respondents responded that the introduction of mandatory compliance of enterprises with environmental activities could have a good impact on the improvement of the environment.

Most of responses of the employees (34 answers) pointed out that they claimed that the lack of compliance of enterprises with pro-environmental activities is influenced by the high costs related to the introduction and use of pro-environmental activities and the lack of management awareness of pro-environmental activities. Employees decided that the most effective are pro-environmental actions, which can be practiced in enterprises, were the elimination of pollution at the source and the optimal use of energy, and the management of nature reserves.

The question of whether the plant uses noise and vibration limiting elements (plugs or headphones, screens) and whether sound levels are checked, the vast majority of all answers were affirmative. The same applies to the question in which employees were asked if there is air pollution, dust, or odor emission. In the case of using energy sources, most responses were for gas fuels and for electricity.

Analyzing the remaining questions asked to the surveyed, it was noted that the employees were informed about possible environmental threats that occur in the company in which they work. Some of them have heard complaints from the environment about the harmful effects on the environment resulting from the activities of their company. However, half of the respondents from the company in which pro-environmental activities were not practiced were claimed that they have not been informed about the harmful effects of their company's activities on the environment. Moreover, virtually no one heard complaints from the surroundings of the harmful impact on the immediate environment of the company's operations.

## 4. Discussion and Summary

The concept of sustainable development consists of striving to fully satisfy the needs of present customers along with maintaining the potential for the next generations. The foundation of the main idea of balanced thinking is to maintain a balance between the social, economic, and ecological dimensions. Therefore, it is so important to make people aware of behavior within the framework of pro-ecological activities, and it is also important to check whether this awareness is at the appropriate level. The aim of the study was to analyze environmental awareness among employees of plastics companies and subsequently to draw conclusions about the level of their pro-environmental awareness. In the article selected pro-environmental activities and policies as well as benefits from it were analyzed. An analysis of the results of questionnaire surveys conducted among 44 employees of plastics was carried out.

It was concluded that the employees of the company in which the environmental activities were practiced are more aware of the environmental protection and the use of pro-environmental activities than in the case of the responses by employees' companies, in which pro-environmental activities were not implemented. The pro-environmental awareness is small among employees from the enterprises, in which pro-environmental actions were not practiced. The management and employees of these enterprises do not talk to each other about the possibility of threats resulting from the activities of their company. Employees do not know how the processes are carried out in the company and whether they have any impact on the natural environment. Furthermore, respondents agreed that one of the factors by which enterprises do not implement environmental protection measures is the lack of management awareness of them. Additionally, the employees of companies not used pro-environmental activities are unaware of the threats resulting from the activities of their company and do not know that other companies about the same activities already apply such activities. It was concluded that the level of awareness of the employees of a plastic industry employees was on the small level. In the case of this type of industry, it is problematic, because this enterprise in particular affects on the environment, so it will be necessary to conduct training in the field of

pro-environmental activities, in which it would be possible to increase pro-environmental awareness. In addition, good practices should be implemented in enterprises like these. Clean Production (CP) or EMAS. Enterprises should focus on meeting customer needs and maintaining high-quality products, but taking into account pro-environmental measures that should be a priority. This is possible if pro-environmental awareness is continually shaped.

## References

1. Afonso, T., Goncalves, Z., Maria, A., Lamounier, L.R. et al. (2016). Environmental Awareness, Pro-Environmental Behaviour And Quality Of Waste Management In Health Services. *Revista De Gestao Ambiental E Sustentabilidade-Geas*, *5(3),* pp. 106-119.
2. Aguilar-Salinas, W., Ojeda-Benitez, S., Cruz-Sotelo, S.E., Castro-Rodríguez, J.R. (2017). Model to Evaluate Pro-Environmental Consumer Practices. *Environments*, *4, 11*. doi: 10.3390/environments4010011.
3. Armeanu, D., Vintilă G., Gherghina, S. (2017). A Cross-Country Empirical Study Towards the Impact of Following ISO Management System Standards on Euro-Area Economic Confidence. *Amfiteatru Economic, 19(44),* pp. 144-165.
4. Budynek, M., Dybikowska, A., Ratajczak, J., Zagajewski, A. (2014). The EMAS system as a stimulator of the enterprise's environmental innovations. *Support Systems in Production Engineering, 2,* pp. 33-42.
5. Cichy, M.J., Szafraniec M. (2015). Eco-Innovation In Polish Cleaner Production Companies Part 1: General Aspects Of Innovation. Part 1: General aspects of eco-innovation. Science notebooks. *Organization and Management, Scientific Papers of Silesian University of Technology, 77,* pp. 19-37.
6. Díaz-Siefer, P., Neaman, A., Salgado, E., Celis-Diez, J.L., Otto, S. (2015). Human-Environment System Knowledge: A Correlate of Pro-Environmental Behavior. *Sustainability, 7,* 15510-15526. doi: 10.3390/su71115510.
7. Dumitrescu, D., Simionescu, L., Roman, A. (2015). Environmental Responsibility and Company Financial Performance: The Case of Romanian Manufacturing Industry. *Environmental Engineering and Management Journal, 14(12),* pp. 2947-2957.
8. Fatoki, O. (2019). Hotel Employees' Pro-Environmental Behaviour: Effect of Leadership Behaviour, Institutional Support and Workplace Spirituality. *Sustainability, 11(15).*
9. Fu, L., Zhang Y., Xiong X. et al. (2018). Pro-Environmental Awareness and Behaviors on Campus: Evidence from Tianjin, China. *Eurasia Journal Of Mathematics Science And Technology Education, 14(1),* pp. 427-445.
10. Gajdzik, B. (2007). Cleaner Production Strategy in a metallurgical enterprise. *Ecology Problems, 11,* pp. 184-187.

11. Galeja, K. (2006). Cleaner production – actionn (not only) for hard times. *Textile Review – Fiber, Clothing, Leather, 5,* pp. 55-56.
12. Gherghina, Ş.C., Vintilă, G. (2016). Exploring the Impact of Corporate Social Responsibility Policies on Firm Value: the Case of Listed Companies in Romania. *Economics and Sociology, 9(1),* pp. 23-42. DOI: 10.14254/2071789X.2016/9-1/2.
13. Górzycki, J. (2002). EMAS environmental management systems. *Fuel and Energy Economy, 10,* pp. 2-6.
14. Helm, S.S., Joyce, A., Sun, Y. et al. (2019). Materialist values, financial and pro-environmental behaviors, and well-being. *Young Consumers, 20(4),* pp. 264-284.
15. Jagers, S.C., Martinsson, J., Matti, S. (2016). The Environmental Psychology of the Ecological Citizen: Comparing Competing Models of Pro-Environmental Behavior. *Social Science Quarterly, 97(5),* pp. 1005-1022.
16. Janmaimool, P., Khajohnmanee, S. (2019). Roles of Environmental System Knowledge in Promoting University Students' Environmental Attitudes and Pro-Environmental Behaviors. *Sustainability, 11(16).*
17. Jotanovic, S.R., Ratkovic, M., Zakic, N. (2017). Pro-Environmental Activities Of Consumers. *Polish Journal Of Management Studies, 16(1),* pp. 55-66.
18. Kim, M.J., Hall, C.M. (2019). Can Climate Change Awareness Predict Pro-Environmental Practices in Restaurants? Comparing High and Low Dining Expenditure. *Sustainability, 11(23).*
19. Lin, S.-C., Nadlifatin, R., Amna, A.R., Persada, S.F., Razif, M. (2017). Investigating Citizen Behavior Intention on Mandatory and Voluntary Pro-Environmental Programs through a Pro-Environmental Planned Behavior Model. *Sustainability, 9, 1289.* doi: 10.3390/su9071289.
20. Lumnitzer, E., Hricova, B., Bednarova, L. et al. (2018). Development of materials obtained from recycled cars and their subsequent use in noise reduction. *Progress in rubber plastics and recycling technology, 34(4),* pp. 221-229, DOI: 10.1177/1477760618798412.
21. Malindzak, D. et al. (2017). An effective model for the quality of logistics and improvement of environmental protection in a cement plant. *Przemysł Chemiczny, 96(9),* pp. 1958-1962, DOI: 10.15199/62.2017.9.31.
22. Masternak, J. (2009). The Methods for Implementing Sustainable Development in the Industry. *Sustainable development problems, 4,* pp. 107-113.
23. Ostasz, G., Siwiec, D., Pacana, A. (2022). Universal Model to Predict Expected Direction of Products Quality Improvement. *Energies*, *15*, 1751. https://doi.org/10.3390/en15051751.
24. Pacana, A., Bednarova, L., Liberko I., et al. (2014). Effect of selected production factors of the stretch film on its extensibility. *Przemysł Chemiczny, 93(7),* pp. 1139-1140.
25. Pacana, A., Radoń-Cholewa, A, Pacana J., et al. (2015). The study of stickiness of packaging film by Shainin method. *Przemysl Chemiczny, 94(8),* pp. 1334-1336.

26. Pacana, A., Siwiec, D., Bednarova, L. (2019). Analysis of the incompatibility of the product with fluorescent method. *Metalurgija, 58(3-4),* pp. 337-340.
27. Pacana, A., Siwiec, D., Bednárová, L. (2020). Method of Choice: A Fluorescent Penetrant Taking into Account Sustainability Criteria. *Sustainability, 12,* 5854. https://doi.org/10.3390/su12145854.
28. Pacana, A., Siwiec, D. (2021). Universal Model to Support the Quality Improvement of Industrial Products. *Materials*, *14*, 7872. https://doi.org/10.3390/ma14247872.
29. Pacana, A., Siwiec, D. (2022). Model to Predict Quality of Photovoltaic Panels Considering Customers' Expectations. *Energies*, *15*, 1101. https://doi.org/10.3390/en15031101.
30. PN-EN ISO 14001:2015 (2016). *Systemy zarządzania środowiskowego. Wymagania i wytyczne stosowania.* Warszawa: PKN.
31. Schmitt, T., Aknin, B., Axsen, J. et al. (2018). Unpacking the Relationships Between Pro-environmental Behavior, Life Satisfaction, and Perceived Ecological Threat. *Ecological Economics, 143,* pp. 130-140.
32. Shimoda, A., Hayashi, H., Sussman, D. et al. (2020). Our health, our planet: a cross-sectional analysis on the association between health consciousness and pro-environmental behavior among health professionals. *International Journal Of Environmental Health Research, 30(1),* pp. 63-74.
33. Siwiec, D., Bednarowa, L. et al. (2019). Decision support in the selection of fluorescent penetrants for industrial non-destructive testing. *Przemysl Chemiczny, 98(10),* 1594-1596. DOI: 10.15199/62.2019.10.12
34. Siwiec, D., Pacana, A. (2021a). A Pro-Environmental Method of Sample Size Determination to Predict the Quality Level of Products Considering Current Customers' Expectations. *Sustainability*, *13*, 5542. https://doi.org/10.3390/su13105542.
35. Siwiec, D., Pacana, A. (2021b). Method of improve the level of product quality. *Production Engineering Archives, 27(1),* pp. 1-7. DOI: https://doi.org/10.30657/pea.2021.27.1
36. Siwiec, D., Pacana, A. (2022a). A New Model Supporting Stability Quality of Materials and Industrial Products. *Materials, 15, 4440*. https://doi.org/10.3390/ma15134440.
37. Siwiec, D., Pacana, A. (2022b). Prediction of Quality Level of Product Considering Current Customer's Expectations. *Management and Production Engineering Review, 13(2),* pp. 127-128. DOI: DOI 10.15199/62.2019.10.121.
38. Siwiec, D., Pacana, A. (2021c). Model of Choice Photovoltaic Panels Considering Customers' Expectations. *Energies, 14,* 5977. https://doi.org/10.3390/en14185977.
39. Siwiec, D., Pacana, A. (2021d). Model Supporting Development Decisions by Considering Qualitative–Environmental Aspects. *Sustainability*, *13*, 9067. https://doi.org/10.3390/ su13169067.
40. Wolniak, R., Skotnicka-Zasadzien, B. (2014). The use of value stream mapping to introduction of organizational innovation in industry. *Metalurgija, 53(4),* pp. 709-712.

41. Wu, L. (2018). The relationships between environmental sensitivity, ecological worldview, personal norms and pro-environmental behaviors in Chinese children: Testing the value-belief-norm model with environmental sensitivity as an emotional basis. *Psych. Journal, 7(3),* pp. 111-121.
42. Zhang, Y., Zhang, H.L., Zhang, J. et al. (2014). Predicting residents' pro-environmental behaviors at tourist sites. The role of awareness of disaster's consequences, values, and place attachment. *Journal Of Environmental Psychology, 40,* pp. 131-146.

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# THE CONCEPT OF THE MAIN DEWATERING MODEL IN A COAL MINE CONSIDERING TECHNICAL, MANAGERIAL, AND ECONOMIC CRITERIA

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**Purpose:** The primary purpose of the article is to cross-sectionally present the concept of a model for optimizing the main drainage system in a coal mine.
**Design/methodology/approach**: The stated goal was achieved by using several research methods, including a literature study of existing technical system models and technical system modeling. Finally, the methodology used was based on a layered approach, which was verified by testing in a mine environment.
**Findings:** In the course of the work, it was found that the main drainage system at the Sobieski Coal Mine is very complex. The energy intensity of the main dewatering process was identified as the main problem. The proposed concept of a layered model of the main dewatering system makes it possible to identify the influence of technical, management and economic parameters of the system.
**Research limitations/implications:** The research limitations are due to the complexity of the system, the difficulties arising from the specificity of the mine environment, the lack of the possibility of ongoing diagnostics of the entire infrastructure (e.g. pipeline specification, the ability to measure sediment in water galleries, smooth change of the speed of drive mechanisms, etc.).
**Practical implications:** The results of the research work will be recommendations for engineering and technical staff aimed at reducing the energy intensity of the system.
**Social implications:** the conducted research is part of the current trend of searching for methods to reduce the energy intensity of systems and equipment.
**Originality/value:** The originality of the issue stems from the proposed concept of a layered model of the main drainage system, taking into account technical, organizational and economic parameters. Determining the relationship between the elements of each layer will enable the development of an optimization method to reduce the energy intensity of the system.

**Keywords:** main dewatering system, technological processes, energy intensity, technical system model.

**Category of the paper:** Conceptual paper.

## 1. Introduction

The production of hard coal in underground mines requires large capital expenditure and high operating costs. Large-scale activities are undertaken in coal mining companies to optimise operating costs. In mines with a large inflow of water from the rock mass, costs related to the operation of the main dewatering system are of significant importance. Research and development work is being carried out with a view to improving the efficiency of the use of technical and technological infrastructure and the organisation of the main dewatering processes, enabling the reduction of failures and disruptions to the system's operation, and thus reducing the costs of operation of the main dewatering system. Improving the effectiveness of the main dewatering system requires the implementation of solutions comprising tasks at the investment and operational levels based on continuously developing technical and technological solutions. This article presents a concept of the main dewatering model in a hard coal mine. The concept was developed on the basis of research undertaken at the Sobieski Coal Mine of TAURON Wydobycie S.A. The research, conducted between January 2021 and November 2021, included an in-depth analysis of the technical infrastructure and technological processes carried out within the main dewatering system. Research was also conducted based on the available literature. The proposed layered model of the main dewatering in a coal mine includes the following layers: process, infrastructure, interference and economic. The developed concept will enable a complete and coherent identification and quantification of the elements of the main dewatering system in order to analyse and recommend the possibility of applying selected technical, technological as well as organisational solutions to improve the effectiveness of the system.

## 2. Research methodology

Research to determine the basic elements and their mutual relationships was carried out in the period January 2021 - November 2021 at the Sobieski Coal Mine, in a mine with a high level of water inflow from the rock mass. The research process included an in-depth analysis of the main dewatering system, taking into account the analysis of the technical infrastructure (mainly the operation of machinery and equipment, their configuration and operation) and the identification and inventory of technological processes. The establishment of technological process metrics made it possible to determine the mutual relationships between technological processes and the technical and organisational parameters characterising these processes.

Figure 1 shows a schematic of the research model used to develop the concept of the main dewatering model. The research was divided into 3 stages. For each stage, research tasks were defined and selected research methods were applied, which resulted in the achievement of the intended effects within a given stage.

| | **Stage 1** | **Stage 2** | **Stage 3** |
|---|---|---|---|
| **Research tasks** | 1. Recognition of the legal, technical, and organisational conditions for the operation of the main dewatering.<br>2. Analysis of the technical infrastructure of the main dewatering system. | 1. Identification of technological processes.<br>2. Identification of system problems and disturbances.<br>3. Identification of technical, managerial, and economic criteria determining the operation of the system. | 1. Establishing layers in the main dewatering system.<br>2. Establish relationships between the different layers of the system.<br>3. Development of a layered model of the main mine dewatering. |
| **Research methods used** | 1. A study of literature.<br>2. Face-to-face interviews with engineering and technical staff and system operators.<br>3. Analysis of source materials. | 1. Analysis of technical documentation of machinery and equipment.<br>2. Analysis of data on the operation of machinery and equipment.<br>3. On-site visit including observation of the operation of the system under analysis.<br>4. Face-to-face interviews with engineering and technical staff and system operators. | 1. A literature study in systems analysis.<br>2. Analysis of existing technical systems models.<br>3. Analysis of possible modelling concepts for the main dewatering system. |
| **Results obtained** | 1. Determine the determinant of the functioning of the main dewatering system.<br>2. Identification of technical, legal and organisational conditions.<br>3. Identification and inventory of the technical infrastructure elements of the system under analysis. | 1. Establish the primary and secondary technological processes of the main dewatering system.<br>2. Categorising processes and assigning weights.<br>3. Establish metrics for identified processes.<br>4. Identify key problems, interferences and failures in the system under analysis.<br>5. Definition of criteria determining the operation of the system. | Conceptualisation of the main dewatering model in a coal mine. |

**Figure 1.** Scheme of the research model used to develop the concept of the main dewatering model (own elaboration).

The 1st stage was focused on identifying legal conditions and analysis of the technical infrastructure of the main dewatering system at the Sobieski Coal Mine. Direct interviews with the engineering and technical staff were of great importance at this stage. As a result, technical, legal and organisational conditions for the functioning of the main dewatering system in the hard coal mine were identified elements of technical infrastructure of the system were identified and inventoried.

The 2nd stage involved an in-depth analysis of the technical documentation of the machinery and equipment of the main dewatering infrastructure, as well as the analysis of the operating data of this equipment. This enabled the full identification and categorisation of technological processes, the establishment of metrics for these processes and the identification of key disturbances and failures that occur in the analysed system.

The 3rd stage was aimed at developing a concept of the main dewatering model in a coal mine. The concept was built on the basis of establishing the layers in the main dewatering system and the relationships between these layers.

Finally, the research carried out enabled the development of a conception for a layered model of the main dewatering in a coal mine, which is described further in this article.

## 3. Literature study on the main dewatering system in hard coal mining

The system of main dewatering of hard coal mines is a very broad topic and has a connection with many fields of knowledge. It is related to, among others, legal issues (Act of 9 June 2022…; Journal of Laws of the Republic of Poland, Regulation of the Minister of Energy of 23.11.2016…), cost aspects which have been noted by many authors (Dorosiński, 2016; Stępniewski, 1985, pp. 173-479) and technical issues (Kałuża; Wilk S., Golec, Wilk A., 2008, pp. 17- 81; Tajduś, Sroka, Misa, Dudek, 2019).

**Legal aspects**

The overriding legal act is the Act of 9 June 2011. Geological and Mining Law (Act of 9 June 2022…), which obliges hard coal mines to, among other things, develop hydrogeological documentation and carry out dewatering in order to extract minerals. Moreover, it obliges mines to continue dewatering of seams even after termination of mining activities. Another document is the Regulation of the Minister of Energy of 23.11.2016 on detailed requirements for the conduct of underground mining plants (Journal of Laws of the Republic of Poland, Regulation of the Minister of Energy of 23.11.2016…). This act regulates, among other things, the topic of requirements for the main dewatering pump chambers, the minimum number of pumps in the system and water hazard alarm signaling. The legal act concerning mine dewatering is also the Regulation of the Minister of Environment of 29 January 2013 on natural hazards in mining plants (Journal of Laws of the Republic of Poland, Regulation of the Minister of the Environment of 29 January 2013…). Among other things, it regulates the criteria for assessing natural hazards by introducing a three-stage water hazard scale. This act is referred to in the article (Szymański, 2013, pp. 1-8). The authors of the article point out that in order to avoid the deterioration of water hazards in hard coal mines, it is necessary to: improve the existing procedures and legal regulations for the assessment, monitoring and control of water hazards

and emphasize these issues in hydrogeological documentation, as well as improve the quality of hydrogeological documentation and revise the procedure for the opinion and approval of documentation. Another document used in the mine is the internal regulation of the Manager of the Energy Department (Kierownik Działu Energo-Mechanicznego…, 2017, pp. 1-3), which contains a detailed instruction for the inspection of the technical condition of the equipment of the main dewatering system. This document introduces, among others, the concept of current, periodic and annual inspection and documentation containing records related to dewatering.

**Cost aspects**

The topic of mine dewatering costs was taken up by Korbiel and Wojciechowski (Korbiel, Wojciechowski, 2019, pp. 413-419). The authors indicate that depending on the depth of the mine and the average water inflow, the dewatering costs consist of: the costs of electricity supplying the electric motors driving the pumps, the costs of depreciation of the equipment, the costs of service and the costs of eventual water disposal together with environmental charges. In turn, the authors of the article (Jonek-Kowalska, Turek, 2013, pp. 727-740) estimated that the maintenance of dewatering areas of closed mines costs more than 50 million USD annually. However, the results of the conducted research and forecasts allow us to conclude that there are possibilities to reduce the overall costs by 17% in the perspective to 2030. In 2016, an article (Dorosiński, 2016) was published, in which the author points out that in Silesia there are many liquidated hard coal mines. However, the fact that a coal mine has ceased production does not mean that it no longer requires further technical supervision. Gumińska and co-authors in a 2021 article (Gumińska, Plewa, Grodzicka, Gumiński, Rozmus, Michalak, 2021, pp. 1-15) presented the results of a technological and economic analysis of mine water treatment systems prior to its discharge into the environment. The analysis made it possible to determine the profitability of investments taking into account the concentration of TSS (total suspended solids) in mine water. The simulation results showed that it is economically viable to use a water treatment system if natural sedimentation carried out in underground mine water passages or in sedimentation basins located on the ground surface is ineffective for TSS removal. In contrast, Masood Noshin and co-authors in 2020 (Masood, Edwards, Farooqi, 2020, pp. 2-16) raise the topic of the true cost of coal mining. The paper reviews the impact of coal mining on water resources, land subsidence, interruption of hydrological channels, floods and decreasing water level. This represents the main measurable impact of the mining sphere on the hydrological environment.

**Technical aspects**

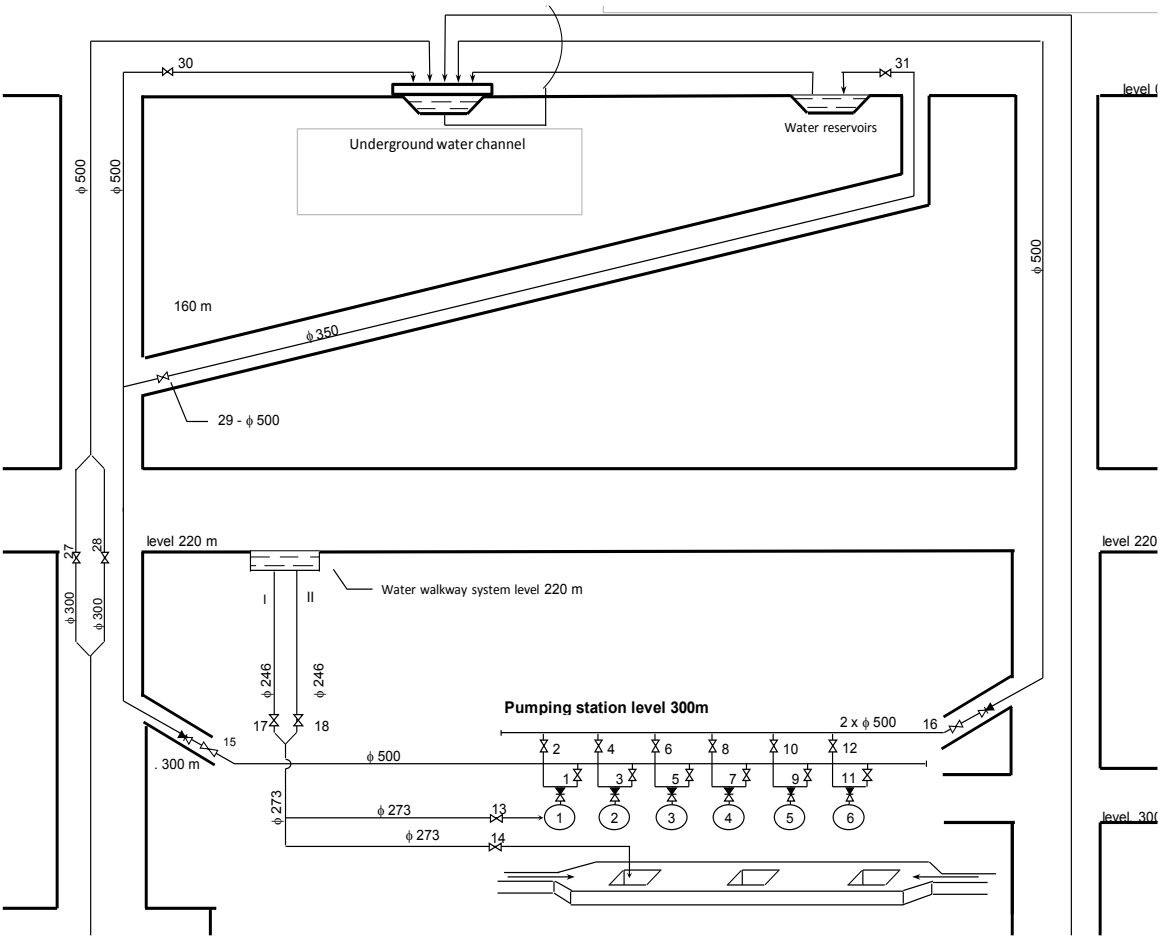
Among the items analysed in the literature study, Mieczysław Stępniewski's book entitled Pompy [English translation Pumps] (Stępniewski, 1985, pp. 173-479) deserves attention. It is a comprehensive collection of thorough theoretical knowledge of hydromechanics and principles of operation of positive displacement and centrifugal pumps, methods of their calculation and design, together with examples. It discusses the phenomena occurring during the operation of pumps, their operating characteristics, principles of parameter regulation and cooperation in pumping systems. Submersible pumps are used in mines to remove local underflows. The article (Kałuża, pp. 1-6) is devoted to this type of pumps. Each submersible pump design is characterised by one basic common requirement; the driving electric motor must be tight against the pumped medium. Additionally, mine conditions are an area of application where explosive hazards are present. An interesting item is an article from 2007 (Mikoś, Kalukiewicz, Wojciechowski, 2007, pp. 1-53). The authors experimentally determined the relationship between the shape of the suction jet velocity fields and the pumping capacity. The information obtained may be a starting point for the development of a new, energy-efficient way of regulating the efficiency of centrifugal pumps. The article from 2016 (Szymański, 2016) refers to modern control systems that should include smart (artificial intelligence) procedures to ensure optimal and energy-efficient dewatering of mine workings. In turn, the article (Rózkowski, Zdechlik, Chudzik, 2021, pp. 1-18) touches on the topic of open-pit mines. It is interesting to note the numerical modelling method used to find a solution for minimising the environmental impact of dewatering. This case study analyses possible dewatering solutions related to the change of the mining dewatering system: liquidation by flooding of a depleted deposit and dewatering of a new one located in its vicinity. Authors of the article: "In an underground mine by using a 3D finite" (Hu, Zhang, Yang, Fan, Li, Wang, Lubale, 2020) describe a 3D groundwater model using the FEFLO simulation program. This model consists of combined regional and local geological models, integrating 16 hydrogeological cross-sections and borehole logging data to predict underground dewatering in the studied area. In turn, the handbook of Pakuła and Strączyński (Pakuła, Strączyński, 2013, pp. 129-201) and the article by Wilk and co-authors (Wilk S., Golec, Wilk, A., 2008, pp. 17-81) are items dedicated to practitioners who deal professionally with pumps in mining. Correct selection, installation and operation are the condition for long-term and failure-free operation. Szymański in 2013 published an article (Szymański, 2013, pp. 1-8), which presents selected methods of diagnostic testing of the drive system of main dewatering pumps, with particular emphasis on the diagnostics of the systems: power supply, control and the drive part of the pump. In 2019, the article (Tajduś, Sroka, Misa, Dudek, 2019, pp. 1-12) was published, which addressed the topic of water hazards resulting from the end of mining, occurring on the surface. The authors presented examples of regions, where serious damage caused by surface rising has been observed and compiled a dozen examples of these events for coal mines. Konsek and Czapnik in their article (Konsek, Czapnik, 2020, pp. 99-110) draw attention to the fact that liquidation

of mines and restructuring of hard coal mining in the Upper Silesian Coal Basin (Polish: Górnośląskie Zagłębie Węglowe – GZW) – due to the presence and necessity of protection of active mines, does not solve the problem of dewatering of the mines that have been liquidated. According to the authors, the cheapest, safest and technically simplest solution is the Central Mines Dewatering Plant [Polish: Centralny Zakład Odwadniania Kopalń (CZOK)] implemented by the Mining Restructuring Company S.A., which comprehensively deals with the deep-sea dewatering system. It turns out that the amount of water flowing into the underground of mines is not constant. For information on this topic, see the 2017 article (Karpiński, Batko, Kmiecik, Tomaszewska, Zdechlik, 2017, pp. 1-60). The paper characterizes the variability of underground water inflows to the workings of the Sobieski Coal Mine, in the years 1970-2013. The topic of water hazards was also taken up by Zając (Zając, 2017). The issue of water inflow to the mine and its dewatering is dealt with by various services, which should closely cooperate in this respect. The intake of water in the place of its occurrence and its discharge into the mine dewatering system belongs to the mining and power engineering services. These services are also responsible for the maintenance and operation of the mine dewatering system. The literature study prepared by the authors of the article, structured in legal, economic and technical aspects, confirms the multidisciplinary character of the subject. Thus, it illustrates the great scientific potential of the area of interest and a wide spectrum of possibilities for analysing the issue of main mine dewatering systems. This topic is and will remain valid also after the end of operational activity of Polish mines.

In the literature study, the authors did not find any research concerning the drainage system as a system divided into separate layers. The proposed concept is unique and could be applied in other production enterprises to create structures, component layers, and interconnection between these layers.

## 4. Process structure and technical and technological infrastructure of the main dewatering system

The Sobieski Coal Mine is one of the three plants operating within TAURON Wydobycie S.A. (TAURON Group). Among the key processes affecting the Company's functioning in terms of both organisation and costs is the mine's main dewatering system. This system is a complex organism which is responsible for the safety of miners, has an impact on the proper organisation of production activities and is a significant cost factor in the mine's operations.




| No. Agreg. | Pump type | Q $m^3$ /min | Engine type | P kW | n rpm |
|---|---|---|---|---|---|
| 1 | OW 200AM/5 | 5 | Sf 355Y-4 | 400 | 1485 |
| 2 | OW 300/5 | 12 | SCUdm 134t-E | 1000 | 1485 |
| 3 | OW 300/5 | 12 | SCUdm 134t-E | 1000 | 1485 |
| 4 | OW 300/5 | 12 | SDUd 134T | 1000 | 1480 |
| 5 | OW 300/5 | 12 | SDUd 134T | 1000 | 1480 |
| 6 | OW 300/5 | 12 | SDUd 134T | 1000 | 1480 |

**Figure 2.** A section of the main mine dewatering system – schematic diagram.

Of particular importance is the energy intensity of the system and the cost of the infrastructure (OPEX, CAPEX). This is due to the very high degree of waterlogging in the mine, with an average inflow of approximately 60 $m^3$/min of water from the rock mass. This translates directly into coal extraction costs. In order to illustrate the scale of the problem, it should be assumed that on average, 1 tonne of excavated material yields approximately 10 $m^3$ of water, which must be pumped several hundred metres, through a pipeline initially leading through galleries, and later through a vertical shaft to the surface of the mine.

In the course of the analysis of the issue, in order to structurize knowledge, the authors of the article decided to recognise the main dewatering system from a process point of view, so that after the analysis of mutual influences and interrelations, management recommendations could be developed for the engineering and technical staff that would make it possible to achieve effects in the form of organisational, technical and cost optimisation.

First, the basic processes of the main dewatering system were identified. By definition, these are all those processes which, if they are disturbed, will cause great difficulties or complete immobilisation of the mine's main dewatering system. The basic processes include all those processes that belong to the main link of the main dewatering system of a coal mine. 6 basic processes were identified and they are shown in Figure 3.

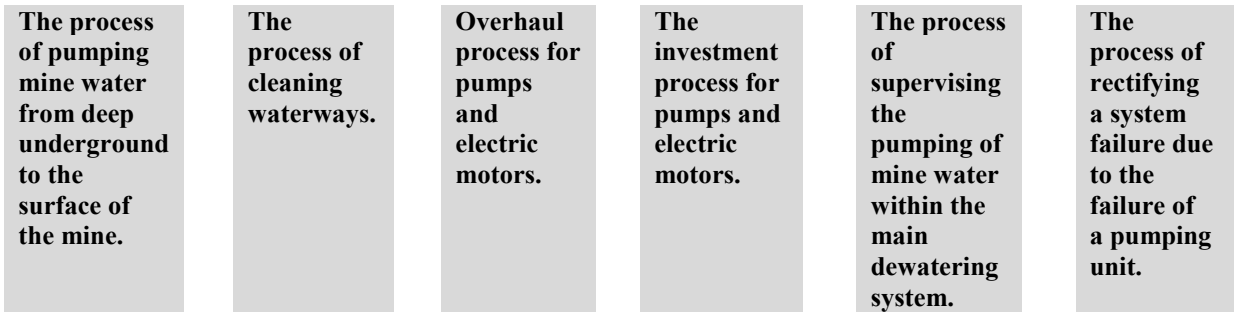



**Figure 3.** Basic processes.

All other processes, which are of a supporting nature to the main processes, should be considered as auxiliary processes. 15 auxiliary processes have been identified, examples of which are shown in Figure 4.

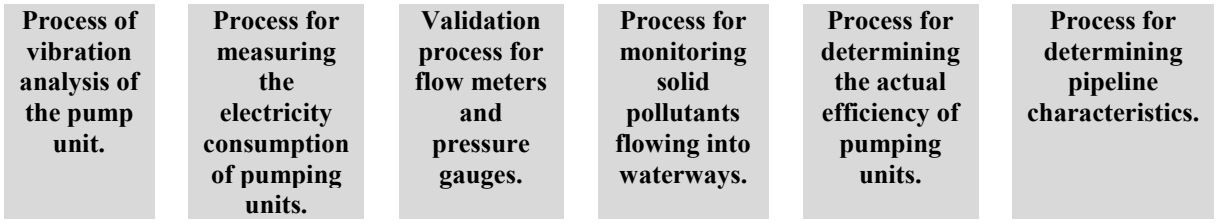



**Figure 4.** Examples of auxiliary processes.

The complexity and sophistication of the main dewatering system imposes the need to carry out an inventory and preliminary analysis of all identified processes occurring within the system, and then to select them from the point of view of their importance for the functioning of the main dewatering system.

The concept of process importance on a scale of 1-5 was introduced:

1. an auxiliary process associated with the main dewatering system, the inadequate implementation or lack thereof of which does not affect the main dewatering process,
2. an auxiliary process related to the main dewatering system,
3. auxiliary process of the main dewatering system related to the main dewatering system to monitor and diagnose the main dewatering system,
4. an essential process, the absence of which will result in significant disruption to the mine water pumping process,
5. the primary process, the absence of which will result in stopping the main dewatering process.

Furthermore, in order to carry out a multifaceted analysis, the concept of process categories was also introduced and defined as follows:

A. discrete process – is limited to where it occurs,
B. continuous process – occurs throughout the system's operating cycle,
C. technical process – related to technical infrastructure,
D. management process – related to the process of supervision and management of the system.

The next stage of the work was to identify the elements at the input to each primary and secondary process and to identify the elements at the end of each process (which is the result of carrying out the process). This analysis took into account the change in state of the object on which the process is performed, the parameters, the type of energy, the control pulses, etc. An example of element identification is shown in Table 1.

**Table 1.**
*Examples of process input and output elements*

| **Process name** | **Elements at the entrance for the process** | **Elements at the output from the process** |
|---|---|---|
| The process of pumping mine water from deep underground to the mine surface | Underground mine water, electricity, process start signal, exceeded water column level in the water gallery | Mine surface water in collecting vessels, process shutdown signal, permissible water column level in the water gallery |

The next stage of the work was to identify the technical infrastructure that is assigned to each basic and auxiliary process. Each process requires e.g. equipment, accessories, machines, devices, instruments, tools, without which the process would not be possible to carry out. Examples of infrastructure assigned to basic processes are presented in Figure 5.

| **The process of pumping mine water from deep underground to the surface of the mine.** | **The process of cleaning waterways.** | **Overhaul process for pumps and electric motors.** | **The investment process for pumps and electric motors.** | **The process of supervising the pumping of mine water within the main dewatering system.** | **The process of rectifying a system failure due to the failure of a pumping unit** |
|---|---|---|---|---|---|
| Screens, piping, pump units, valves, expansion vessels, control and monitoring equipment. | Loaders, underground locomotives, sludge pumps, turnstiles, haulage trucks, track, measuring tools, hand tool, shaft equipment. | Specialised machinery of repair and production companies. | Specialist machinery for repair and production companies. | Control and measuring equipment, supporting devices: computer hardware, computer software report books, control devices. | Control and measuring tools, locksmith tools and instruments, spare parts, consumables. |

**Figure 5.** Basic processes with the associated technical infrastructure.

Next, each process was assigned an estimate of costs in the form of labour intensity of technological processes necessary to operate it (in the case of operating the process internally) or cooperation costs in the case when the process cannot be performed on one's own e.g. due to lack of appropriate technical competence.

| Process for determining the operating points of pumping units and pipelines | Process for monitoring the degree of pollution of waterways | Pollution monitoring process for water settling tanks | Cleaning process for water settling tanks |
|---|---|---|---|
| **4 day stays/ 2 persons** | **4 days/ 1 person** | **6 day stays/ 2 persons** | **approx. 6 000 000 PLN - external company** |

**Figure 6.** Labour intensity of exemplary auxiliary processes.

Of great importance for the proper functioning of the main dewatering system is the correct identification of potential process disturbances. The disturbing events may be of various character and dimension. Their proper inventory affects their effective counteraction through the application of prediction principles. Examples of disturbances and threats they may cause to the system equipment and operation of the mine are presented in Table 2.

**Table 2.**
*Examples of disturbances and the risks they may cause to system equipment and mine operations*

| Disturbance | Threat |
|---|---|
| bearing temperature of the pump and the electric motor exceeded | overheating of bearings, seizure, damage to housing and rotating parts |
| failure of the pump gland seal | aeration, cavitation and loss of power and efficiency |
| malfunction of signals and indications of measuring instruments | misdiagnosis of the current state of machinery, sudden stoppage of pumping units, flooding of the seams, danger to mine operations, danger to crew's lives, loss of control over the system |

## 5. Layer model concept for the main dewatering system

The completion of the research tasks made it possible to develop the concept of a layered model of the main dewatering system. A conceptual diagram of this layered model is shown in Figure 7.

The model of the main dewatering system includes four layers which include elements of other types i.e.:

1. a layer of primary and secondary processes,
2. a layer of infrastructure elements,
3. a layer of process disruption (problems, failures, downtime, upgrades),
4. a layer of technical and economic effects.

The primary and auxiliary processes layer includes all identified primary and auxiliary processes of the main dewatering system. This layer is the starting layer for further analysis. The identification of these processes required contacts with the staff of the Sobieski Coal Mine, local inspections underground in the pumping chambers, familiarisation with the diagrams of the main dewatering system, familiarisation with the system reporting, diagnostic software and work organisation. All these factors must ensure compliance with the current Mining Law regulations and thus ensure the safety of the workforce and continuity of the Mine's operational activities.

The infrastructure elements layer includes the technical equipment necessary to implement the processes of the main dewatering system. These include machinery, equipment, pipelines, control and measuring instruments, tools, control devices, computer equipment. The main part of this infrastructure is located on the equipment of the mine. The remainder of the necessary infrastructure is held by manufacturers of machinery and equipment for the mining industry, who carry out production or repairs, and by service providers who carry out orders at the mine site with their own equipment, e.g. cleaning of water galleries or cleaning of water settling tanks.

The process disturbance layer comprises a set of factors that negatively affect the functioning of the main dewatering process leading to its failure or complete shutdown. They are phenomena that must be anticipated and prevented. Various types of diagnostic equipment are used for this purpose. Appropriate equipment with control and monitoring elements makes it possible, based on current observation, to prevent emergency states or to prepare in advance for their occurrence. Currently, each pumping unit in the Sobieski Coal Mine is equipped with vibration sensors, temperature sensors, pressure sensors, flowmeters and ammeters. The measurement results are recorded by specialised computer software in the on-line mode and are subject to ongoing analysis by supervisory staff.

The layer of technical and economic effects is the resultant layer in the main dewatering system. Technical and economic effects can be divided into positive and negative ones. The task of the authors of this article is, among other things, to determine the cause-effect relationships between the elements of the process of the main dewatering system and to identify measures enabling the reduction of negative effects and the strengthening of positive effects.

The layers defined in the model are interconnected by numerous relationships that illustrate the complexity of the main dewatering system under analysis. In the layer diagram, each relationship is marked with a symbol that reflects the way in which specific elements of different layers are related. In general, the symbol $R^{ij}_{k,l-m}$ denotes the relation between the element of the *i*-th layer and the *j*-th layer of the model, which is the *k*-th relation between these layers, namely between the *l*-th element in the *i*-th layer and the *m*-th element in the *j*-th layer.

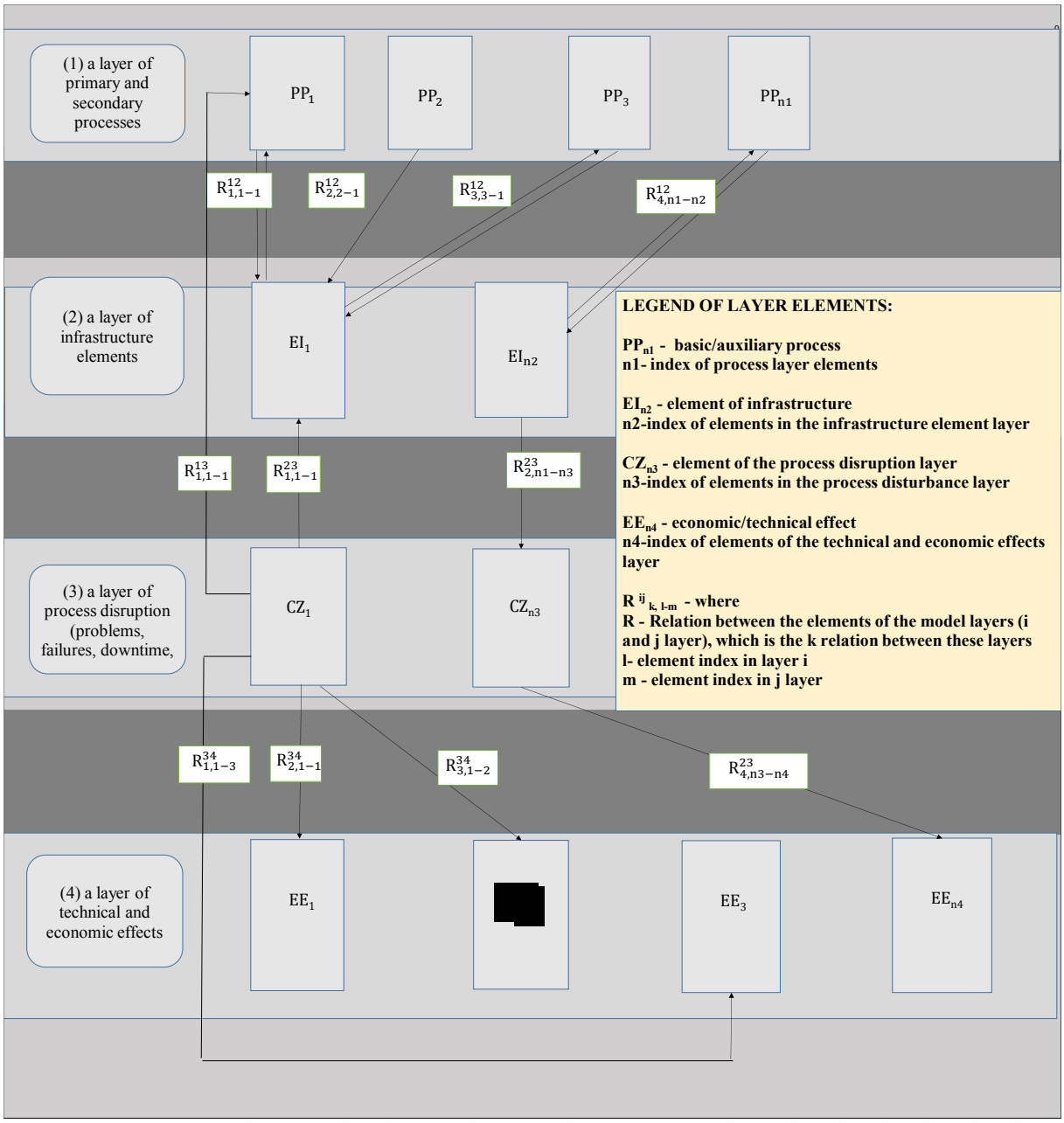



**Figure 7.** Schematic diagram of a layered model of the main dewatering system in a coal mine

In order to complete the proposed model and develop a method to optimise the operation of this system, it will be necessary to determine the target decision variables, which are the parameters that determine the operation of the main dewatering system. Generally, these parameters can be divided into 3 groups: technical parameters, organisational parameters and economic parameters. Each of the established parameters requires identification and initial quantification.

The following parameters can be included in the group of technical parameters:

- water pressure in the pipeline,
- capacity of the pump unit,
- the vibration level of the pump unit,
- oil temperature of the engine bearing and pump,

- efficiency of the pump unit,
- length of main dewatering pipelines,
- operating point: pump unit – pipeline,
- the current drawn by the motor of the pump unit,
- electricity consumption of the pump unit motor.

The following parameters can be included in the group of organisational parameters:

- number of manual workers,
- number of supervision staff,
- shift work,
- frequency of inspections,
- frequency of checks on measuring instruments,
- frequency of verification of measuring instruments.

The following parameters can be included in the group of economic parameters:

- the cost of electricity consumption,
- labour costs for manual workers,
- the cost of janitorial staff,
- capital expenditure,
- refurbishment costs,
- depreciation of machinery and equipment,
- cost of materials,
- cost of external services,
- environmental costs,
- costs of other utilities (except electricity),
- costs of surveillance of surface infrastructure.

The proposed model of the main dewatering system requires consideration of both economic, technical and technological conditions and the specifics of the system's operation in a hard coal mine. The established criteria and decision variables enable the development of a method for optimising the operation of this system, in which the total cost of operation of the system taking into account investment outlays and operating costs will be the objective function.

## 6. Conclusions

Recognition of the operating conditions of the main dewatering system in a selected coal mine enabled the preparation of a concept for a main dewatering model. The concept is based on a layered approach, which takes into account technical, economic and management criteria.

Ultimately, the developed concept of the main dewatering model in a hard coal mine will be enriched with an optimisation method that will make it possible to achieve stable operation of the system while minimising maintenance costs.

The research conducted allows the following conclusions to be drawn:

1. The main dewatering system is a complex system whose main task is to drain mine water that flows from the rock mass as a result of coal mining. The efficiency of operation of this system is an important element in the economic efficiency of a hard coal mine due to the high capital expenditure and operating costs of the main dewatering system.
2. The concept of the main dewatering system was based on a layer model including 4 layers, i.e. process layer, infrastructure elements layer, process disturbance layer, technical and economic effects layer. The model takes into account the identified elements of individual layers and the existing relationships between the elements of the aforementioned layers.
3. The development of a method for optimising the use of machinery and equipment of the main dewatering system with the use of the proposed model requires detailed quantitative research to establish the functional relationships characterising the identified relations between the individual layers and, ultimately, to build the objective function, which will be the total cost of operation of the system taking into account the investment and operating costs.
4. The parameters determining the operation of the main dewatering system in a hard coal mine, which are the decision variables, can be divided into technical, organisational and economic parameters. Establishing cause-and-effect relationships makes it possible to determine the objective function, which is key to the optimisation analysis of the operation of the main dewatering system.
5. The method for optimising the use of main dewatering machines and equipment and its implementation will make it possible to achieve measurable financial savings related to efficient use of the existing technical infrastructure. The proposed concept and optimisation method will be implemented and verified in a selected hard coal mine. Ultimately, the developed solution will be able to be used in other mining plants, especially in those with a high-water hazard.

## References


1. Act of 9 June 2022 Geological and Mining Law, Art. 4, Art. 50, Art. 90.
2. Dorosiński, M. (2016). Kosztowna konieczność. *Górnicza Izba Przemysłowo Handlowa, Biuletyn Górniczy, Nr 1-2(246),* http://www.giph.com.pl/biuletyn-gorniczy/biuletyn-gorniczy-nr-1-2-246-styczen-luty-2016-r/kosztowna-koniecznosc.
3. Gumińska, J., Plewa, F., Grodzicka, A., Gumiński, A., Rozmus, M., Michalak, D. (2021). *Analiza ekonomiczna zastosowania systemu technologicznego do usuwania zawiesin stałych z wód odwadniających kopalń*, 1-15.
4. Hu, L., Zhang, M., Yang, Z., Fan, Y., Li, J., Wang, H., Lubale, C. (2020). *Estimating dewatering in an underground mine by using a 3D finite element model*. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239682.
5. Jonek-Kowalska, I., Turek, M. (2013). Cost Rationalization of Maintaining Post-Industrial Regions. *Pol. J. Environ. Stud., Vol. 22, No. 3*, 727-740.
6. Journal of Laws of the Republic of Poland, Regulation of the Minister of Energy of 23.11.2016 on detailed requirements for the conduct of underground mining operations (Journal of Laws item 1118), §28, §37, §38, §66, §69, §121, §138, §450, §454, §528-532.
7. Journal of Laws of the Republic of Poland, Regulation of the Minister of the Environment of 29 January 2013 on natural hazards in mining plants (Journal of Laws, item 230), Chapter 7, §24-27.
8. Kałuża, G. *Konstrukcja i badania zatapialnych pomp wirowych przeznaczonych do pracy w przestrzeni zagrożonej wybuchem.* Główny Instytut Górnictwa Kopalnia Doświadczalna „BARBARA" Zakład Bezpieczeństwa Przeciwwybuchowego, https://docplayer.pl/27623932-Dr-inz-gerard-kaluza-konstrukcja-i-badania-zatapialnych-pomp-wirowych-przeznaczonych-do-pracy-w-przestrzeni-zagrozonej-wybuchem.html, 1-6.
9. Karpiński, M., Batko, R., Kmiecik, E., Tomaszewska, B., Zdechlik, R. (2017). *Czasowa zmienność wielkości dopływów wód dołowych do wyrobisk ZG Sobieski*, 1-60.
10. Kierownik Działu Energo-Mechanicznego (2017). *Instrukcja szczegółowa przeprowadzania okresowych i bieżących kontroli stanu technicznego urządzeń i układu systemu głównego odwadniania*, 1-3.
11. Konsek, S., Czapnik, A. (2020). Docelowy model odwadniania zlikwidowanych kopalń w Górnośląskim Zagłębiu Węglowym. *Systemy Wspomagania w Inżynierii Produkcji, Energia i Górnictwo – perspektywy zrównoważonego rozwoju, Vol. 9, iss. 2,* 99-110.
12. Korbiel, T., Wojciechowski, J. (2019). Systemy wspomagania w inżynierii produkcji, Analiza kosztów eksploatacji systemu głównego odwadniania kopalni węgla kamiennego. *Górnictwo – perspektywy i zagrożenia, Vol. 8, iss. 1*, 413-419.
13. Mikoś, M., Kalukiewicz, A., Wojciechowski, J. (2007). Wpływ wydajności pompy wirowej na kształt pola prędkości strugi w przewodzie ssawnym. *Maszyny Górnicze, 1*, 1-53.

14. Masood, N., Edwards, K.H., Farooqi, A. (2020). Environmental Geochemistry Laboratory, Department of Environmental Sciences, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad, PO 45320, Pakistan b Camborne School of Mines and Environment and Sustainability Institute, 2020 r., University of Exeter, Tremough Campus, Penryn, TR10 9EZ, UK, 2-16.
15. Pakuła, G., Strączyński, M. (2013). *Podręcznik eksploatacji pomp w górnictwie*. Warsyawał Wydawnictwo Seidel-Przywecki Sp. z o.o., 129- 201.
16. Rózkowski, K., Zdechlik, R., Chudzik, K. (2021). Open-Pit Mine Dewatering Based on Water Recirculation—Case Study with Numerical Modelling. *Energies, Vol. 14, Iss. 15,* 10.3390/en14154576, 1-18.
17. Stępniewski, M. (1985). *Pompy*. Warszawa: WNT, 173-479.
18. Szymański, Z. (2013). *Nowoczesne metody sterowania i badań diagnostycznych kopalnianych pomp głównego odwadniania*, http://beta.nis.com.pl/userfiles/editor/nauka/22013_n/Szymaski_02-2013.pdf, 1-8.
19. Szymański, Z. (2016). Smartsterowanie, czyli o nowoczesnych metodach sterowania i badań diagnostycznych kopalnianych pomp głównego odwadniania. *Pompy, pompownie, 1*, https://www.kierunekpompy.pl/magazyn,smartsterowanie-czyli-o-nowoczesnych-metody-sterowa-nia-i-badan-diagnostycznych-kopalnianych-pomp-glownego-odwadniania.html.
20. Tajduś, K., Sroka, A., Misa, R., Dudek, M. (2019). *Zagrożenia powierzchni terenu deformacjami ciągłymi i nieciągłymi aktywującymi się podczas zatapiania podziemnych kopalń.* Instytut Mechaniki Górotworu PAN, https://imgpan.pl/wp-content/uploads/2019/07/Kwartalnik-19-4-02-Tajdus.pdf, 1-12.
21. Wilk, S., Golec, K., Wilk, A. (2008). *Górnicze pompy stacjonarne.* Gliwice: Zakład Mechaniki Przemysłowej „ZAMEP", 17-81.
22. Zając, C. (2017). *Materiały dydaktyczne dla górników. Zagrożenia wodne*.

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# ANALYSIS OF THE MAIN TRENDS IN THE HOTEL AND RESTAURANT INDUSTRY OF UKRAINE UNDER THE CONDITIONS OF THE COVID-19 PANDEMIC

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**Purpose:** The purpose of the article is to research and analyze the main trends in the hotel and restaurant industry of Ukraine under the conditions of the COVID-19 pandemic, to identify the main problems of business entities in the field of hospitality and to outline the prospects for its further development.
**Design/methodology/approach:** In the research process, general scientific methods were used – information collection, its analytical processing, theoretical generalization and comparison; graphic method – to illustrate the dynamics of the indicators studied in the work. The object of the study is the activity of enterprises of the hotel and restaurant industry in Ukraine. The subject of the study is the peculiarities of the functioning of domestic enterprises of the hotel and restaurant business in the conditions of the COVID-19 pandemic. The information base of the research became theoretical and methodological developments of domestic and foreign authors, materials of periodicals; statistical data of the State Statistics Service of Ukraine; research of the Association of Hotels and Resorts of Ukraine (UHRA); informational materials of the National Tourist Organization of Ukraine.
**Findings:** The article provides an analysis of the efficiency of the hotel and restaurant business. In article is shown the negative impact of the pandemic on the development of the hotel and restaurant industry in Ukraine. The analysis of the consequences of the COVID-19 pandemic showed that the hotel and restaurant business needs the implementation of complex innovative approaches in various spheres of activity.
**Practical implications:** Based on the analysis of the theoretical and methodological principles and trends in the development of the hotel and restaurant business in Ukraine during the pandemic, were summarized practical recommendations and were substantiated a measures aimed at overcoming the consequences of the crisis and improving the efficiency of the enterprises.
**Originality/value:** The results of the conducted research will contribute to the improvement of the management system of hotel and restaurant business enterprises and increase their competitiveness on the domestic and international markets.

**Keywords:** hotel and restaurant business, COVID-19 pandemic, crisis, trends, development.

**Category of the paper:** Research paper.

## 1. Introduction

The spread of the COVID-19 disease and the introduction of strict quarantine restrictions has become a serious test for humanity in the 21st century. The pandemic led to significant human losses and to major changes in the political, social, economic, religious and financial systems of the world. More than 80 countries have closed their borders. A large number of enterprises and institutions were forced to switch to remote work or suspend their activities. The world's largest economies such countries like the USA, China, Japan, Germany, Great Britain, France, India, Italy, Brazil and Canada, suffered significant losses (Makalyuk, & Kysil, 2021). Restrictive measures, which introduced because of the spread of COVID-19 on the Ukraine territory, had a significant impact on the national economy (Quarantine measures, 2021). Non-food stores, restaurants, public catering establishments, night clubs, shopping and entertainment centers were closed for long periods. The pandemic affected the sharp restriction of mass events, international and national flights, which caused a decrease in demand on different types of goods and services. Analysis of the main restrictive measures shows that the pandemic had a negative impact on the service sector, in particular – tourism sphere, hotel-restaurant and entertainment business.

An important component of the hospitality industry is the hotel and restaurant business, which develops in close relationship with the tourism industry. The effective functioning of these industries is a positive indicator of changes in the economy of the state and its regions and is an important prerequisite for intensifying the development of international relations. Most analysts predict that international travel and tourism will return to normal levels by 2025 (Jones, Palumbo, & Brown, 2021). After the relaxation of quarantine measures, a large part of catering establishments (about 86%) resumed their activities, at the same time, a number of representatives of the hotel and restaurant business could not overcome the consequences of the crisis and went bankrupt (Vozovych et al., 2021).

So, the COVID-19 pandemic became a factor that made adjustments to the work of almost all subjects of economic activity, especially, establishments in the hotel and restaurant sector. The hotel and restaurant business faced the task of rethinking priority directions and finding new forms of activity. Thus, the purpose of the research is to analyze the main trends in the hotel and restaurant industry of Ukraine in the conditions of the COVID-19 pandemic, to identify the main problems of the business entities of the hospitality sector and to outline the prospects for its further development.

## 2. The hotel and restaurant industry in the context of the COVID-19 pandemic: a literature review and statement of the problem

In scientific works, are actively investigated the problems of the impact of the pandemic on the economy and its individual branches. In addition, statistical data are periodically published by: relevant ministries, the World Health Organization, heads of state, representatives of the headquarters for controlling the spread of the coronavirus and statistical agencies, leading economists, political scientists and other experts.

The work is devoted to the study of global economic effects due to the spread of the coronavirus disease (Jackson et al., 2021). The work presents the results of the analysis caused by the impact of pandemic on the economy of the different countries (Razumova, But, & Butsanova, 2022). The work examines the impact of COVID-19 on the economic situation in Ukraine, identifies socio-economic losses, and analyzes the global experience of overcoming the negative consequences of the pandemic. (Onyshchenko, Sivitska, & Cherviak, 2021).

Considerable attention of scientists is devoted to the study of the impact of the consequences of the pandemic on the activities of enterprises of the hotel and restaurant industry. In particular, the article analyzes the impact of COVID-19 on the global hospitality industry, highlights the significant negative consequences of the pandemic for many areas of hospitality, and presents a selection of modern information sources dedicated to the relevant topic (Fowler, 2022). The author studied the practical experience of restaurants during three important stages of their operation – «before COVID-19», «during COVID-19» and «after COVID-19» (Wahab, 2021).

Scientists have studied different management methods which can help bringing out the tourism industry and hospitality of the crisis in different countries (Androniceanu, 2020; McCartney, 2020); analyzed state regulatory measures for the tourism sector and hospitality, as well as local regional response tools to the global pandemic crisis in the European Union (Sanabria-Díaz, Aguiar-Quintan, & Araujo-Cabrera, 2021). Also, in a number of works, investigated anti-pandemic precautions, which implemented in the hotel business and their effectiveness in terms of tourist satisfaction (Davras, & Durgun, 2022); was carried out the risk assessment in the context of COVID-19 (Gursoy, & Chi, 2020).

Based on the analysis of the activities of hotel enterprises in the regions of Ukraine (Hromyk, 2022) it is shown that the hotel market is witnessing increased competition from global hotel concerns. Therefore, hotel enterprises try to increase their productivity and competitiveness by implementing effective methods of organization and management.

The article (Slava, Chyniak, & Puhinska, 2021) presents the results of a study of the intra-organizational features and operating conditions of hotels in a separate region of Ukraine in the context of the global spread of the COVID-19 and summarizes proposals for organizational and technological solutions to eliminate or minimize the impact of the pandemic.

In the scientific work are highlighted the main problems of the development of hotel and restaurant business enterprises; was confirmed the importance of ensuring the quality of products and services for the effective functioning of institutions; is defined the role of image in the formation of the competitiveness of establishments in the hotel and restaurant sphere. (Mukha, 2021)

At the same time, the unstable market environment and the realities of the modern world, caused by the impact of the pandemic, actualize the further development of research into the main trends of the hotel and restaurant industry, the outline of key problems and further prospects for its development.

## 3. Research methodology

In the research process, general scientific methods were used – information collection, its analytical processing, theoretical generalization and comparison; graphic method – to illustrate the dynamics of the indicators studied in the work. The object of the study is the activity of enterprises of the hotel and restaurant industry in Ukraine. The subject of the study is the peculiarities of the functioning of domestic enterprises of the hotel and restaurant business in the conditions of the COVID-19 pandemic. The information base of the research became theoretical and methodological developments of domestic and foreign authors, materials of periodicals; statistical data of the State Statistics Service of Ukraine; research of the Association of Hotels and Resorts of Ukraine (UHRA); informational materials of the National Tourist Organization of Ukraine.

## 4. Study of the main trends in the hotel and restaurant industry of Ukraine in the conditions of the Covid-19 pandemic

The hospitality industry includes the following main elements: accommodation facilities (hotels, hostels, camping sites, etc.); food establishments (cafes, restaurants, canteens, bars); tourism; transport; entertainment; social and cultural institutions. As a result, of the introduction of quarantine restrictions on March 12, 2020, were established transportation limits or a complete ban on passenger transportation, which led to a significant reduction in international and domestic tourist flows. Thus, if during 2015-2019, approximately 12-14 million people entered Ukraine every year, then in 2020 this indicator decreased to approximately 3.4 million people (Fig. 1).

The specified factors caused a decrease in the number of hotel guests (Fig. 2), and as a result, a reduction in the use of their room stock (Fig. 3).

The analysis of the given static dependencies shows that the largest number of guests in collective accommodation facilities was observed in 2012-2013. At the same time, the decrease in the indicator in 2014 is a consequence of the temporary occupation of the territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the territories in the Donetsk and Luhansk regions.

However, for the period of 2015-2018, there is a recovery of the hotel industry and, accordingly, an increase in the total number of people in accommodation facilities by 29.2% compared to 2014. At the same time, it should be noted that this increase was mainly due to domestic tourism of Ukrainian citizens. In 2020, there is a significant decrease in the number of people in institutions compared to 2019 (by 51.8%), which is precisely the result of the COVID-19 pandemic.

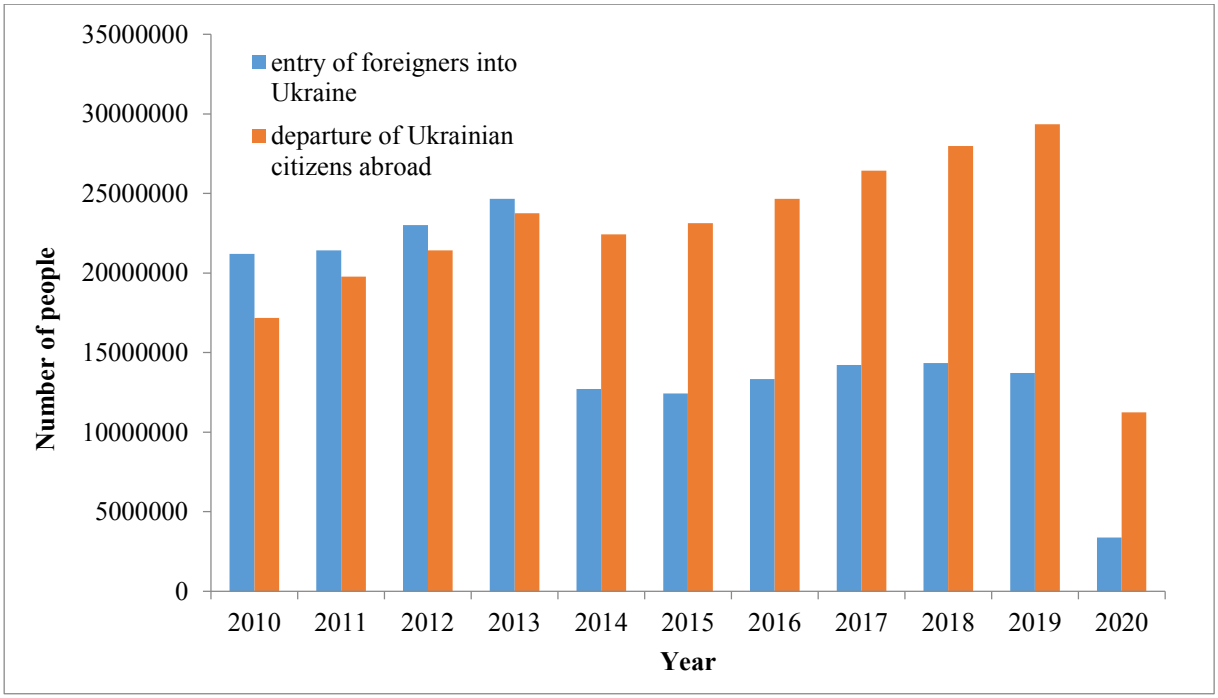


**Figure 1.** Entry of foreigners and stateless persons into Ukraine and departure of Ukrainian citizens abroad, persons. Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

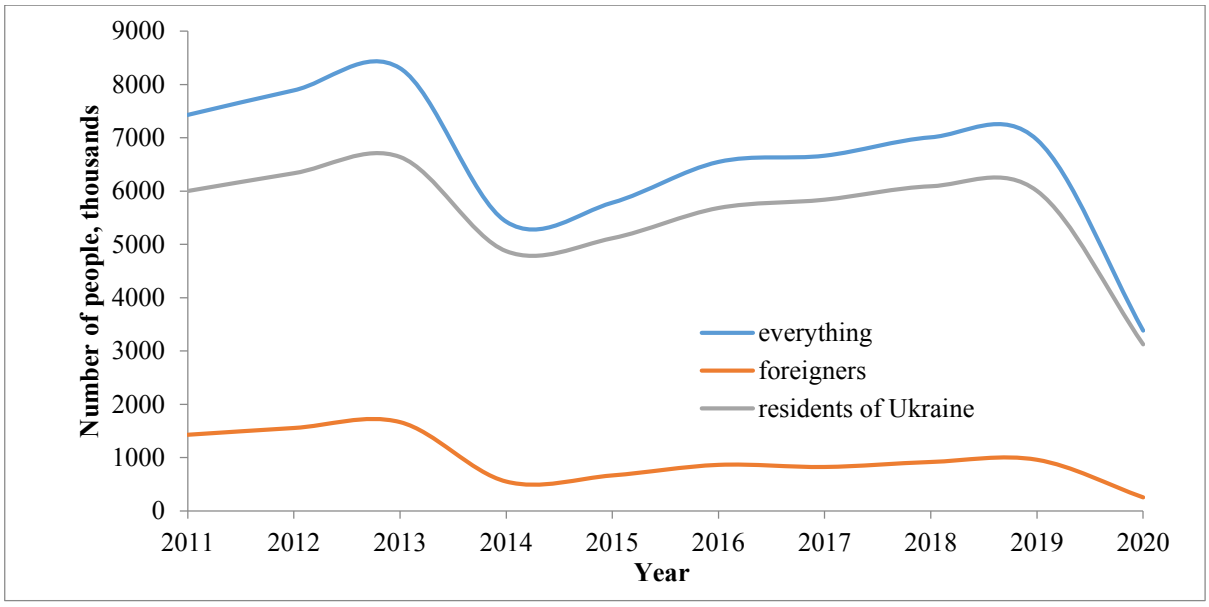


**Figure 2.** The number of persons who were in collective means of accommodation, thousands of persons (2014-2020 – excluding the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in the Donetsk and Luhansk regions). Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

The analysis of indicators of the efficiency of the institutions in the period 2015-2020 (Fig. 3) showed that despite the increase in the number of people who stayed in institutions of collective accommodation, there is a decrease in the total number of days of their stay.

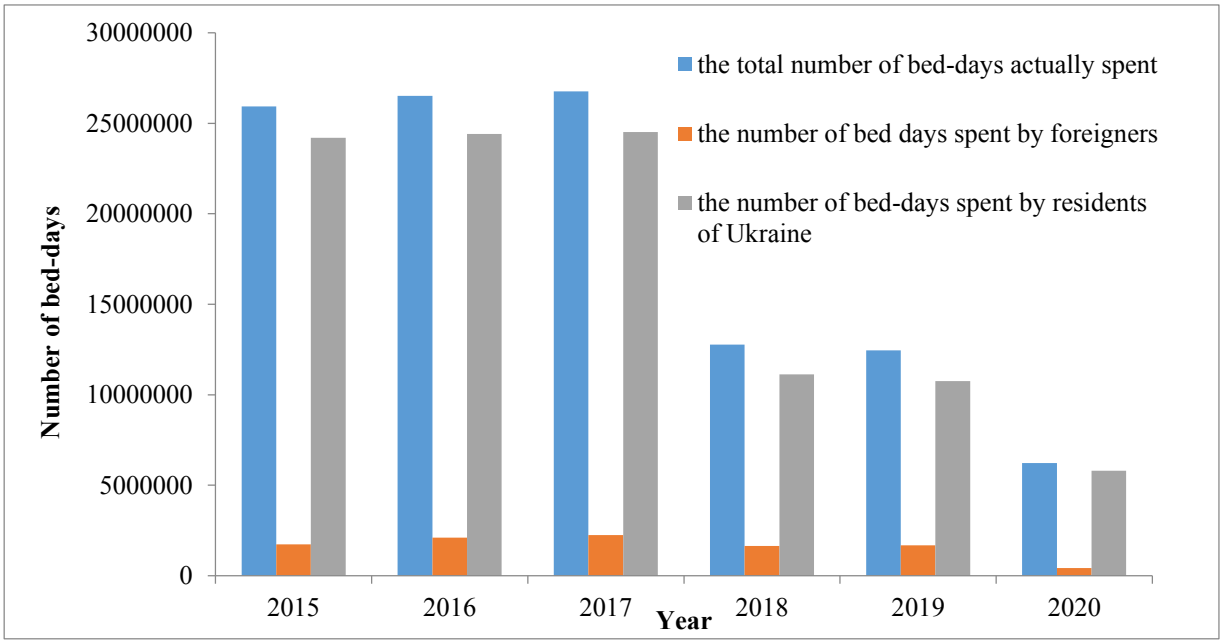


**Figure 3.** The number of bed-days actually spent in collective means of accommodation. Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

The number of foreign tourists and, accordingly, days of stay changed slightly in the period 2015-2019. In 2020, the number of days of stay of foreign citizens in hotel establishments decreased by almost 4 times compared to 2019.

The decrease in citizens' incomes and the introduction of restrictive measures led to a reduction in household spending on services (Fig. 4). So, for example, the share of total spending on restaurants and hotels (per month) in total consumer spending in 2019 was 2.6%, and in 2020 it decreased to 1.55%. In general, household spending on restaurants and hotels in 2020 decreased by 41.3% compared to the previous year.

Accordingly, in 2020, there was also a reduction in the volumes of products sold by business entities belonging to the hospitality sector. Thus, the volume of sold products of hotels and similar means of temporary accommodation in 2020 decreased by 40.57% and amounted to 8.5 billion UAH, while in 2019 the specified indicator amounted to 14.3 billion UAH (Fig. 5).

A decrease in the volume of sold products is also observed in the field of food services (Fig. 6). In 2020, the activities of restaurants and the provision of mobile catering services reduced the volume of product sales by 4.6% compared to 2019; beverage service – by 9.8%.

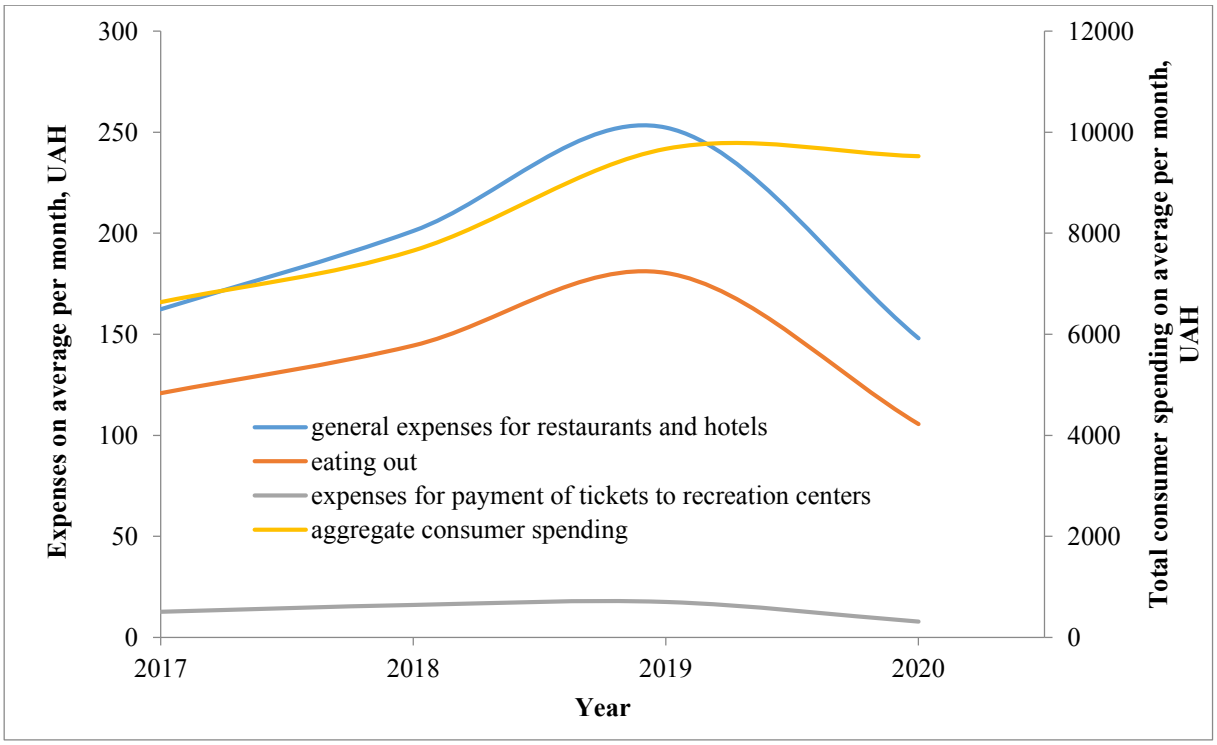


**Figure 4.** Expenses of Ukrainian households on restaurants and hotels (monthly average), UAH. Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

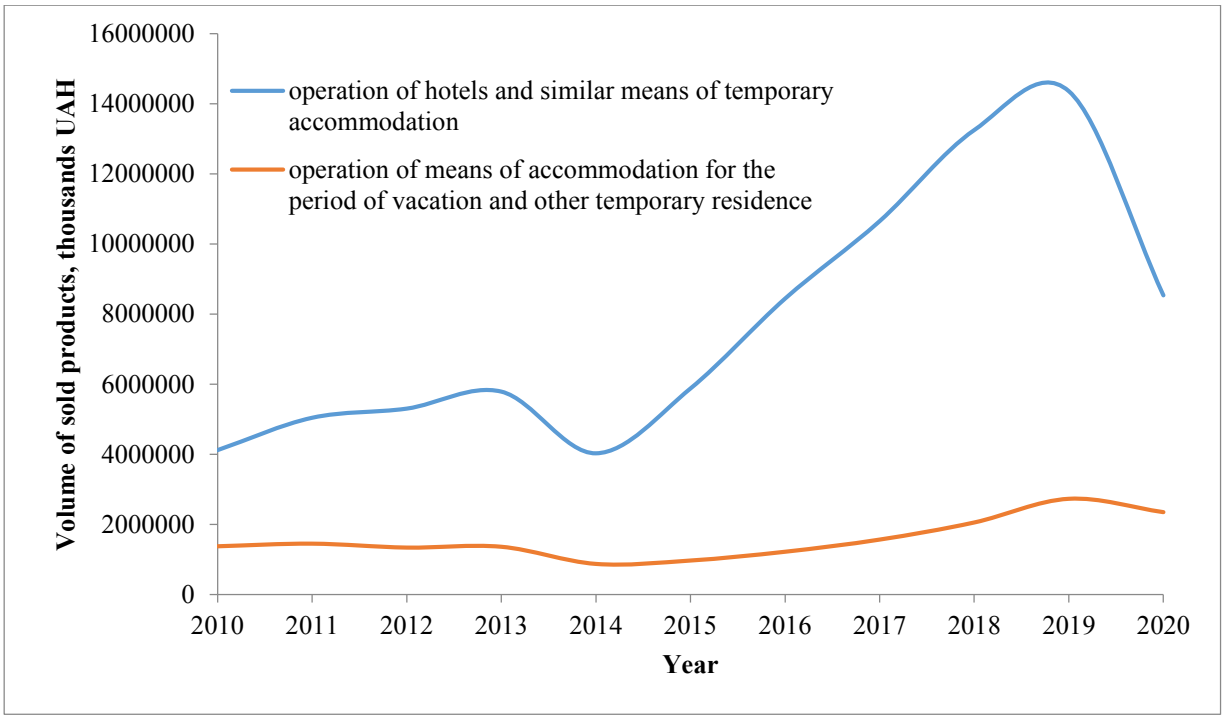


**Figure 5.** Volume of sold products (goods, services) of economic entities by types of economic activity (accommodation services) in 2010-2020 (thousand UAH). Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

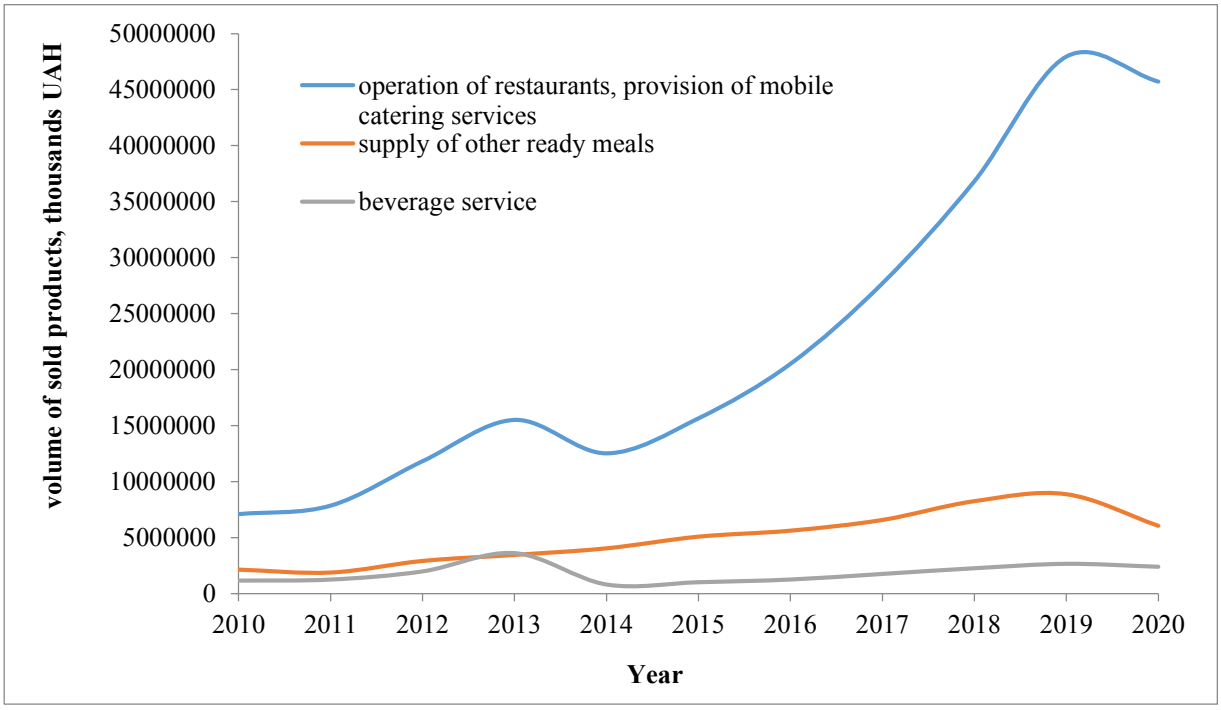


**Figure 6.** Volume of sold products (goods, services) of business entities by type of economic activity (food and beverage services) in 2010-2020 (thousand UAH). Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

Consequently, the reduction of tourist trips and the introduction of quarantine restrictions led to a decrease in the profitability of the operation of enterprises in the hotel and restaurant industry (Fig. 7), as well as significant financial losses. Thus, according to the research of the Association of Hotels and Resorts of Ukraine (UHRA), 93% of respondents confirmed a general decline in the level of revenue of their hotel, in 21% of hotels the gross revenue decreased by 25-40%, in a third of hotels – by 40-60%, in 30 % of hotels such reductions reached more than 60%, only 4% of hotels showed an increase in annual revenue, and in 3% it remained at the same level (Assessment of the impact of COVID-19 on the hotel industry of Ukraine, 2021).

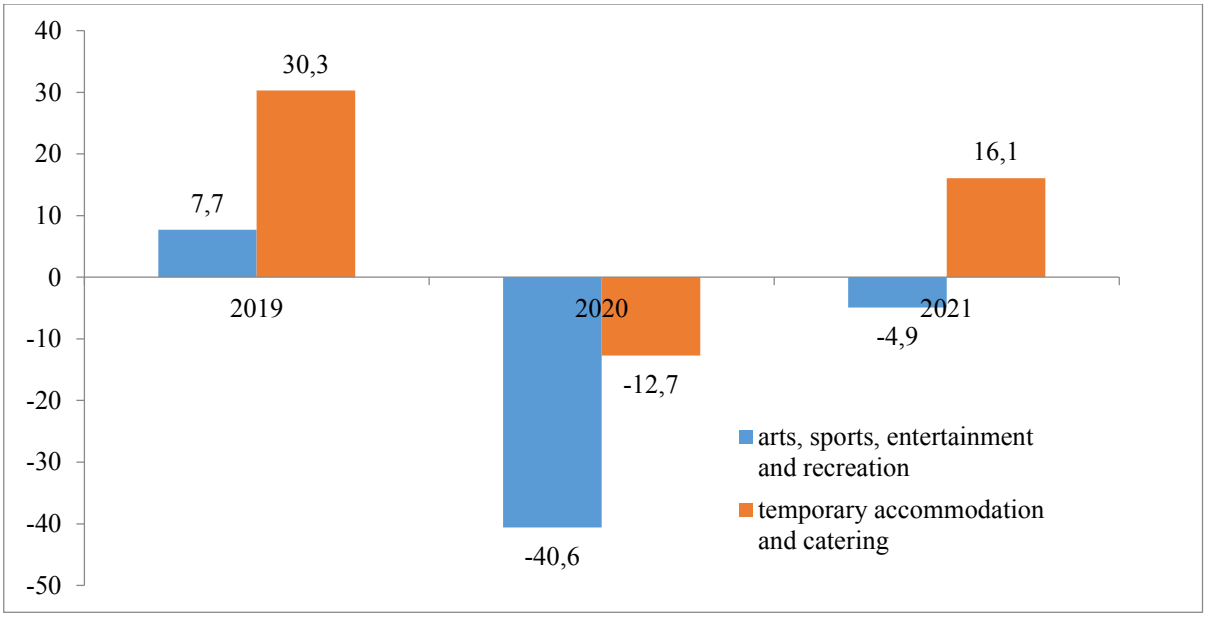


**Figure. 7.** Profitability of operating activities of temporary accommodation, catering, entertainment and recreation enterprises in 2019-2021. Source: compiled by the authors based on data (State Statistics Service of Ukraine, 2019-2021).

Also, in 2020 year compared to 2019 year, recorded a decrease on 39.9% in the volume of capital investments in the restaurant business and on 14.5% in the field of temporary accommodation (Fig. 8).

In fig. 9 presents a description of the main measures that hotel enterprises had to take in order to optimize their costs during the COVID-19 pandemic.

Thus, the majority of hotel enterprises during the 2020 year (66%) were forced to reduce the number of employees and reduce the prices of services. Among other areas of activity optimization, the following should be highlighted: introduction of alternative services (co-working, renting rooms for offices) – 27%; improvement of marketing and information tools – 33.3%. Improvement of products and services in order to improve their quality became an important direction of organizational measures aimed at increasing the competitive advantages of hotel enterprises (63%).

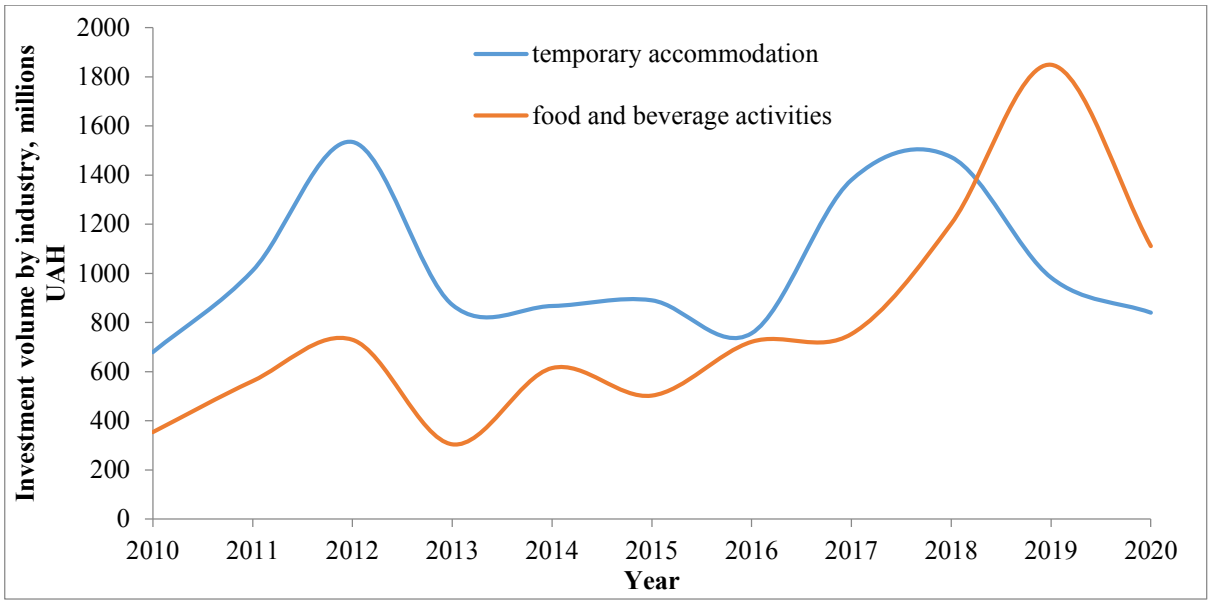


**Figure. 8.** Capital investments by types of economic activity for 2010-2020 (million UAH). Source: compiled by the authors based on data (Tourist Barometer of Ukraine, 2021).

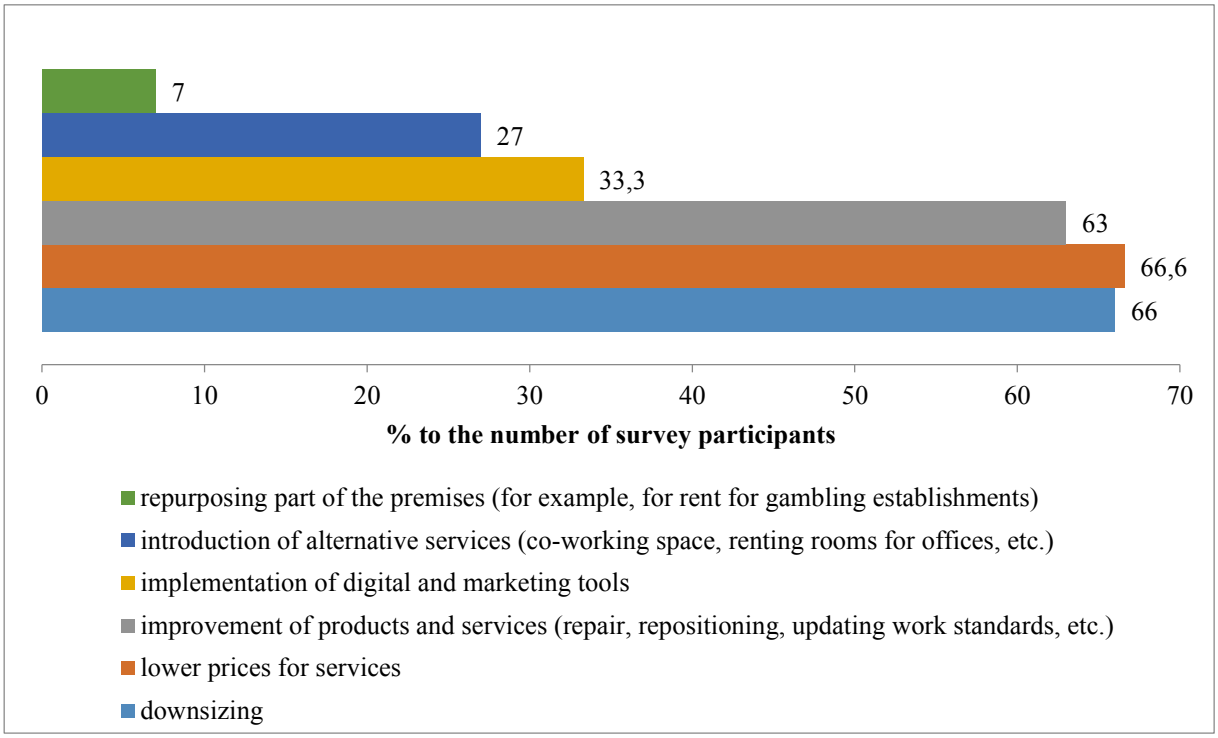


**Figure 9.** Measures implemented by hotel enterprises in order to optimize their costs, percentage of the number of interviewed representatives. Source: compiled by the authors based on data (Assessment of the impact of COVID-19 on the hotel industry of Ukraine, 2021).

It is also worth noting that, in addition to the negative factors associated with the spread of the coronavirus disease, a number of other problems are characteristic of the restaurant and hotel business enterprises in Ukraine, in particular (Sokolenko, & Onoprienko, 2020; Novykova, 2020):

- insufficient level of satisfaction of consumer requirements,
- shortcomings of the quality management system at enterprises,
- insufficient level of management in institution,
- low level of qualification of staff and quality of service provision,
- insufficient advertising activity of institutions and an imperfect image strategy,
- insufficient number of hotels capable of providing quality accommodation services,
- lack of a well-developed network of alternative means of accommodation of a more economical nature for tourists (f.e. hostels, small hotels, etc.).

## 5. Discussion

The hotel and restaurant business and tourism is one of the key sectors for the development of the economy of both the region and the country as a whole. In Ukraine, this area has significant potential, since the market of hotel and restaurant services has not yet reached full saturation and characterized by favorable conditions for attracting both internal and external additional investment resources.

In modern conditions caused by the spread of the COVID-19 and the introduction of quarantine restrictions, the enterprises of the hotel and restaurant industry forced to develop new mechanisms for the preservation and development of their business. As well as they must to adaptation to new conditions of the external environment. As mentioned above, the hotel and restaurant business suffered significant losses as a result of the pandemic, which is primarily due to long-term bans and restrictions on movement, settlement, business trips, tourism, mass celebrations. The format of most communication events (conferences, meetings, meetings) has been changed to remote.

To date, there are certain trends regarding the improvement of the hospitality industry (table 1). For example, the improvement of the quality of hotel services is due to the increase in demand for more comfortable accommodation, and this should be taken into account by middle-class hotels, for which the improvement of the comfort of rooms can be a key point for increasing the number of customers.

**Table 1.**
*Measures aimed at overcoming the consequences of the COVID-19 pandemic and improving the efficiency of the hotel and restaurant business*

| A group of activities | Content of events |
|---|---|
| Sanitary and hygienic | temperature screening of employees; installation of protective screens between employees and visitors; strengthening of requirements for cleaning premises; provision of antiseptic and other means of protection; social distancing. |
| Digitization of technological process | use of digital keys and software for remote control of processes in hotel rooms (control of safes, heating systems, air conditioning, etc.); access to the menu via QR codes and contactless payment. |
| Organizational and managerial | use of chatbots for quick response to customer requests; introduction of a system of preliminary online registration of hotel customers; use of online scoreboards/desktops for orders in cafes and restaurants; implementation of Kitchen Display Systems – a communication system of restaurant services for prompt transfer of orders from waiters to the kitchen, tracking the time of order fulfillment and controlling the need to replenish stocks; creation of own and involvement of third-party specialized delivery services. |
| Volumetric planning | use of the open space of the institution (terraces, roofs); flexible space planning (mobile furniture, chairs and sofas with high backs; screens and partitions for zoning); arrangement of zones for issuing orders with self-delivery. |

Source: summarized by the authors based on (Krukovska, 2022; Novikova, 2020; Sokolenko, & Onoprienko, 2020; Sheyko, 2021).

Also need improvement the hotel approaches operational management, hotel promotion, corporate approach to sales and reservations, etc. At the same time, for effective organizational and economic provision of services in the hospitality industry, enterprises must adhere to the principles and rules of their provision (Ihnatenko et al., 2019). The priority of importance are ethical principles (honesty, intelligence, benevolence, tact, delicacy, education); ecological principles (the provision of services should not harm the environment, other people); cost-effectiveness principles (services should be useful for consumers and providers, should save time and prevent its unproductive expenses); principles of quality and professionalism; principles of legality and safety.

In addition, in the conditions of the pandemic, an effective solution was the introduction of state support measures for hotel and restaurant businesses: tax relief, direct subsidies, employment support or payments to employees who lost their jobs; activation of employment centers for employment, etc. (Krukovska, 2022).

It is also worth paying attention to a number of technological and informational changes and innovative trends that characterize the development of the hospitality industry in recent years (Sheiko, 2021): strengthening of sanitary and hygienic requirements; development of non-contact technologies for managing processes in hotel rooms via the Internet; implementation of operational communication systems of restaurant services; expansion of delivery services by setting up own and using the services of specialized services; changing interior planning solutions in order to increase the open space for consumers.

At the same time, the principle of safety of services in modern conditions becomes especially relevant (Krukovska, 2022). The spread of the COVID-19 pandemic led to the introduction of strengthened anti-epidemiological, organizational and economic measures for

the provision of services regulated both at the global and national levels. Digitization of industry objects (transition to online sales, payments, reservations) greatly simplifies and lowers the cost of business processes, but requires a more complete elimination of risks regarding the reliability of the preservation of commercial secrets, personal data, etc.

So, the modern component of the hotel and restaurant business is the information space, which complements the above-mentioned elements of the hospitality sphere. The information sphere of business is represented by sites, services, reference information, advertising and contributes to the improvement of the provision of hospitality services (Romanukha et al., 2021). In the hotel business, an important component of development is the segmentation of the target audience and the calculation of the effectiveness of the introduction of innovations.

It should be noted, that a high level of ensuring the quality and safety of hospitality services should become the paradigm of all organizational decisions in the context of a pandemic. Objective restrictions and prohibitions may to extent limit the range of products and services, but the level of service or set of services must correspond to the declared level and be improved in accordance with the development strategy of the hotel and restaurant business enterprise.

It should be noted that a high level of ensuring the quality and safety of hospitality services should become the paradigm of all organizational decisions in the context of a pandemic. Objective restrictions and prohibitions can restrict the range of products and services, but the level of service or complex of services must correspond to the declared level and be improved in accordance with the development strategy of the hotel and restaurant business enterprise.

## 6. Conclusions

Based on the analysis of the theoretical and methodological principles and trends in the development of the hotel and restaurant business in Ukraine during the pandemic, summarized the practical recommendations and substantiated the measures aimed at overcoming the consequences of the crisis and improving the efficiency of the enterprises.

As the research results showed, in the period 2018-2019 years the hotel and restaurant sector in Ukraine developed quite dynamically, there was an increase in the main technical and economic indicators. However, the spread of the COVID-19 presented new challenges to the hotel and restaurant industry, which required the implementation of urgent measures in order to meet the priority needs of consumers in the context of the pandemic, preserve jobs and maintain market positions.

Thus, the analysis of the impact of the COVID-19 pandemic showed that the hotel and restaurant business needs to apply of complex innovative measures. In particular, we may be talking about the wider use of Internet technologies, online services to ensure address delivery of orders, etc.

At the same time, the practical aspects of the implementation of proposed measures require a further research in order to optimize the activities of enterprises in crisis conditions.

The results of our research will contribute to the improvement of the management system of hotel and restaurant business enterprises and increase their competitiveness on the domestic and international markets.

## References

1. Androniceanu, A. (2020). Major structural changes in the EU policies due to the problems and risks caused by COVID-19. *Administraties i Management Public*, *34*, 137-149.
2. *Assessment of the impact of COVID-19 on the hotel industry of Ukraine: final materials of the press conference of the State Tourism Development Agency of Ukraine and the Association of Hotels and Resorts of Ukraine* (2021). Retrieved from https://www.ukrinform.ua/rubric-presshall/3172330-ocinka-vplivu-covid19-na-gotelnu-industriu-ukraini.html, 01.08.2022.
3. Davras, Ö., Durgun, S. (2022). Evaluation of precautionary measures taken for COVID-19 in the hospitality industry during pandemic. *Journal of Quality Assurance in Hospitality & Tourism, 23, 4,* 960-982, doi: 10.1080/1528008X.2021.1932013.
4. Fowler, D.S. (2022). Impact of COVID-19 on the global hospitality industry: a brief review of current academic literature and meta-analysis to determine primary qualitative themes. *Research in Hospitality Management, 12, 1,* 29-4, doi: 10.1080/22243534.2022.2080948.
5. Gursoy, D., Chi, C.G. (2020). Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda. *Journal of Hospitality Marketing & Management, 29, 5,* 527-529, doi: 10.1080/19368623.2020.1788231.
6. Hromyk, O. (2022). The condition assessment of hotel business development in Ukraine. *Restorannyi i hotelnyi konsaltynh. Innovatsii*, *5(1),* 52-62. doi: 10.31866/2616-7468.5.1.2022.260873.
7. Ihnatenko, M.M., Marmul, L.O., Sarapina, O.A., Sakun, A.Zh., Pylypenko, K.A. (2019). Models of implementation of enterprises in agricultural green tourism in European countries and assessment of the irefficiency. *International Journal of Innovative Technology and Exploring Engineering, 8*, 337-340.
8. Jackson, J.K., Weiss, M.A., Schwarzenberg, A.B., Nelson, R.M., Sutter, K.M., Sutherland, M.D. (2021). Global economic effects of COVID-19. Retrievedfromhttps://sgp.fas.org/crs/row/R46270.pdf.
9. Jones, L., Palumbo, D., Brown, D. (2021). *Coronavirus: How the pandemic has changed the world economy*. Retrieved from https://www.bbc.com/news/business-51706225.

10. Krukovska, O.V. (2022). Novi orhanizatsiino-ekonomichni zasady upravlinnia posluhamy v industrii hostynnosti na rivni pidpryiemstv hotelno-restorannoho biznesu. *Ahrosvit*, *3*, 70-76.
11. Makalyuk, I.V., Kysil, A.P. (2021). *Naslidky pandemii COVID-19 dlia natsionalnykh ekonomik svitu.* Zbirnyk tez dopovidei II Mizhnarodnoi naukovo-praktychnoi konferentsii «Biznes, innovatsii, menedzhment: problemy ta perspektyvy». Kyiv: Politekhnika. Retrieved from http://confmanagement.kpi.ua/proc/article/view/230936, 28.07.2022.
12. McCartney, G. (2020). The impact of the coronavirus outbreak on Macao. From tourism lockdown to tourism recovery. *Current Issues in Tourism, 24, 19,* 2683-2692, doi: 10.1080/13683500.2020.1762549.
13. Mukha, R.A. (2021). Doslidzhennia stanu hotelno-restorannoi industrii Ukrainy ta vplyv pandemii Covid-19 na nei. *Efektyvna ekonomika, 7*. doi: 10.32702/2307-2105-2021.7.90. Retrieved from http://www.economy.nayka.com.ua/?op=1&z=9075, 02.08.2022.
14. Novykova, V.I. (2020). *Hotelni pidpryiemstva yak zvychaina infrastruktura turystskoi diialnosti.* Materialy mizhnarodnoi naukovo-praktychnoi konferentsii «Suchasni tendentsii rozvytku industrii turyzmu ta hostynnosti u konkurentnomu seredovyshchi». Kharkiv: Kharkivskyi natsionalnyi universytet miskoho hospodarstva imeni O.M. Beketova. Retrieved from https://drive.google.com/file/d/1k-GjEw-sTG7G4jUBLpeCd60zAIVpEEM4/view, 25.07.2022.
15. Onyshchenko, V., Sivitska, S., Cherviak, A. (2021). COVID-19 and Its Impact on Ukrainian Economy. *Economics and Region, 1 (80),* 614.
16. Quarantine measures (2021). Retrieved from https://covid19.gov.ua/karantynni-zakhody, 28.07.2022.
17. Razumova, H.V., But, K.A., Butsanova, K.H. (2022). Otsinka vplyvu pandemii na ekonomiku krain svitu. *Biznesinform*,*1*, 28-32.
18. Romanukha, O.M., Khalilova-Chuvaieva, Yu.A., Khavrova, K.S., Kovalenko, O.S. (2021). Dynamika rozvytkuindustrii hostynnosti v Ukraini na prykladi hotelno-restorannoi haluzi. *Ekonomika ta derzhava, 2,* 43-46. doi: 10.32702/23066806.2021.2.42. Retrieved from http://www.economy.in.ua/pdf/2_2021/9.pdf, 01.08.2022.
19. Sanabria-Díaz, J.M., Aguiar-Quintan, T., Araujo-Cabrera, Y. (2021). Public strategies to rescue the hospitality industry following the impact of COVID-19: A case study of the European Union. *International Journal of Hospitality Management, 97(1).* doi: 10.1016/j.ijhm.2021.102988.
20. Sheiko, Yu. (2021). Tendentsii rozvytku industrii hostynnosti v umovakh pandemii COVID-19. *Scientific Collection «InterConf», 72,* 7-9. Retrieved from https://ojs.ukrlogos.in.ua/index.php/interconf/article/view/14110, 02.08.2022.
21. Slava, S.S., Chyniak, V.V., Puhinska, V.V. (2021). Vnutrishno-orhanizatsiini osoblyvosti diialnosti hotelnykh pidpryiemstv Zakarpatskoi oblasti v umovakh pandemii. *Naukovyi*

*visnyk Uzhhorodskoho Universytetu,* 2(58), 33-38, doi.org/10.24144/2409-6857.2021.2(58).33-38.

22. Sokolenko, A.S., Onoprienko, K. Yu. (2020). *Pidvyshchennia konkurentospromozhnosti pidpryiemstv restorannoho hospodarstva za rakhunok uprovadzhennia systemy yakosti.* Materialy mizhnarodnoi naukovo-praktychnoi konferentsii «Suchasni tendentsii rozvytku industrii turyzmu ta hostynnosti u konkurentnomu seredovyshchi». Kharkiv: Kharkivskyi natsionalnyi universytet miskoho hospodarstva imeni O.M. Beketova. Retrieved from https://drive.google.com/file/d/1k-GjEw-sTG7G4jUBLpeCd60zAIVpEEM4/view, 25.07.2022.
23. State Statistics Service of Ukraine. Profitability of operational activities of enterprises (2019-2021). Retrieved from https://ukrstat.gov.ua/operativ/operativ2021/fin/rodp/rodp_ed/rodp_ed_u/arh_rodp_ed21_u.htm, 28.07.2022.
24. Tourist barometer of Ukraine 2020 (2021). Retrieved from https://www.ntoukraine.org/, 25.07.2022.
25. Vozovych, A., Mytnyk, I., Horodenko, M., Mezentsev, O., Ohorodniichuk, O., Dzhobolda, D., Martseniuk, A. (2021). Karantyn ekonomiky. Kyiv: Adastra. Retrieved from https://ucci.org.ua/uploads/files/602f9ce03135f554471158.pdf, 01.08.2022.
26. Wahab, K. (2021). Impact of COVID-19 on the Hospitality Industry: Climbing Towards Recovery. *International European Extended Enablement in Science, Engineering & Management (IEEESEM)*, *9(6),* 59-77. dx.doi.org/10.2139/ssrn.3877089.

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# MODERN ASPECTS OF CIVIL SOCIETY INTERACTION WITH LOCAL GOVERNMENT BODIES

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**Purpose:** The purpose of the article is to reveal the essence and forms of interaction of local government with the civil society in Ukraine, to identify the main problems and to outline the ways of improvement.
**Design/methodology/approach**: In the research process, general scientific methods were used – information collection, its analytical processing, theoretical generalization and comparison; graphic method – to illustrate the dynamics of the indicators studied in the work.
The object of research is communicative processes in regional administration. The subject of the study is the peculiarities of modern aspects of the interaction of civil society with local government bodies.
The information base of the research became theoretical and methodological developments of domestic and foreign authors, materials of periodicals; statistical data of the State Statistics Service of Ukraine.
**Findings:** Based on the analysis of literary sources was summarized the essence and forms of interaction of civil society with local government. It is shown that in the modern conditions of the development of society, as well as external challenges in Ukraine and in the world, a promising direction for the development of communication processes of local government with civil society is the use of electronic democracy tools. Presented an analysis of statistical data on the use by citizens various forms of electronic communications in local government in Ukraine for 2019-2020 years. It was established that the effectiveness of using electronic capabilities in the communicative processes between local government and civil society is not the same in different regions.
**Research limitations/implications**: The presented problem also requires further research in order to establish criteria for determining the effectiveness of the application of various communication approaches in the process interaction between civil society and local government bodies.
**Practical implications:** Based on the generalization of the research results, was proposed the main directions for improving the communicative activity of local government.
**Originality/value:** The conducted studies showed that after the implementation of the decentralization reform, local government in Ukraine became more open and transparent. Has been established a positive trend in the use of such communication mechanisms as electronic appeals, electronic petitions and the participation budget. However, it is necessary to

pay attention to the uneven use of the specified types of communications in different regions of the country, which requires solving a number of organizational, technological and social issues.

**Keywords:** local government, civil society, communicative processes, electronic democracy tools, communication technologies.

**Category of the paper:** Research paper.

## 1. Introduction

A necessary condition for the development of democracy in Ukraine is the establishment of effective cooperation between the authorities and institutions of civil society. The priority is an issue of involving the civil society in the process of making decision, which will ensure increased efficiency and transparency of the activities of public authorities.

The issue of interaction with the public society is one of the key point in the Association Agreement between Ukraine and the European Union (Association Agreement between the European Union and its Member States, of the one part, and Ukraine, of the other part, 2015). In particular, in the text of the Agreement determined that the interaction of the state with civil society based on partnership is necessary for the development of Ukraine as a legal, democratic and social country.

The experience of the democratic countries all over the world proves that it is public participation, contributes to the greater efficiency of public administration, the openness and transparency of the activities of state bodies and local government, and increases the level of society trust. To date, the adoption of a number of legislative acts provides grounds for asserting the expansion of the legal field for the interaction of executive authorities, local government and the public society. At the same time, focusing on dialogue with society through more active involvement of the public requires the introduction of new methods and tools. Successful and effective interaction of local government bodies with the civil society is an important component of solving topical issues of local politics and socio-economic development of the region.

It should be noted that the development of local government in our country is in a state of stagnation. Such state required effective and significant changes in approaches to the process of regional and local governance. The decentralization reform, which began in 2015, provided for the transfer, adaptation and implementation of European practices in Ukraine, which would be based on the principles of transparency and accountability (Kravtsova, 2019). Historically, it happened that for decades the paradigm of thinking of the governing bodies in the territory of Ukraine was formed without the involvement of the public in the process of forming an opinion and making decisions both at the local and national levels (Selivanov, Obushna, Khadzhyradieva, 2019). At the same time, public consultations of the authorities with the

community require the formation of such an effective model of understanding and trust, where the authorities are legitimate, and the level of political culture and legal awareness of the population is high (Vysokyi, 2021).

The modern legislation of Ukraine provides certain opportunities for the interaction of public authorities with the civil society, but the technologies and methods of this interaction still need to be implemented and improved.

Also, it should be noted that the need to improve approaches in the communication processes of local authorities with the public society is also due to current external challenges, namely the impact of the pandemic and introduction of the state of war in the country. The specified factors actualize the further development of studies of the state and main trends in improving the process of civil society interaction with local government bodies.

Accordingly, the purpose of the article is research and analysis of modern aspects of the interaction of civil society with local government bodies, identifying the main problems and outlining ways of improvement.

## 2. The essence and forms of interaction between local government bodies and the civil society

Progress in all spheres of life of society and the country is possible only under the condition of the functioning and development of an active public society. The interaction of state authorities of Ukraine with the public is the most important joint task of state administration, local government and the society.

The government acts as a subject when involving the public society in joint interaction in the decision process. At the same time, it influences for the public society in order to intensify its activities, creates the conditions necessary for them, organizes different events, etc. As a result, the public society, which acted as an object of government activity, turns into a subject. That is, the public society begins to influence on the government, execute certain control over its decisions and actions, and demand solutions to urgent issues (Kolianko, 2021).

Local government reflects the social interactions and dependencies between the people who make it up. The key aspects here are: a connecting goal (interest), and therefore the ability to act on behalf of the community, a sense of group and spatial identity, the socio-economic space of action (Fig. 1) (Sakowicz, 2007).

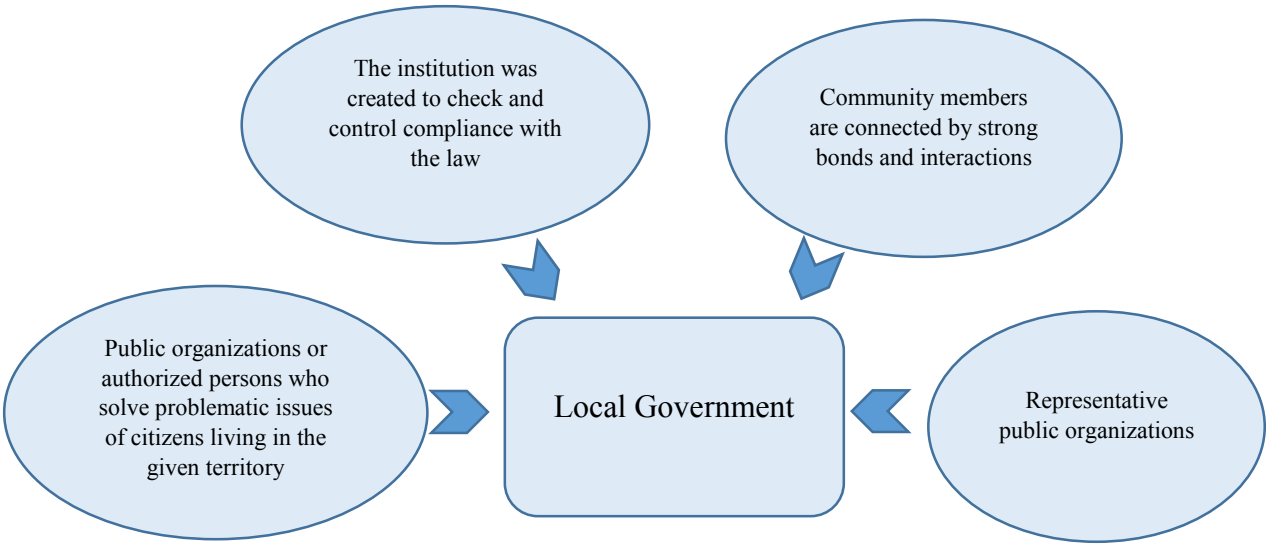


**Figure 1.** Elements of local government. Source: compiled by the authors based on work «Modernizacja samorządu terytorialnego», Sakowicz.

Institutions of public society include public, religious, charitable organizations, trade unions and their associations, creative unions, associations, employers' organizations, non-state mass media and other non-business societies and institutions legalized in accordance with the legislation of Ukraine.

The process of interaction of authorities with the public society involves informing, consultations, active participation of citizens in the development and implementation of state policy (dialogue) and partnership (Asotsiatsiia Sotsialno-Ekonomichni Stratehii ta Partnerstva, 2012). In particular, in the Law of Ukraine «About Local Government» considerable attention is paid to openness and accountability in the development of public policy and making management decisions (Zakon Ukrainy “Pro mistseve samovriaduvannia”, 2021).

Pisotskyi's (Pisotskyi, 2013) work proposed a classification of forms of communicative interaction between public administration bodies and the civil society. Author considers the classification of forms and methods of manifestation of communicative activity of the territorial community in the process of implementing local government according to the criteria of their belonging to certain types of communication. The proposed classification takes into account the methods and scales of certain communicative interaction: 1) according to the method of interaction – direct, indirect (technically or socially) and mixed communication; 2) by the scale of communication – interpersonal, group and mass communication.

The practice of relations between state authorities and local government involves, first of all, informing the public society in order to provide it with a general idea of activities, implementation of plans and problems that need to be solved. To achieve this goal, executive authorities use the following main types of communication channels:

- direct communication,
- personal contacts between citizens (associations of citizens), on the one hand, and government officials, on the other,
- intercourse using different means of communication (telephone, various forms of personal correspondence),
- indirect communication through mass media (press, television, radio, computer networks, etc.) (Hurina, 2013).

In order to achieve mutual understanding, friendly relations and cooperation between state authorities and the public society, according to L. Gurina (Hurina, 2013), should be observed the following requirements:

- to provide broad, adequate information to both the public society as a whole and its individual social groups,
- organize effective «feedback» with the public society,
- involve the public society to take part in the process of discussion and making decision.

According to S.M. Vysotskaya, can be used different types of relations between state authorities and local government bodies with mass media (Vysotska, 2012):

- issue and distribution of newsletters, reviews, photos, video materials, information collections, express information, etc.,
- conducting press conferences, briefings, televised debates, press clubs, organizing interviews with heads of state authorities and local government bodies for employees of domestic and foreign mass media,
- provision of publications (speeches) of heads of state authorities and local government in mass media,
- creation of archives of information on the activities of state authorities and local government bodies,
- placing web pages on the Internet about activities of state authorities and local government.

Currently, Ukraine needs a system of relations between the public authorities and the civil society, which would be professional, effective, designed to serve the interests of citizens (Rykun, 2013).

People consider that the main reasons that prevent public society cooperation with the state authorities and local government is disbelief that their influence on the government can be effective (34%), as well as the unwillingness of state authorities and local government to cooperate with the public, lack of information about its decision. Among the various forms of activity of public organizations, the population considers the most important those related to control over the activities of the government (42%), helping people to defend their rights (39%), helping socially vulnerable groups (37%), joint development by the government state decisions (25%), environmental protection (23%) (Hurina, 2013).

Eva Zeman-Mishevska's (Zeman-Miszewska, 2019) research shows that there is a problem of cooperation between local government and public society, as there is still little real interest in such cooperation. However, it is worth noting that local governments are gradually gaining trust among representatives of the local community, which may contribute to the growth of public participation in the future. Forms of active participation of citizens facilitate this, for example, in the management of public budgets.

Thus, one of the conditions for the stable functioning of local government is a developed civil society. Unfortunately, unlike countries with a stable democracy, in our country, it is only at the stage of formation, and the vast majority of society is indifferent to the processes of managing the territories in which they live.

## 3. The use of electronic democracy tools in communication processes of local government with the public society in Ukraine

The communicative subsystem of public administration includes subjects of interaction, information connections and management relations, processes of interaction of subjects of administration among themselves and with other public institutions. It also includes the infrastructure that ensures the creation, transmission, search and receipt of management information, that is, information that circulates in this system and is used to implement management interactions and influences (Dreshpak, 2015).

The main forms of public involvement in the process of making state decision used by modern Ukrainian government are: public hearings; open budget hearings as their component; the so-called «hotline» – answers of authorities representatives to citizens' questions by phone, etc.

In the tables number 1-4 shown statistics data of using electronic democracy tools by local government.

Thus, one of the common electronic communication tools is an E-appeal, where a citizen notes personal information and explains the essence of the raised question, remark, proposal, statement or complaint, request or demand. The analysis of statistical data (Table 1) showed an increase in the number of «E-appeals» in 2020 by 49% compared to 2019.

**Table 1.**
*Analysis of the use of electronic appeals by citizens («E-appeals») in local government for 2019-2020*

| Year | The number of registered «E-appeal», units | The number of considered «E-appeal», units | The share of considered «E-appeal» in the total number of registered «E-appeal», % |
|---|---|---|---|
| 2019 | 356634 | 349779 | 98,1 |
| 2020 | 534314 | 532842 | 99,7 |

Source: compiled by the authors based on data from the State Statistics Service (Derzhavna sluzhba statystyky, 2020).

This fact indicates positive trends in the development of communications between local authorities and the public society, as well as an increase in civil society trust to the local government. In addition, this is due to the introduction of strict quarantine regulations in connection with Covid-19. Most people began to use online services, instead of the usual meetings with representatives of the authorities.

With electronic petitions, citizens can apply to the local government body through the official website of the body to which it is addressed, or the website of the public association that collects signatures in support of the electronic petition.

The number of published «E-petitions» is significantly less compared to the number of «E-appeals» of citizens (Table 2).

**Table 2.**
*Analysis of using of public society of the electronic tool «E-petitions» in local government for 2019-2020*

| Year | The number of published «E-petitions», units | The number of supported «E-petitions», units (which received the required number of votes in their support) | The number of «E-petitions» supported by the decisions of the local government to whom the petitions are addressed, units | The share of «E-petitions» supported by the decisions of the local government to which the petitions are addressed, in the total number of supported «E-petitions» (which received the required number of votes in their support), % |
|---|---|---|---|---|
| 2019 | 9607 | 1533 | 918 | 59,9 |
| 2020 | 6344 | 875 | 458 | 52,3 |

Source: compiled by the authors based on data from the State Statistics Service (Derzhavna sluzhba statystyky, 2020).

In addition, the number of «E-petitions» for 2020 that received the required number of votes is only 13.8% of the total number submitted. This indicates insufficient readiness of citizens to formulate the essence of petitions and low public activity. At the same time, local government supported more than half of the petitions (52.3-59.9%) of those that received the required number of public votes.

From the analysis of information (Table 3), it can be noted that there is a positive trend of increasing the level of trust to the local government, because the number of "e-consultations" in 2020 compared to 2019 increased by 45.7%.

**Table 3.**
*Analysis of citizens' use of the electronic tool «E-consultation» in local self-government for 2019-2020*

| Year | The number of published «E-consultations», units | The number of published reports based on the results of «E-consultations», units | Share of reports, % |
|---|---|---|---|
| 2019 | 5736 | 1844 | 32,1 |
| 2020 | 14093 | 937 | 6,6 |

Source: compiled by the authors based on data from the State Statistics Service (Derzhavna sluzhba statystyky, 2020).

An essential factor in the making of effectively relationship between local government and the civil society is the participation of the public in the creation of local projects aimed at solving social problems in a certain territorial community. The analysis of statistical data (Table 4) shows that in 2020, local government supported more such projects than in 2019 (as a percentage equivalent to those that submitted). That is, the local government listens to the opinion of the community and promotes their interaction.

**Table 4.**
*Analysis of citizens' use of the electronic tool «Participatory budget (public budget)» in local government for 2019-2020*

| | Year | |
|---|---|---|
| | 2019 | 2020 |
| Number of projects submitted by the public «Participation budget (public budget)», unit | 13749 | 10635 |
| The number of projects submitted for voting «Participation budget (public budget)», unit | 11516 | 8615 |
| Number of supported projects (winning projects) «Participation budget (public budget)», unit | 5014 | 3267 |
| The number of projects «Participation budget (public budget)» implemented at the expense of the local budget in the reporting year, units | 3790 | 2685 |
| The share of projects «Participation budget (public budget)», implemented at the expense of the local budget in the reporting year, in the total number of supported projects (winning projects) «Participation budget (public budget)», % | 75,6 | 82,2 |

Source: compiled by the authors based on data from the State Statistics Service (Derzhavna sluzhba statystyky, 2020).

Tables number 1-4 presented summarized data on the use of e-democracy tools by local government bodies. At the same time, it is necessary to note significant differences in the degree of use of such methods in different regions of the country. For example, in fig. 1 presents in the form of a diagram a sample statistical data of the use of «E-appeals» by local government in individual regions for 2020.

It should be noted that the most active interaction of local government with the public society is observed in large regional centers, such as the city of Kyiv, Lviv, Odesa, Kharkiv and Dnipropetrovsk regions. This is due to the following factors:

- the digital literacy of the population and the degree of interest in the development of communities in cities is higher than in villages and small regions,
- internet connection.

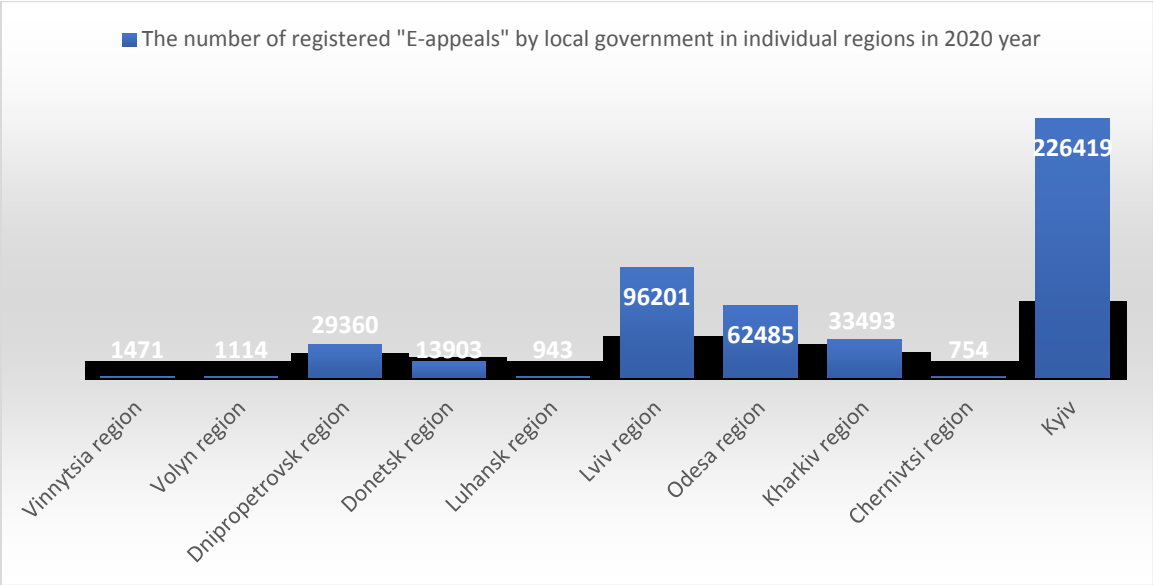


**Figure 1.** The number of registered "E-appeals" by local government in individual regions in 2020 year. Source: compiled by the authors based on data from the State Statistics Service (Derzhavna sluzhba statystyky, 2020).

The lowest indicators of cooperation of the population with local government were recorded in Chernivtsi and Luhansk regions.

## 4. Discussion

In the conditions of global challenges facing Ukraine, gaining special relevance the issue of ensuring transparency and openness of the activities of public administration bodies using the modern capabilities of the information society and the latest forms and methods of communication activities. Such requirements require the provision of effective feedback to the public society, improvement of communication processes in the system of local government.

Communicative activity in the system of local government consists in carrying out information exchanges aimed at the performance of public administration functions. An important component of the interaction of local government with the population of the community is information. Local government bodies must constantly inform citizens about their own activities through social networks, the website, and mass media. Another important component is access to public information: regulatory documents, financial statements, etc. If in regional centers and big cities there are mostly no problems with this, then small settlements often have problems both with timely information and with access to documentation.

However, it should be noted that the effectiveness of using electronic capabilities in the communicative processes of local government is not the same in different regions. It mainly happens for the following reasons:

- reluctance of authorities and their representatives to cooperate with the population,
- lack of legal obligation of government to solve all important issues together with the public society,
- concerns of the authorities that the public society through its participation will slow down the process of making decision,
- ignorance of the public, lack of specific knowledge among the majority of the population about the activities of the government body, its obligations to the community, as well as their rights and obligations.

The possibility of creating information units in local government is provided for by the Law of Ukraine «On the procedure for covering the activities of state authorities and local government». According to Article 6 of this Law, information units (services) in the system of executive bodies and councils may be created in the form of information departments, information and analytical units, press services, press centers, public relations departments and centers, press bureaus, press-secretaries and press attachés with the appropriate apparatus (Zakon Ukrainy «Pro poriadok vysvitlennia diialnosti orhaniv derzhavnoi vlady ta orhaniv mistsevoho samovriaduvannia v Ukraini zasobamy masovoi informatsii», 2005).

The main functions of public relations departments established at local government bodies are:

- relations with mass media,
- relations with the local citizens,
- relationships with information centers,
- creation and maintenance of a generalized image of a state authority or a local government body,
- organization of exhibitions, meetings and lectures,
- work on increasing the role and authority of the state administration body (Malyk, 2015).

Therefore, in order to improve the communicative activity of public administration bodies in modern conditions, it is most expedient to develop the following directions at the regional and local levels:

- ensuring the openness and transparency of the activities of local government through fuller engagement of the civil society in the discussion of a wide range of issues,
- development of electronic democracy tools to create optimal conditions for community development planning,
- improvement of information support for sustainable socio-economic development of communities (cities, towns, villages): ecology, education, social protection, etc.
- use of the modern information and communication technologies during the provision of public services to citizens and organizations in various spheres of activity,

- improving approaches to using the communicative potential of official websites of local government bodies,
- creation of interactive services to expand the participation of civil society in solving socially significant matters at the regional and local levels, including by using methods of marketing analysis of the target audience,
- introduction and development of modern tools for interaction between public administration bodies and interested groups at the local and regional levels based on the use of modern forms and means of communication, including social networks,
- expansion of participation of civil society in communicative interaction with local government due to the implementation of training programs for people in the field of information and communication technologies.

Thus, the modernization of the communicative activity of public administration bodies in modern conditions requires solving problems of an organizational, social, and technical-technological nature.

## 5. Conclusion

Based on the analysis of theoretical and methodological principles and the main aspects of the interaction of civil society with local government, summarized the directions for improving the communicative activity of public administration bodies in modern conditions at the regional and local levels.

It should be noted that after the implementation of the decentralization reform, local government bodies became more openness and transparent. There is a positive trend in the use of such communication mechanisms as electronic appeals, electronic petitions, and the participation budget. However, it is necessary to pay attention to the uneven use of the mentioned types of communications in different regions of the country, which requires solving a number of issues of an organizational, technological and social nature. Expanding the communication capabilities of civil society interaction with local government will contribute to increasing the degree of trust to public administration bodies, the socio-economic development of communities, and increasing the investment attractiveness and competitiveness of Ukraine.

## References


1. Association Agreement between the European Union and its Member States, of the one part, and Ukraine, of the other part (2015). Retrieved from https://zakon.rada.gov.ua/laws/show/984_011#Text.
2. Brytanska Rada v Ukraini, Laboratoriia zakonodavchykh initsiatyv, *Asotsiatsiia «Sotsialno-Ekonomichni Stratehii ta Partnerstva» Uchast hromadskosti u protsesi pryiniattia rishen na mistsevomu rivni* (2012). Retrieved from https://goo.su/a9fj.
3. *Derzhavna sluzhba statystyky* (2019-2020). Retrieved from https://www.ukrstat.gov.ua.
4. Dreshpak, V.M. (2015). *Komunikatsii v publichnomu upravlinni.* DRIDU NADU, 168.
5. Hurina, L. (2013). *Zviazky iz hromadskistiu v orhanakh derzhavnoi vlady*. Natsionalnyi universytet «Ostrozka akademiia».
6. Kolianko, O.V. (2021). Visnyk Lvivskoho torhovelno-ekonomichnoho universytetu. *Ekonomichni nauky. №65,* UDK 334.72:005.35 Retrieved from http://journals-lute.lviv.ua/index.php/visnyk-econom/article/view/1042/987.
7. Kravtsova, Z.S. (2019). Teoretychni, pravovi ta praktychni osnovy hromadskoho kontroliu za zdiisnenniam derzhavnoi vlady v Ukraini. *Ekspert: paradyhmy yurydychnykh nauk i derzhavnoho upravlinnia. № 3(5).* 89-104.
8. Malyk, Ya (2015). *Do pytannia pro vzaiemodiiu orhaniv derzhavnoi vlady ta orhaniv mistsevoho samovriaduvannia v Ukraini*. Efektyvnist derzhavnoho upravlinnia. № 43, 295-361.
9. Pisotskyi, V. (2013). *Komunikatyvna aktyvnist terytorialnoi hromady vprotsesi zdiisnennia mistsevoho samovriaduvannia v Ukraini.* Derzhavne upravlinnia ta mistseve samovriaduvannia, *DRIDU NADU, № 4(19*), 240-251.
10. Rykun, M. (2013) *Zviazky iz hromadskistiu v orhanakh mistsevoho samovriaduvannia v Ukraini.* Materialy VI Mizhnarodnoi naukovo-praktychnoi internet-konferentsii «Problemy ta perspektyvy rozvytku nauky na pochatku tretoho tysiacholittia Ukrainy SND», 216-217.
11. Sakowicz, M. (2007). *Modernizacja samorządu terytorialnego*. Warszawa: Oficyna Wydawnicza SGH, 43-44.
12. Selivanov, S.V., Obushna, N.I., Khadzhyradieva, S.K. (2019). *Rozvytok kadrovoho potentsialu derzhavnoi sluzhby v Ukraini v umovakh reform: problemy teorii ta praktyky*. monohrafiia. Kyiv: Karavela, 135-137.
13. Vysokyi, M.S. (2021). *Vzaiemodiia orhaniv mistsevoho samovriaduvannia z hromadskistiu v Ukraini*. Retrieved from https://jpasmd.donnu.edu.ua/issue/view/403.
14. Vysotska, S.M. (2012). Udoskonalennia dialohu orhaniv vlady i hromadskosti na rehionalnomu rivni. *Derzhavne upravlinnia: teoriia ta praktyka. № 2,* 17-21.

15. Zakon Ukrainy «Pro mistseve samovriaduvannia vid 13 lyst. 2021 r. № 1818-IX». Retrieved from https://zakon.rada.gov.ua/laws/show/280/97-%D0%B2%D1%80#Text.
16. Zakon Ukrainy «Pro poriadok vysvitlennia diialnosti orhaniv derzhavnoi vlady ta orhaniv mistsevoho samovriaduvannia v Ukraini zasobamy masovoi informatsii vid 23 veresnia 1997 r. № 539/ 97-VR (iz zminamy)». Verkhovna Rada Ukrainy. Vidomosti Verkhovnoi Rady.-K., 2005, 10.
17. Zeman-Miszewska, E. (2019). Współpraca samorządów terytorialnych z innymi podmiotami w procesie świadczenia usług publicznych. *Studia Ekonomiczne, № 378.* Uniwersytet Ekonomiczny w Katowicach.

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# MANAGING THE DISTRIBUTION PROCESS WITH AN EXAMPLE OF THE FMCG MARKET

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**Purpose:** The purpose of this article is to present the problems and challenges faced by organisation of distribution logistics with a selected example. Comparing the company to the competition and focusing on the problems and challenges faced by the studied enterprise on the market of fast-moving consumer goods.
**Design/methodology/approach**: The subject of the study is the evaluation of distribution channels of the selected enterprise through the analytical and point method.
**Findings:** The obtained results, thanks to the use of the analytical-point method and the efficiency index of distribution channels, indicate that for the surveyed enterprise, Eurocash distribution channels are not sufficiently effective. The indicator of distribution costs in sales compared to the competition is the highest. Several factors had an impact on such results.
**Research limitations/implications**: However, the issues presented in the paper regarding the problems and challenges of distribution organization cannot be considered as exhaustive, because the discussed topics constitute a multifaceted and interdisciplinary research area. The study would be more complete if the management of distribution logistics on the FMCG market were presented based on the changes caused by the Sars-Cov-19 pandemic.
**Practical implications:** The conducted research draws attention to the effectiveness of distribution channels on the FMCG market. The article may be useful for enterprises providing services in this business sector.
**Social implications:** The article shows the importance of making decisions in the area of distribution processes that significantly affect the entire supply chain, and thus customer service. The use of optimal distribution channels affects the efficiency of logistics services, contributing to an improvement in the quality of service provided to the final recipient and the competitiveness of the company on the FMCG market.
**Originality/value:** The work is addressed to entrepreneurs operating in the FMCG industry. As well as all those interested in the subject of logistics, management and distribution on the market of fast-moving consumer goods.

**Keywords:** distribution, FMCG market, logistics, distribution channels.

**Category of the paper:** Research paper.

## 1. Introduction

The basis for conducting and expanding an enterprise's operations is the sale of manufactured products or services. There is currently a lot of competition in many markets and companies are trying to gain an advantage by introducing organisational, technological or technical changes. The ability to adapt to changing market conditions allows enterprises to maintain their position on the market and achieve success. The precondition for the smooth functioning of the market is an economy based on a large number of small enterprises. The underdeveloped sector of small and medium-sized enterprises causes an economic slowdown (Dziadkiewicz, Kiss, 2011, p. 168). The Fast Moving Consumer Goods (FMCG) market is considered to be one of the most dynamic, flexible markets, while being resistant to crisis (Góra et al., 2018, pp. 1065-1066). This industry is dominated by online sales, where mainly small enterprises compete with each other as well as the development of large enterprises offering various product distribution channels (Drucker, 2018, p. 39). Although in recent years there has been a decline in small and medium-sized enterprises in this sector, this form of activity still prevails on the Polish market (Barska, 2019, pp. 7-8)

The primary function of an enterprise operating in the FMCG sector, which allows for the presence on the market and sales of goods and services and gaining a competitive advantage, is distribution (Pecolt, 2014, pp. 108-109). Determining the best distribution strategy for a given enterprise makes it possible to approach this objective. The choice of the appropriate distribution strategy by an enterprise depends on many factors. The most important of these are (Kolasińska-Morawska, 2014, pp. 10-11):

- characteristics of products, e.g. vulnerability to loss of value,
- customers' needs and expectations regarding the availability of products at points of sale, the conditions of their purchase or the possibility of using additional services,
- the competitive position, requirements and subjective structure of commercial agents,
- availability of the distribution network in a given market and the possibility of its use in the created distribution channel,
- the size and type of financial and material resources, e.g. logistics infrastructure designated to create a distribution system.

Distribution functions are also designed to balance the differences between the manufacturers' offer and the real demand reported by customers. This applies to such issues as the type of goods, time, place, quantity or product range. It is assumed that these differences are objective. This consists in the fact that the circumstances of making production decisions are different (what to produce? where to produce? when to produce? in what quantity?) and other circumstances affect the purchasing decisions made by the final recipient (Rutkowski, 2002, pp. 45-48).

The main distribution functions include (Arya, Mittendorf, 2013, pp. 99-100):

- transaction (coordination) function – the purpose of this function includes all operations related to the purchase and sales of goods, including balancing demand with supply;
- organisational (logistic) function – consists in the organisation of all processes to which the product is subjected. The most important activities are transport, storage of goods, commercial processing, transformation of the production range into a commercial range and creation of appropriate conditions of sales.

The FMCG market is dynamic and constantly evolving. The FMCG sector mainly includes everyday products, i.e. food products, including those for animals, cigarettes, beer, cosmetics, cleaning products and personal hygiene, household chemicals, or small household products. The FMCG market is not an easy field for business activities, as competition is very high here. Competitive entities fighting for the end customer adapt the entire production and logistics facilities to the needs of buyers, among others, through offers tailored to their expectations in terms of the type and quality of products, acceptable price levels, convenient location of shops, convenience of shopping or quality of service (Twardzik, 2016, p. 49). In the case of fast-moving products, the unique proposal should meet the consumer's expectations and be adapted to their social and financial profile. FMCG market players must learn about consumer habits or preferences that change. As a consequence, enterprises should immediately automatically adapt to the changing tastes of customers and respond to their needs, which is why distribution management is important in this sector (Brzozowska, Kabus, 2018, pp. 7-8).

The purpose of this article is to present the problems and challenges faced by organisation of distribution logistics with an example of a selected enterprise. Comparing the company to the competition and focusing on the problems and challenges faced by the analysed company on the market of fast-moving goods.

The thesis consists of an introduction, research methodologies, results and discussions as well as conclusions.

## 2. Materials, research methodology and research sample

### 2.1. Research background

A distribution channel is a set of organisational branches of an enterprise and external entities that participate in the process of selling the product on the market or a network of persons and companies cooperating in the process of introducing goods or services for use or consumption (Pisz et al., 2013, pp.146-147). Distribution creates two main decision-making problems. The first relates to the method of sales, selection of the best distribution channel in terms of transactions. The second is physical distribution, i.e. choosing the right way to transfer

the goods from the place of production to the final customer. Physical distribution process management is described as distribution logistics, which combines the processes of planning, organising and controlling the supply chain, and related information (Sławińska, 2008, pp. 27-28, Kabus, 2016, p. 145). Distribution channels with the right structure, type, capacity and competitiveness allow for the implementation of a specific sales volume, while the appropriate organisation of physical distribution should provide buyers with a satisfactory level of service, while minimising the total cost of distribution (Zahng et al., 2012, p. 250). In the FMCG market, there are several types of distribution channels when it comes to the distribution of consumer products (Figure 1).


**Figure 1.** Typical distribution channels for consumer products. Source: Michalski E., Marketing - Academic Manual, PWN, Warsaw 2017, p. 261.

Figure 1 shows the different types of distribution channels for consumer products. The first channel marked with the letter A is the direct distribution channel between the manufacturer and the buyer. In this case, the manufacturer communicates directly with its customers and applies a mass promotion. Direct channels of distribution of consumer products can take many forms, such as (Michalski, 2017, p. 260; Shetty, Basri, 2017, p. 20):

- sale through the manufacturer's factory shops,
- sales based on catalogues or online purchases,
- sales of banks' financial services and insurance policies,
- sales of products through personal contact (marketing acquisition),
- sales by organising promotional parties in order to present the product to potential customers, the type of sales used in the cosmetics industry or household goods.

Direct distribution is more common in the case of sales of industrial products when compared to consumer products. This is because the individual batches of industrial products sold are much larger than in the case of consumer goods. The subsequent channels presented in Figure 1 relate to intermediate channels for the distribution of consumer products. In these channels between the manufacturer and the consumer, the ownership of the products passes through one or more intermediaries. In channel B, the product initially reaches the retailer. This distribution method is common when selling products with high storage costs (cars, computers, TV sets or mechanical household appliances). In channel C there are two intermediaries: a wholesaler and a retailer. This is how products of general use, whose storage costs are low, are moved, similarly to the unit prices for the product. The product first goes to

the wholesaler and then to the retailer, and then the product goes to the final customer. Channel C is used, for instance, for the sales of candies and chocolate products. In addition to the wholesaler and retailer, Channel D also includes agents or brokers. Their task is to investigate the market and lead to direct contact between the manufacturer and the wholesaler, sometimes also the retailer. On behalf of the manufacturer, agents or brokers may negotiate terms of sales or carry out marketing functions, but as the only ones in the distribution channel they do not acquire ownership of the product. In many cases, it is unprofitable for manufacturers to carry out their own distribution activities. When looking for savings, entrepreneurs choose an intermediate distribution channel for their goods. Intermediaries are a source of savings. Thanks to their specialisation they reduce the differences in time, place and possession between the production of goods and the final customer.

The distribution channels are also distinguished by the nature of the links between the channel members. There is a conventional channel and a vertically integrated channel.

In the conventional distribution channel, each participant individually strives to maximise its profits by using aggressive negotiations, and the next link is the last buyer for the previous one (Gołembska, 2010, p. 202). It is also characteristic for the conventional channel that contacts are rare, they take place due to the need to conduct a specific purchase-sale transaction (Góra et al., 2018, p. 1065). In turn, the vertically integrated channel includes manufacturers, wholesalers and retailers. They create a distribution channel in which one of the entities is the owner. This type of distribution channel prevails on the FMCG markets. In vertically integrated channels, corporate, contractual and administered channels are listed (Gołembska, 2010, p. 203):

- corporate – they consist in the coordination of the activities of all channel participants by one enterprise, having ownership of the other channel participants,
- contractual – channels where participants are independent at different levels of production and distribution but have to comply with the commitments contained in contracts,
- administered – a characteristic feature of this type of channel is the economic dominance of one of the channel participants over the others, which is coordinated by the remaining entities.

### 2.2. Selected example of an enterprise operating in the FMCG industry for analysis

Eurocash S.A is a joint-stock company consisting of many business units and brands of shops such as Delikatesy Centrum, abc, Mila, Groszek or Lewiatan. The company's goal for the last 25 years has consistently been to provide independent companies with effective tools for business development and to guarantee innovative cooperation offers. The possibility of cooperation with the Eurocash Group enables small shops to compete with the largest supermarkets or discount shops. Over the years, the company has achieved the leading position in the wholesale market in the FMCG industry (https://grupaeurocash.pl/).

According to a report published by the Eurocash Group, on 31 December 2020, the company owned 180 Cash & Carry wholesalers that organised wholesale trade for the abc partner shop chain, which included 9137 local grocery shops. In addition, the distribution of 5251 shops in franchise and partner chains cooperated with Eurocash. In the retail chain, there were 1573 small supermarkets, including 1545 shops operating under the name of Delikatesy Centrum and 432 Inmedio press shops (Consolidated Annual Report, p. 10).

Eurocash Group's financial results for 2020 for the sale of products, goods and materials generated revenues equal to PLN 25,411.04 million. Compared to 2019, this is an increase of 2.25%. Retail sales increased by 3.15% while wholesales by 0.97% compared to the previous year, generating revenues of PLN 6,091.10 million and wholesale of products amounted to PLN 18,892.65 million and constituted the largest part of the company's revenues. Sales of products carried out by the projects segment in 2020 amounted to PLN 300.38 million compared to PLN 104.56 million last year (Consolidated Annual Report, p. 10). Such a large increase over one year is mainly related to the inclusion in the consolidation of Frisco S.A., the full takeover of which was carried out in 2020 (Figure 2).

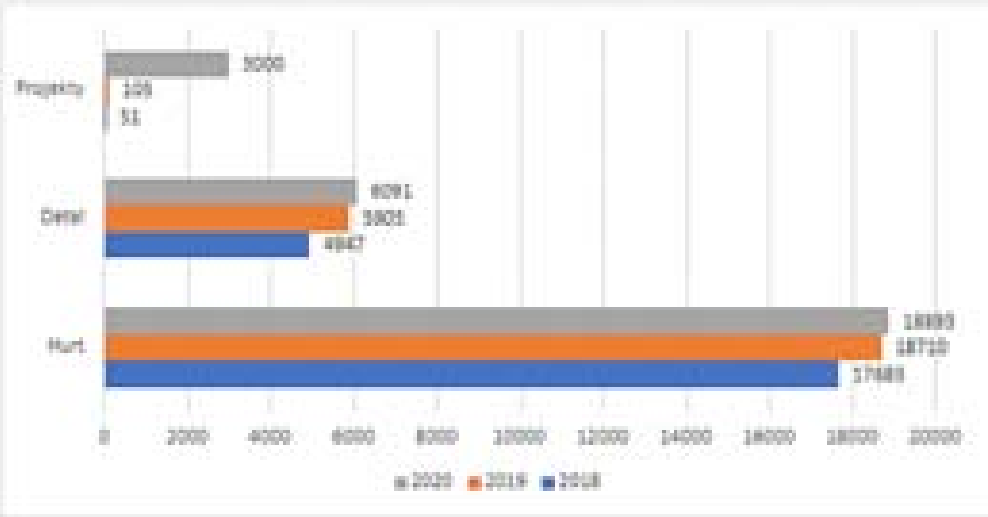


**Figure 2.** Revenues from the sales of goods in 2018-2020 broken down into individual segments (PLN million). Source: own study based on: Eurocash Group, Consolidated annual report for 2020, Komorniki 2021, p. 10.

### 2.3. Statistical method

The subject of the study for the purposes of this paper is to present the distribution logistics organisation based on the selected Eurocash enterprises operating in the FMCG industry, owning many brands of grocery shops. In this case, distribution logistics is seen as a study of the most profitable distribution channels and the organisation of strategy and cooperation with manufacturers, wholesalers and retailers in order to obtain the lowest possible costs that affect the price of the product.

The purpose of the paper is to present the organisation of distribution in Eurocash S.A. as well as comparison of the company to the competition and focusing on the problems and challenges faced by the analysed company. The author of the work adopted the following research hypothesis:

*H01: The challenge of modern distribution organisation is to develop optimum distribution channels.*

The objective of the work and the research hypothesis impacted the structure of the article. This work consists of a theoretical and empirical part. It was based on a review of Polish and foreign language publications relating to the discussed topic and the adopted research method (analytical and point method). The subject of the study is the evaluation of Eurocash distribution channels through the analytical and point method with the example of enterprise Y, which uses Eurocash distribution channels as well as competitive shop chains. Conducting this study will ultimately assess and compare the effectiveness of Eurocash distribution channels to competitive retail chains. The analytical-point method is a method mainly used by enterprises with a wide and diverse range of products. It is recognised as the most accurate method, due to the use of many criteria. Its use requires the following (Dohn et al., 2012, pp. 101-102):

- defining any number of criteria and prioritising them,
- determination of a point scale of assessment of the degree of implementation of individual criteria in the assessed channels,
- reviewing channels according to the points obtained,
- selecting the channel with the highest number of points.

When choosing the criteria for the analytical and point method, one can take into account the following (Pisz et al., 2013, pp. 168-169):

- economic criteria (channel capacity, commercial costs, investment related to the construction of the channel, profitability and others),
- organisational criteria (size of stock, speed of payment flows, product compatibility of participants, image of intermediaries),
- information criteria (scope of information provided, possibility of promotion),
- scope of control over the flow of products, prices, level of services,
- the ability to adapt to changes taking place in markets, etc.

The methods presented above allow the enterprise to choose the most effective distribution systems that will maintain a balance between channel capacity and costs that must be incurred for optimum distribution service.

In the analysis undertaken, the level of fulfilment of the selected criteria was assessed according to the scale, with points awarded from 1 to 6. The data contained in the evaluation sheet was based on an interview with the employees of the analysed enterprise Y, which allowed for the assessment of the criteria as well as the assignment of appropriate weights (Table 1).

**Table 1.**
*Criterion sheet with characteristics and assigned weight*

| Number | Criterion | Weight |
|---|---|---|
| 1. | The capacity of the distribution channel is determined on the basis of the annual sales value | 10 |
| 2. | Distribution costs defined as the percentage share of distribution costs in the annual sales value. The highest point value was awarded to channels whose share did not exceed 5%. However, the lowest value was awarded in cases where the share exceeded 20% | 8. |
| 3. | The size if unit profit determined on the basis of the quotient of the annual sales value and the quantity of products sold (tonnes) per year | 8. |
| 4. | Scope of price control determined on the basis of the prices of the products of the examined company in individual chains of shops | 5 |
| 5. | Promotion effectiveness. If it is effective, it will make it possible to extend the range sold to the recipient. The advantage of sales in this case is conditioned by an effective promotion | 5 |

Source: Own study.

## 3. Results and discussion

Conducting the following study made it possible to indicate the optimum channel from among the examined shop chains. The first one, Auchan, has two central warehouses (in Wolbórz and Mszczonów) where products from manufacturers are sent and then they are transported to the entire country, to individual Auchan shops. The second one, Eurocash has 12 central warehouses where it receives goods from the manufacturers cooperating with them. Biedronka, on the other hand, has 16 central warehouses, from which it delivers products to its shops. The last chain of shops, namely Makro has 30 outlets in the country, where goods go directly from manufacturers (Figure 3).

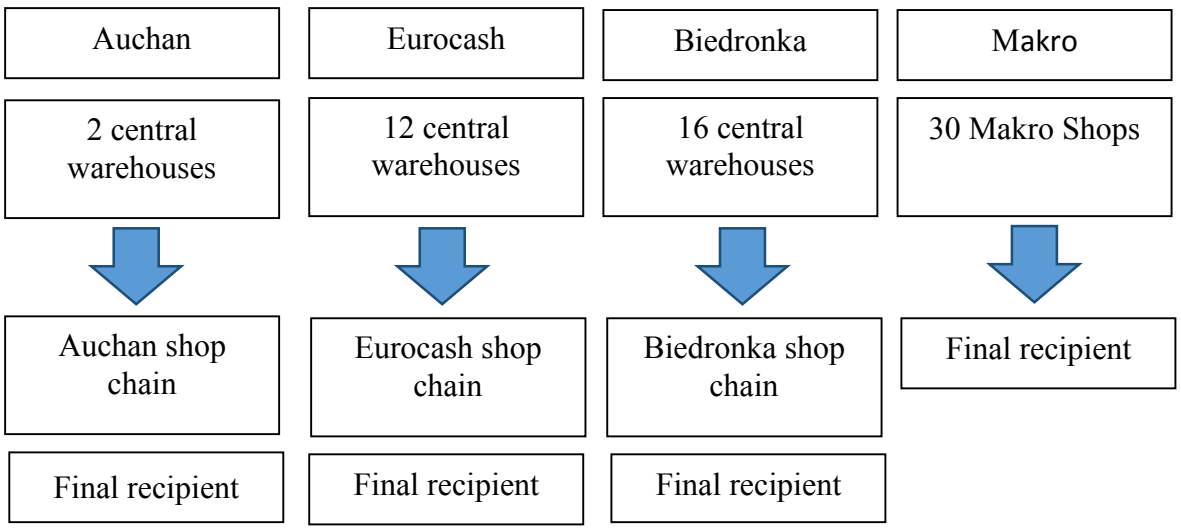


**Figure 3.** Diagram of distribution channels with selected examples. Source: Own elaboration based on the data regarding individual companies.

Each of the presented channels is a vertically integrated channel, including wholesalers and retailers. The presented channels are also contractual, in which the entities are independent, but comply with the obligations contained in respective contracts. Only the Makro chain channel is an intermediate, short channel and there is one intermediary. The enterprise is directly linked to the final recipient.

In other cases, we are dealing with a long indirect channel, where the number of intermediaries is higher. This information made it possible to conduct further diagnosis of the effectiveness of the channels of individual shop chains.

To conduct the study, the data of enterprise Y, which supplies its food products to the indicated chain of shops, were used. The analysed company did not agree to the publication of the company name and the figures regarding the goods sold as well as the achieved revenues or distribution costs. However, the company stressed that the cost of distribution includes the cost of transport, the cost of packaging, the costs related to warehouse stock, including the cost of maintaining warehouses (Table 2).

**Table 2.**
*Evaluation of distribution channels using the analytical and point method*

| **Criteria** | **Weights assigned to appropriate criteria** | **Channel Auchan** | | **Channel Eurocash** | | **Channel Biedronka** | | **Channel Makro** | |
|---|---|---|---|---|---|---|---|---|---|
| | | Criterion fulfilment level (1-6) | Score in points | Criterion fulfilment level (1-6) | Score in points | Criterion fulfilment level (1-6) | Score in points | Criterion fulfilment level (1-6) | Score in points |
| 1 | 10 | 5 | 50 | 5 | 50 | 4 | 40 | 6 | 60 |
| 2 | 8 | 4 | 32 | 4 | 32 | 3 | 24 | 5 | 40 |
| 3 | 5 | 5 | 25 | 4 | 20 | 4 | 20 | 5 | 25 |
| 4 | 8 | 5 | 40 | 4 | 32 | 5 | 40 | 5 | 40 |
| 5 | 5 | 5 | 25 | 5 | 25 | 4 | 20 | 5 | 25 |
| **Total** | | | **172** | | **159** | | **144** | | **190** |

Source: Own study.

Information about the enterprise's activity regards 2020. The results of the analytical and point evaluation of distribution channels in descending order are presented below (Table 3).

**Table 3.**
*Results of analytical and point evaluation of distribution channels – descending order*

| **Distribution channel** | **Points** |
|---|---|
| Makro | 190 |
| Auchan | 172 |
| Biedronka | 159 |
| Eurocash | 144 |

Source: Own study.

Furthermore, the effectiveness of the distribution channels was assessed by determining the indicator of the distribution costs shares in sales for each of them, where this indicator is equal to the indicator of the value of the annual distribution costs of a given channel as well as the value of the annual sales of a given channel (Table 4).

**Table 4.**
*Classification of the sales distribution cost indicator*

| Distribution channel | Points |
|---|---|
| Makro | 0,056 |
| Auchan | 0,069 |
| Biedronka | 0,093 |
| Eurocash | 0,097 |

Source: Own study.

Based on the analytical and point method as well as the efficiency indicator of distribution channels, the obtained results indicate that for the surveyed enterprise Y, the chain of Makro stores is the best distributor. High sales with low distribution costs impacted such results. The distribution channel of Auchan was slightly worse. Eurocash discussed in more detail in this work has achieved noticeably fewer points. Several factors had an impact on such results. The first factor is the high costs of distribution itself, the highest of the analysed shop chains (distribution cost indicator in sales 0.097), which is impacted by the number of shops included in the Eurocash Group as well as their distribution in the country. Shops are located not only in large cities, but also in smaller towns and even villages, where transport organisation requires more organisation and involvement of more people and equipment. This affects higher prices of the enterprise's products and lower effectiveness of promotion in the Eurocash chain. The Biedronka distribution channel is similar to the Eurocash distribution channel and faces similar issues in the distribution of products belonging to enterprise Y.

It is considered that the assumed objective of this thesis has been achieved. The distribution organisation at Eurocash S.A. was presented and compared to the competition on the FMCG market. The problems and challenges faced by the analysed enterprise were also outlined. The research hypothesis: *The challenge of modern distribution organisation is to develop optimum distribution channels* has been proven. Proper management of distribution logistics determines the level of customer service and the proper functioning of the entire company. Therefore, companies use various measures and indicators that allow for efficient control and assessment of the efficiency of the distribution logistics system or individual distribution channels. However, the issues presented in the paper regarding the problems and challenges of distribution organisation cannot be considered as exhaustive, because the discussed topics constitute a multifaceted and interdisciplinary research area. The study would be more complete if the management of distribution logistics on the FMCG market were presented based on the changes caused by the Sars-Cov-19 pandemic.

## 4. Conclusions

The results obtained, thanks to the use of the analytical and point method as well as the efficiency indicator of distribution channels, evidence that for the surveyed enterprise, Eurocash distribution channels are not sufficiently effective. The indicator of distribution costs in sales compared to the competition is the highest. Several factors had an impact on such results. Shops are located throughout the country, not only in large cities, but also in smaller towns and even villages, where transport requires a higher level of organisation and involvement of more people and equipment. This results in higher product prices and less effective promotion in the Eurocash chain.

## References

1. Arya, A., Mittendorf, B. (2013). The Changing Face of Distribution Channels: Partial Forward Integration and Strategic Investments. *Production and Operations Management*, *No. 22*, pp. 99-107.
2. Barska, A. (2019). *Consumers of the Millennial generation on the market of innovative food products in the border areas of Poland, Germany, the Czech Republic and Slovakia.* Zielona Góra: Publishing House of the University of Zielona Góra.
3. Brzozowska, A., Kabus, J. (2018). Determinants of Enterprises' Innovativeness in the Light of Empirical Studies – Case Studies of Austria and Poland. *Scientific Journals of the Silesian University of Technology. Organisation and Management, z. 116*, pp. 7-22.
4. Dohn, K., Matusek, M., Odlanicka-Poczobutt, M. (2014) Evaluation of the effectiveness of distribution channels in a selected manufacturing enterprise – part I. *Logistics 4/2012.*
5. Drucker, P. (2018). Customer in control of the supply chain. *Logistic Manager, No. 2(2)*.
6. Dziadkiewicz, M., Całus, T. (2011). Administrative barriers to development of small and medium enterprises in Poland. *Polish Journal of Management Studies, Vol. 3,* pp.167-177.
7. Gołembska, E. (ed.) (2010). *Compendium of knowledge about logistics.* Warsaw: PWN.
8. Góra, G., Matuszak, Z., Żabińska, I. (2018). Characteristic of selected issues of goods distribution. *Buses, 12.*
9. Kabus, D. (2016). Genetically Modified Food Safety in Supply Chain. *Academic Books of the Częstochowa University of Technology*, *vol. 21*, pp. 143-149.
10. Michalski, E. (2017), *Marketing – Academic Manual.* Warsaw: PWN.
11. Miłaszewicz, B., Wengel, M. (2015). Indicative assessment of the functioning of distribution logistics. *Logistics, 6*.

12. Pecold, E. (2014). *Distribution – Place in the marketing and logistics activities of an enterprise.* University of Economics, Faculty of Management, Department of Market Policy and Marketing Management.
13. Pisz, I., Sęk, T., Zielecki, W.(2013). *Logistics in an enterprise.* Warsaw: PWE.
14. Rutkowski, K. (ed.). (2002). *Distribution logistics.* Warsaw: Difin.
15. Shetty, A., Basri, S. (2017). Sales behavioural intentions of distribution channels in the insurance industry: A systematic review. *Indian Journal of Marketing*, *Vol. 47(12),* pp.19-35. https://doi.org/10.17010/ijom/2017/v47/i12/119899.
16. Sławińska, M. (ed.) (2008). *Compendium of knowledge about trade.* Warsaw: PWN.
17. Twardzik, W. (2016). Development of modern trade in small cities and rural areas in the outer zone of a metropolis. *Economic Studies Scientific Books of the Katowice University of Economy*, *No. 279*.
18. Zhang, Y., Wang, Y., Wu, L. (2012),.Research on Demand-driven Leagile Supply Chain Operation Model: A Simulation Based on Any Logic in System Engineering, The 2nd Research on Demand-Driven Leagile Supply Chain Operation International Conference on Complexity Science & Information Engineering. *Systems Engineering Procedia, No. 3*, pp. 249-258.

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# ASSESSMENT OF INVESTMENT OPPORTUNITIES FOR DISTRIBUTION CENTER LOCATION IN POLAND

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**Purpose:** Main reason to write the paper is to show one of possible models in market research for choosing the macro area for location of distribution center. There is lack of such researches in the research studies so it's worth to show different perspectives that are also used in real logistics business.
**Design/methodology/approach**: The approach to the topic is to present and introduce the theoretical value of the topic with an analysis of the literature to then conduct empirical research. Main methods used for research were Mixed Methods between Observation, Secondary Data Analysis and Experiments. The goals of the article have been achieved through the scientific study conducted.
**Findings:** The main results developed in the article are concerned with measuring the attractiveness of Poland's regions for investment in creating a goods distribution center for a logistics operator. The analysis model can be used secondarily to analyze other, arbitrarily selected regions.
**Research limitations/implications**: The research conducted in the course of preparing the publication addresses several key factors, selected by the author. Further research may consider other aspects, factors or may be expanded to include additional factors to deepen the analysis. The research may also be part of the contribution or research part to the creation of a universal model for distribution center location choices.
**Practical implications:** (if applicable) What outcomes and implications for practice, applications and consequences are identified? How will the research impact upon the business or enterprise? What changes to practice should be made as a result of this research? What is the commercial or economic impact? Not all papers will have practical implications.
**Social implications:** The research is 100% focused on practical use and application. For logistics operators looking to expand their business, especially in Poland, it provides a starting point for analysis and strategic decision-making within the location of their base of distribution facilities. A limitation is the access to data on demographics and especially considering the level of earnings of operational employees, which is difficult to estimate for a general model due to the lack of specific business assumptions about the scale of operations.
**Originality/value:** The novelty of the article and the study is the attempt to approach universalization in terms of identifying factors and aspects that are relevant and can be applied to the selection of locations for freely chosen and compared regions, not only the level of provinces as in the case of the study developed in the article.

**Keywords:** Assessment of investment in logistics, distribution centers, distribution center location analysis, investments in logistics, location for distribution center.

**Category of the paper:** market research.

## 1. Introduction

It is impossible to disagree with the statement that logistic centers and distribution centers are an important elements of the economy of each country. On the one hand, they are quite a key factor for economic development, which has an impact on the systematization of the flow of goods, influencing the increase in the efficiency of logistics channels. On the other hand, logistics centers affect the development of cities and even the region in which they are built and for which they perform various service functions (Kaźmierski, 2012).

The literature on the subject indicates many definitions that describe, characterize what logistic centers or logistics distribution centers are, but does not pay too much attention to the definition of a distribution center. Due to some volume limitations for this material, there is no reason to deal with all terms related to the distribution center, but it would make sense to focus on the most important elements of them.

Regardless of the above, however, it should be clearly indicated that there are several concepts related to distribution that refer to infrastructure facilities and are a kind of buffers for transported goods. These terms are: logistics distribution center, logistics center, warehouse center, warehouse facility, logistics service center and distribution center (Grabiński, 2015). As mentioned earlier, for this material there is no particular justification for detailed attention to each of them, therefore the attention will be focused only on the concept of "distribution center".

## 2. The place of the distribution centers in logistics processes

Distribution centers are centers of concentration and coordination of logistic services. Their goal is to ensure an integrated, time-saving and cost-effective organization of the physical flow of products, from manufacturers to users. Their basic tasks come down to:

- planning,
- effective implementation of transport between contractors,
- ensuring the proper technique and technology of reloading,
- ensuring proper storage of stored goods, forming load units,
- ensuring communication, as well as an appropriate flow of information,
- offering consulting services within the above-mentioned areas (Czubata, 2001).

On the other hand, according to newer trends, distribution centers are described as an independent economic entity in which products and components are collected and stored, or one or several producers, for further redistribution to: wholesalers, dealership warehouses, importers, partner companies or other subordinate entities (Markusik, 2010).

Anglo-Saxon literature reduces the concept of a distribution center to a facility, often smaller than a company's central warehouse, which is used for the temporary assembly and distribution of goods, hence the term distribution warehouse. It can also be assumed that the distribution center is a spatial object with an organization and infrastructure appropriate for this type of facility, located in such a way as to enable the economic entity to store, handle goods, and to coordinate transport, in order to meet the needs of recipients, in the shortest and lowest time. cost – as far as possible (Grabiński, 2015).

Although the subject of this material is not logistics centers, but distribution centers, it is worth being aware that the conditions for creating a distribution center can be related to the same factors based on the theory of location that apply to a logistics center, especially in the context of investment and economic aspects.

Thus, the precursor of the location theory was J.H. Thunen, who developed the most economically viable layout of agricultural zones around the city, which was to be an outlet for agricultural products. As part of the developed strategy, he created a graphic model that showed the distribution of various types of agriculture around the market, which was located centrally (Dziekoński, 2014). Thunen, however, used concepts related to agriculture and only Alfred Weber was a pioneer when it comes to the theory of industrial location. According to the definition presented by him: „location factors should be understood as strictly defined benefits occurring when an economic activity is located in a given locality. This advantage is savings on production costs. Achieving it is connected with the fact that the activity is located in a given locality is carried out at a lower cost than if it took place in other places" (Grabiński, 2015).

Interestingly, Weber distinguished only three location factors, namely: transport costs (considering them the most important at the same time), labor costs and agglomeration benefits, which result from the concentration of producers and consumers in a certain area. Weber's theory referred to the turn of the nineteenth and twentieth centuries, with time the evolution of the economy and technology modified, and thus developed the concepts of location factors and their number. Currently, the location factors should be defined as economically specific features that affect the amount of capital expenditure and production costs of localized objects, therefore the costs that change as a result of changing the location. It follows, therefore, that location factors are the most important issue for an enterprise, because it is they who determine the scale of the investment outlays and costs incurred (Budner, 2007).

The group of theories, the purpose of which is to determine the best location, taking into account only such factors as: prices of raw materials, energy, transport costs, labor factor, etc. are called classical theories. They are based on the belief that production costs and profits depend on the geographic location, then the choice of location is associated with the desire to maximize profit (Grabiński, 2015).

Currently, the literature on the subject defines location factors as: "specific features of individual places, having a direct impact on the investment outlays in the plant construction phase and the net profitability of economic activities carried out in these places". When it comes to the real benefits of location, it is mentioned:

- investment outlays related to the purchase of land and utilities,
- investment outlays related to the constructed facility,
- facility operating costs,
- revenues generated by a given unit,
- gains and losses that affect net profitability that arise from running the business.

Due to the fact that the cited definition is definitely universal, it becomes possible to use it and refer to it universally (Grabiński 2015).

Although the location factors are divided into several groups and subgroups (e.g. environmental factors, economic and technical factors, socio-political factors, environmental factors, spatial factors, legal and administrative factors, etc.), economic. These factors result from the socio-economic situation of a given area. They consist of such elements as: inflation, unemployment rate, GDP per capita, but also the size and absorption of the sales market or the size and structure of capital (Grabiński, 2015). As I. Kędra and J. Borowiak argue, the main factors of choosing a location within economic factors remain:

- value of the logistics market,
- attractiveness of the investment project for investors,
- land prices and availability,
- availability of transport and communication infrastructure,
- availability of labor and the level of education of employees,
- purchasing power of the population.

It is worth emphasizing that factors such as environmental damage caused by road transport, unused transport potential of rail transport or road overload, road congestion, etc. are not of particular importance for the investor, as long as there is no state intervention resulting from legal or financial regulations that significantly cost relationships that occur between the various modes of transport (Jędra, Borowiak. 2010).

## 3. Methods and ways of selecting the location of logistics facilities

All the theories of location that have appeared over the years in the literature on the subject, however, do not serve to describe hypothetical situations, but constitute the basis for the development of mathematical models of the location of objects that can be used by managers when making decisions about the location of new objects or changing the location of these objects. objects that already exist. The basis for the decision is the location of the company's facilities, which optimizes the performance of the value chain (Dziekoński, 2014).

In line with the way models are presented in the literature on the subject, they are usually classified into four main categories:

- analytical models that use a significant number of simplifying assumptions. In this type of models, an even demand in the analysed, selected area is assumed, as well as fixed costs of locating objects (regardless of their location) and a constant unit cost of transporting products. It should be noted that the total cost function takes a closed form, which is most often a function related to the number of objects placed. Analytical models provide information on the relationship between the optimal total cost and the number of objects on the one hand and key input parameters on the other. The assumptions that are made in the analytical models limit their value in the practical making of location decisions;
- space continuity models, which assume that the objects to be located may be located anywhere in the analysed space, while the demand is in specific places. In this case, the problem is to determine the location of the facility in such a way as to minimize demand-weighted transport distances;
- network models which assume that in order to determine the location of an object, a network consisting of nodes and connections between them should be built. In this case, the demand is most often generated in the network nodes. At the same time, the network is used to create an algorithm that is dedicated to a specific location problem;
- discrete models that assume that it is possible to define a specific set of places that make up the demand, as well as a set of potential locations. In this case, the problem of object localization is described with the use of linear programming tools.

By the way, it should also be noted that the methods that enable the proper selection of the location of the new facility include, among others: non-hierarchical cluster analysis methods, the Huff model, the radius of the catchment area, network methods or Reilly's trade gravity models (Dziekoński, 2014).

The literature on the subject more and more often points to the fact that when determining a location, quantitative rather than qualitative factors are taken into account. Of course, this has to do with the development of mathematical methods, including optimization, as well as the wider use of IT applications such as DSS or BI (Grabiński 2015).

Undoubtedly, Grabow, Henckel and Hollbach-Grömig presented one of the fullest divisions of location factors, including the division into hard and soft. For this material, the so-called hard factors. They belong to the group of measurable, economic factors defined as objective. They are called objective because they have an indisputable nature, therefore, the use of such input data for statistical analysis or optimization models allows for obtaining an unambiguous result (Grabiński, 2015).

Undoubtedly, the issue of localization in the classical approach, mentioned above, is much more often undertaken due to the essence and possibility of obtaining a mathematical result. At the same time, it is most desirable to use a precise cost analysis related to the planned distribution as well as a financial analysis related to the planned investment. Only a thorough analysis can generate additional savings as well as ensure the efficiency and flexibility of the logistics system. This, in turn, has an impact on the implementation of benefits for customers at the right time, place and in the right quantity and quality, at an acceptable cost (Grabiński, 2015).

Location factors can be divided into three groups: industry location factors, service location factors, and logistics network node location factors. It should be noted that there are several important factors that affect the choice of the best location for the distribution center. The center of gravity method is used for this (Grabiński, 2015). This method (widely described in specialized literature) uses the geographical location of individual sending and receiving points within geographic coordinates as well as the volume of supply and demand at points in the network. In this specific case, optimization consists in selecting a location point for the facility that will guarantee the minimization of the costs of transporting the delivery of raw materials, semi-finished products or goods to the facility, and on the other hand, the export of finished products from the facility. It is true that the choice of location should not be a single-criteria decision, but if the investment conditions in a given geographical area are similar, the choice of location may determine the distance of the created storage location from the sources of supply and to future recipients. Therefore, it can be concluded that the main problem of choosing a location will be to determine such dislocation of the object so that the total transport costs are the lowest, while taking into account the rectangular and Euclidean metrics (Kuczyńska, Ziółkowski, 2012).

The balanced center of gravity method is simple to apply and it really comes down to determining two parameters, assuming that you have the appropriate data concerning the geographical location of suppliers and recipients, the amount of the unit cost of transport as well as the estimated quantities of raw materials and finished products transported (Kuczyńska, Ziółkowski, 2012).

As D. Grewal and V. Thai argue, it has the greatest influence on the decision on the location of the distribution center:

- distance from the audience,
- availability and education of the workforce,
- availability of communal services,
- local taxes, especially on inventories,
- road transport infrastructure,
- opportunities for further expansion,
- customs and tax administration and applicable law in this area,
- standard of living in the region

and

- equipping with appropriate operating devices,
- percentage of lost or damaged parcels,
- convenience and reliability of downloads and deliveries,
- frequency of calls or adequately landings at the port,
- efficient operation of the seaport/airport,
- strategic location,
- competitive fees and taxes,
- speed and adequacy of the response to the needs and requirements of customers.

Of course, you should be aware that the set of criteria presented above is only one of the existing examples in the literature for a comprehensive, holistic approach to the issue of choosing the most convenient location for a distribution center (Grabiński, 2015).

## 4. Analysis of the selection of the location of the distribution center in Poland

In order to build a holistic view on the topic of siting decisions for distribution centers, you should also look at the practical side. The analysis in this respect also shows that the people responsible for implementing projects related to the location of the distribution center make decisions taking into account a certain pattern of factors. Especially when it is not possible to implement the aforementioned "gravity center" analysis – e.g. due to the lack of unambiguous data on flows – creating a new distribution center for the emerging market.

The author's aim was to define investment opportunities as part of the construction of a distribution center by an external logistics operator. The main objective of the study was to verify which or which regions of Poland can be considered the most favorable to investments in the construction of the distribution center mentioned. The idea behind the distribution center was to create a multi-user warehouse with an area of 10,000 to 20,000 square meters. The term "multi-user" is understood as an object created, managed and operated by an external logistics operator. As part of the activity in a given facility, logistic operations and distribution may take place for several (up to 10) different customers. There is no significance as to the industries or the specifics of the goods served. The average operating area occupied by each client varies from 1,000 to 4,000 square meters of the distribution center facility. Such a distribution center is often set up by a logistics operator on a speculative basis. The first stage is operational launch, and only then is the search for principals for logistics services. Thus, the choice of location is one of the key elements in the process of creating this type of business.

As part of the research, 16 Polish voivodeships were identified as macroregions, potential places of investment implementation. The research was based on the data available from the Central Statistical Office. Each of the voivodships was analyzed in terms of the following factors:

- Gross Domestic Product.
- Gross value added by type of activity and region.

The next stage of the analysis was to identify the most important industries in terms of the attractiveness of the customer sector for the logistics operator. For this purpose, historical data obtained directly from logistics operators in the most frequently served industries was used. Based on the analysis of the survey responses, the two most frequently emerging industries were identified:

- Manufacturing – section C according to Polish Classification of Activities.
- Wholesale and retail trade – section G according to Polish Classification of Activities.

Then, the gross value added by specific two activities for 2017-2019 for each region was summed up.

The next step was to determine the cumulative annual growth rate for individual regions - voivodships and selected industries. This element of research made it possible to define the first preliminary ranking of voivodships in terms of growth dynamics.

Next, the share of the Gross Domestic Product indicator for 2019 was calculated as the last available for a given voivodeship in the value of this indicator for the entire country.

**Table 1.**
*Voivodship attractiveness index in terms of added value of selected industries and Gross Domestic Product*

| | 2017 [mln PLN] | 2018 [mln PLN] | 2019 [mln PLN] | CAGR | CAGR - RANK | Weight in 2019 on PL GDP | Weight in 2019 on PL GDP - RANK |
|---|---|---|---|---|---|---|---|
| Poland [total] | 676969 | 718703 | 771847 | - | - | - | - |
| Dolnośląskie | 59999 | 62097 | 66680 | 5,42% | 14 | 8,64% | 4 |
| Kujawsko-pomorskie | 34032 | 36860 | 38744 | 6,70% | 7 | 5,02% | 8 |
| Lubelskie | 23450 | 24254 | 26204 | 5,71% | 12 | 3,39% | 10 |
| Lubuskie | 16526 | 17667 | 18673 | 6,30% | 9 | 2,42% | 13 |
| Łódzkie | 42651 | 45319 | 49062 | 7,25% | 5 | 6,36% | 6 |
| Małopolskie | 51994 | 55359 | 58756 | 6,30% | 9 | 7,61% | 5 |
| Mazowieckie | 124284 | 133797 | 146011 | 8,39% | 1 | 18,92% | 1 |
| Opolskie | 15121 | 16203 | 17173 | 6,57% | 8 | 2,22% | 15 |
| Podkarpackie | 30493 | 32853 | 35497 | 7,89% | 2 | 4,60% | 9 |
| Podlaskie | 14667 | 15607 | 16960 | 7,53% | 3 | 2,20% | 16 |
| Pomorskie | 40106 | 42635 | 45785 | 6,85% | 6 | 5,93% | 7 |
| Śląskie | 88840 | 94158 | 98997 | 5,56% | 13 | 12,83% | 2 |
| Świętokrzyskie | 16032 | 17242 | 18064 | 6,15% | 10 | 2,34% | 14 |
| Warmińsko-mazurskie | 17963 | 18559 | 19841 | 5,10% | 15 | 2,57% | 12 |
| Wielkopolskie | 77744 | 82013 | 89534 | 7,32% | 4 | 11,60% | 3 |
| Zachodniopomorskie | 23067 | 24080 | 25866 | 5,89% | 11 | 3,35% | 11 |

Source: Own study based on data from the Central Statistical Office.

Based on the analyzed data (Table 1), 6 voivodeships were selected for further analysis, which, taking into account both factors, taking into account the weight of over 50% for the GDP factor, are potentially the best investment option: Mazowieckie, Śląskie, Wielkopolskie, Małopolskie, Dolnośląskie and Łódzkie.

For the selected six voivodships, three main currents of soft factors were identified as the next step of the analysis along with their detailed specification and giving importance to each of the detailed levels (Table 2). All factors were defined on the basis of direct information obtained through interviews with logistics operators. Among them are defined:

- Target market – number of potential customers in industries (less important), type of target market (significant), competition in the form of similar distribution centers (rather important) and the availability of local workforce (very important),
- Details about potential customers – type of customer, type of desired logistics service, customer size, type of means of transport used for supply and target distribution (all as less important),

Infrastructure in the vicinity of the Distribution Center - availability of warehouse space (less important), quality of transport infrastructure in the immediate vicinity (less important), the possibility of developing the current location in the future (most important).

**Table 2.**
*Soft factors for the analysis in terms of the attractiveness of selected voivodships*

| Macroarea | Guideline | Subject | Weight |
|---|---|---|---|
| Market | Target markets | Spare parts | Less important |
| | | Machinery | |
| | | Steel | |
| | | Components | |
| | | Finished products | |
| | | Automotive | |
| | | Electronics | |
| | | Dry food and beverages (DF&B) | |
| | | Fast moving consumer goods (FMCG) | |
| | Type of final market | E-commerce (E.g., Amazon) | Important |
| | | Wholesale | |
| | | Industry | |
| | Composition of the business of local market | High vs. low competition | Slightly important |
| | Ability to access local labor market | Complex vs. easy local labor market situation | Very important |
| Customer | Type of customer | Presence of producer clients | Less important |
| | | Presence of seller clients | |
| | Type of activities | Storage only | Less important |
| | | Easy handling | |
| | | Value added services | |
| | Presence and size of clients | Level of small clients' presence | Less important |
| | | Level of medium clients' presence | |
| | | Level of big clients' presence | |
| | Type of inbound transports | Intermodal transport | Less important |
| | | FTL road transport | |
| | | Groupage | |
| | | Air & Ocean | |
| | Type of outbound transports | Intermodal transport | Less important |
| | | FTL road transport | |
| | | Groupage | |
| | | Air & Ocean | |
| Infrastructure | Warehouse availability | Areas with or without warehouses | Less important |
| | Transportation infrastructure | Presence of ports, roads' connections | Less important |
| | Location evaluation | Location evaluation based on clients/industry needs | Extremely important |

Source: Own study.

Each factor was rated on a scale from 1 to 5 for each voivodeship. The scale reflects a factor that fully corresponds to the presence in a given voivodship (5) or not at all (0). This part of research was made with assumptions of own research done by author in accordance with interviews done with logistics operators.

**Table 3.**
*Scoring factors for each voivodeship*

| Subject | Mazowieckie | Śląskie | Wielkopolskie | Dolnośląskie | Małopolskie | Łódzkie |
|---|---|---|---|---|---|---|
| Spare parts | 1 | 4 | 4 | 2 | 2 | 2 |
| Machinery | 1 | 4 | 3 | 4 | 3 | 3 |
| Steel | 2 | 5 | 3 | 3 | 4 | 2 |
| Components | 3 | 4 | 4 | 4 | 3 | 4 |
| Finished products | 5 | 4 | 4 | 4 | 4 | 5 |
| Automotive | 0 | 5 | 4 | 4 | 3 | 2 |
| Electronics | 2 | 2 | 3 | 4 | 1 | 4 |
| Dry food and beverages (DF&B) | 5 | 3 | 4 | 3 | 4 | 3 |
| Fast moving consumer goods (FMCG) | 5 | 4 | 4 | 4 | 4 | 4 |
| E-commerce (E.g., Amazon) | 5 | 5 | 4 | 5 | 4 | 5 |
| Wholesale | 3 | 5 | 5 | 4 | 3 | 5 |
| Industry | 3 | 5 | 3 | 3 | 3 | 4 |
| High vs. low competition | 1 | 0 | 2 | 1 | 4 | 3 |
| Complex vs. easy local labor market situation | 2 | 2 | 1 | 1 | 4 | 4 |
| Presence of producer clients | 1 | 5 | 4 | 3 | 3 | 4 |
| Presence of seller clients | 5 | 5 | 4 | 4 | 4 | 4 |
| Storage only | 4 | 4 | 4 | 4 | 3 | 4 |
| Easy handling | 4 | 4 | 3 | 4 | 4 | 4 |
| Value added services | 5 | 5 | 4 | 5 | 5 | 4 |
| Level of small clients' presence | 4 | 5 | 4 | 4 | 3 | 5 |
| Level of medium clients' presence | 3 | 4 | 4 | 3 | 3 | 4 |
| Level of big clients' presence | 1 | 3 | 3 | 4 | 2 | 2 |
| Intermodal transport | 5 | 3 | 5 | 1 | 0 | 3 |
| FTL road transport | 5 | 5 | 5 | 5 | 4 | 5 |
| Groupage | 5 | 5 | 5 | 5 | 5 | 5 |
| Air & Ocean | 2 | 1 | 0 | 0 | 2 | 3 |
| Intermodal transport | 5 | 3 | 5 | 1 | 0 | 3 |
| FTL road transport | 5 | 5 | 5 | 5 | 4 | 5 |
| Groupage | 5 | 5 | 5 | 5 | 5 | 5 |
| Air & Ocean | 2 | 1 | 0 | 0 | 2 | 3 |
| Areas with or without warehouses | 3 | 3 | 3 | 2 | 0 | 4 |
| Presence of ports, roads' connections | 3 | 4 | 3 | 4 | 3 | 5 |
| Location evaluation based on clients/industry needs | 4 | 4 | 3 | 5 | 3 | 5 |

Source: Own study.

Next step of research was to assigned each factor in significance according to the assumptions: less significant – 0.5; rather important – 0.75; significant – 1 ; very important - .25; the most important – 1.5 (Table 4). This kind of analysis is based on factors described by logistics operators that author made a personal interview with. It's mix of most important factors scored by interviewed logistics operators.

**Table 4.**
*Total assessment of each voivodship taking into account the weight of factors*

| Guideline | Mazowieckie | Śląskie | Wielkopolskie | Dolnośląskie | Małopolskie | Łódzkie |
|---|---|---|---|---|---|---|
| Target markets | 12,00 | 17,50 | 16,50 | 16,00 | 14,00 | 14,50 |
| Type of final market | 11,00 | 15,00 | 12,00 | 12,00 | 10,00 | 14,00 |
| Composition of the business of local market | 0,75 | 0,00 | 1,50 | 0,75 | 3,00 | 2,25 |
| Ability to access local labor market | 2,50 | 2,50 | 1,25 | 1,25 | 5,00 | 5,00 |
| Type of customer | 3,00 | 5,00 | 4,00 | 3,50 | 3,50 | 4,00 |
| Type of activities | 6,50 | 6,50 | 5,50 | 6,50 | 6,00 | 6,00 |
| Presence and size of clients | 4,00 | 6,00 | 5,50 | 5,50 | 4,00 | 5,50 |
| Type of inbound transports | 8,50 | 7,00 | 7,50 | 5,50 | 5,50 | 8,00 |
| Type of outbound transports | 8,50 | 7,00 | 7,50 | 5,50 | 5,50 | 8,00 |
| Warehouse availability | 1,50 | 1,50 | 1,50 | 1,00 | 0,00 | 2,00 |
| Transportation infrastructure | 1,50 | 2,00 | 1,50 | 2,00 | 1,50 | 2,50 |
| Location evaluation | 6,00 | 6,00 | 4,50 | 7,50 | 4,50 | 7,50 |
| **Total** | **65,75** | **76,00** | **68,75** | **67,00** | **62,50** | **79,25** |

Source: Own study.

The final analysis of soft factors for selected regions allowed to determine the ranking of voivodeships (Table 5). Based on that it was able to make a final suggestion about best possible location for distribution center for logistics operator. Analysis is based on attractiveness of voivodeships based on assumptions chosen by author.

**Table 5.**
*Ranking of the attractiveness of voivodeships in terms of the location of the distribution center*

| Region | Mazowieckie | Śląskie | Wielkopolskie | Dolnośląskie | Małopolskie | Łódzkie |
|---|---|---|---|---|---|---|
| Scores | 65,75 | 76,00 | 68,75 | 67,00 | 62,50 | 79,25 |
| **Ranking** | **5** | **2** | **3** | **4** | **6** | **1** |

Source: Own study.

## 5. Summary

Based on the presented research, the following ranking of the attractiveness of provinces in terms of building a distribution center can be presented:

1. Łódzkie.
2. Śląskie.
3. Wielkopolskie.
4. Dolnośląskie.
5. Mazowieckie.
6. Małopolskie.

The assumptions adopted in the analyses assume various approaches to the problem. A look from several independent perspectives, both directly statistical – related to the GDP and CAGR indicators, as well as to soft factors, which are often overlooked in scientific studies due to the inability to define them on the basis of interviews with logistics operators. An important aspect that should be emphasized is the fact that the assessment shown in the research is up-to-date for the time it is carried out and that analysis of this type should be carried out in the current cycle before starting the investment project, because the assessments of factors in the currently rapidly changing business environment tend to expire at short intervals.

There are many methods, models, criteria, factors, and selection conditions. Due to the dynamic development of the economy, they are constantly transformed, changed and modified. It is impossible to present all of them, or at least some of them, in this material. It should be borne in mind that the issues raised belong to the general and most important ones, which should affect the reception of the presented topic. This material should rather be a stimulus for further research and exploitation of the topic and as a source of inspiration or comparisons of conclusions in the context of research on the discussed issue.

## References

1. Budner, W. (2007). Czynniki lokalizacji inwestycji a możliwość rozwoju ekonomicznego gmin w Polsce. *Acta Scientiarum Polonorum. Administratio Locorum, Nr 6/3*.
2. Czubata, A. (2001). *Dystrybucja produktów*. Warszawa: PWE.
3. Dziekoński, K., Matusewicz, E. (2014). Koncepcje lokalizacji nowego centrum logistycznego w Polsce. *Logistyka, 3*.
4. Grabiński, S. (2015). *Wyznaczanie lokalizacji centrum dystrybucji. Modelowanie z wykorzystaniem systemów geoinformacji*. Poznań: Uniwersytet Ekonomiczny w Poznaniu.
5. Jędra, I., Borowiak, J. (2010). Uwarunkowania lokalizacji centrów logistycznych w Polsce. *Logistyka, Nr 6*.
6. Kaźmierski, J. (2012). Konsekwencje lokalizowania centrów logistycznych w przestrzeni miejskiej. *Problemy Rozwoju Miast, vol. 9, no. 1*.
7. Kuczyńska, E., Ziółkowski, J. (2012). Wyznaczanie lokalizacji obiektu logistycznego z zastosowaniem metody wyważonego środka ciężkości – studium przypadku. *Biuletyn WAT, Vol. LXI, No. 3*.
8. Markusik, S. (2010). *Infrastruktura logistyczna w transporcie*. Gliwice: Wydawnictwo Politechniki Śląskiej.

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# A STUDY OF HOUSEHOLD INVESTMENT BEHAVIOR IN SLOVAKIA DUE TO THE COVID-19 PANDEMIC

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**Purpose:** This article is written due to the need to study the investment behavior of households in Slovakia and changes in the investment behavior of households due to the COVID-19 pandemic.
**Design/methodology/approach**: The main methods used in the article are analysis, comparison, and synthesis. These methods were used in the researched issue of investment behavior. The main document from which the data were obtained was The Slovak survey of the financial situation and household consumption as a part of the European Household Finance and Consumption Survey (HFCS) published by National Bank of Slovakia with cooperation of European Central Bank. These surveys were published in 2010, 2014 and 2017. By mutual comparison of these surveys and subsequent analysis, we can observe changes in the investment behavior of households in recent years. The analyzes were partially supplemented by various studies from the last year as well as partial outputs of the European Household Finance and Consumption Survey, which was researched in 2021, but at the time of writing this article had not yet been published.
**Findings:** The results of the research presented clearly indicate a changing trend in the behavior of household investments. Strongly conservative households are gradually beginning to trust investment in mutual funds, bonds, and shares, and the share of funds deposited in deposits is gradually declining and is approaching the European average. Investment in real estate remains the most popular investment in Slovakia. These are often the main real estate used by households for housing or investment properties.
**Originality/value:** The article presents interesting findings in the area of investment behavior of households in Slovakia and points to the upcoming change in investment behavior. The results of the research will help to set and update the content of subjects dealing with financial literacy and investing at a technically oriented university.

**Keywords:** Investment, Household, COVID-19.

**Category of the paper:** Research paper.

## 1. Introduction

Investing should be one of the basic financial activities for every household. Savings alone and the creation of reserves are not enough for long-term operation, although these activities are necessary. Several studies show that Slovak households are at the bottom of the EU and OECD investment rankings. This trend is beginning to change, as the new data show. In this article, we will examine the results of extensive surveys conducted by the National Bank of Slovakia in cooperation with the Statistical Office of the Slovak Republic, which were conducted in 2010, 2014 and 2017. The latest data from 2021 have not yet been published. In the last part of the work, we deal with the impact of the COVID-19 pandemic on the investment behavior of households.

## 2. Results

The annual investment rate of households in Slovakia and neighbouring countries is shown in Figure 1. The investment rate in Slovakia has remained between 6,7-6,9% in recent years. In 2017, there was a turnaround, when the countries of Hungary, Poland, and Slovakia had values close to each other, and subsequently the development in Hungary changed positively, while in Poland it was negative. In 2020, Slovakia had 1,49% less than the EU average. The gross investment rate of households is defined as gross fixed capital formation divided by gross disposable income, with the latter being adjusted for the net change in pension entitlements. Austria has the highest investment rate of 9,27%. The projection in EU countries for 2021 is also rising (a 9% year-on-year increase in the EU).

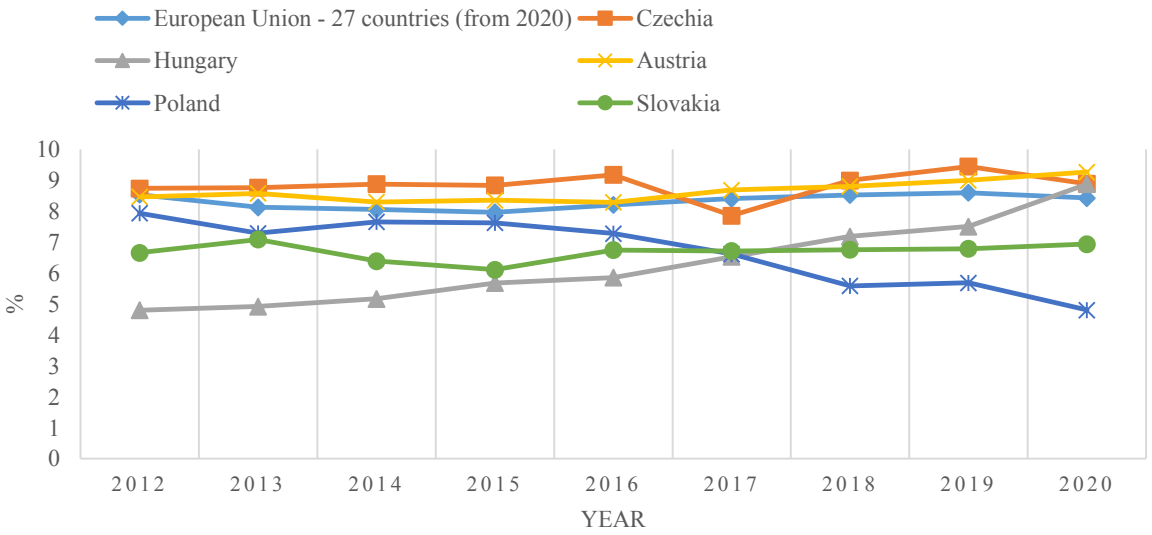


**Figure 1.** Gross Investment rate of households 2012-2020 in selected countries. Source: Statistics, Eurostat, Household Investment Rate.

The household savings rate, on the other hand, has been increasing across the board in recent years. In each of the monitored countries, as well as in the European Union, we can see an increase in the years 2019-2020. In Slovakia, household savings increased from 9,83% in 2019 to 10,86% in 2020. Slovakia is 7,4% below the EU average. The biggest savings of households have in 2020 Czechia (20,97%), right after Austria (19,69%). The average of EU countries is 18,27% (Statistics Eurostat, 2022).

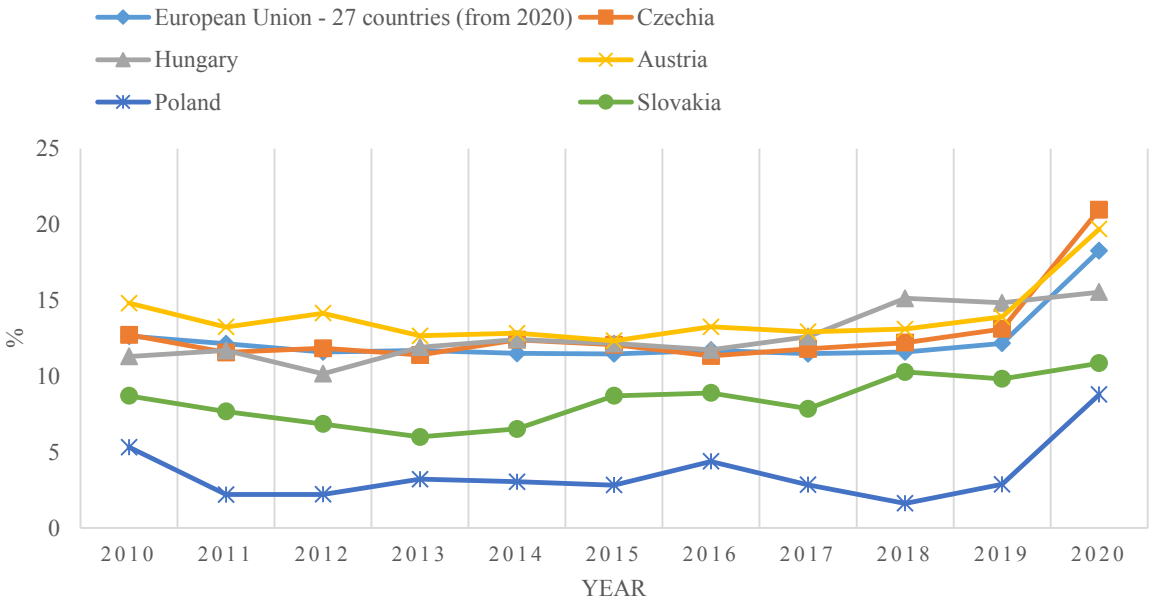


**Figure 2.** Household savings rate 2010-2020 in selected countries. Source: Statistics, Eurostat, Household Saving Rate.

### 2.1. Results of the survey on the financial situation of Slovak households

The Slovak survey of the financial situation and household consumption is part of the European Household Finance and Consumption Survey (HFCS), coordinated by the ECB (European Central Bank). This survey was conducted in Slovakia for the first time in 2010, later it was conducted in 2014 and the last published results are from 2017. Slovakia was also involved in the survey in June 2021, but the results have not yet been published (Slovensko získa nové dáta o finančnej situácii a spotrebe domácností, 2021). All euro area countries are currently participating, as well as some noneuro area countries (Poland, Hungary, Croatia, Romania, and Czech Republic). The project aims to supplement macroeconomic data with information at the individual level of households, which captures the heterogeneity of households in terms of financial distribution resources (Kucserová and Strachotová, 2019).

The study published by Kucserova and Strachotova (2019) summarizes the main results of the third wave, which was carried out by the NBS (National Bank of Slovakia) in 2017 in cooperation with the Statistical Office of the Slovak Republic. The results of the first and second wave are presented in the works of Senaj and Zavadil (2012) and Cupák and Strachotová

(2015). The methodology for detecting the first and second waves of HFCS is given in HFCN (2013) and HFCN (2016).

From the HFCS surveys, we can get comparative data on the assets and liabilities. The project is coordinated by ECB, the survey methodology is the same for all countries, which carry it out mostly through their central banks, so the obtained data can be compared between the participating countries. The HFCS is primarily focused on gathering structural microeconomic data on household wealth and its components- financial assets, real assets, and liabilities. The survey also collects other information in order to analyse the economic decisions taken by households (e.g., household income, intergenerational transfers, selected categories of consumption and credit constraints, as well as demographic characteristics of surveyed individuals such as age, education, or occupational status) (Household Finance and Consumption Network – HFCN, 2022).

Management of Slovak households in the period between the second and third waves of the HFCS survey (2014-2017) led to an increase in flows on the assets and liabilities side. Households invested their resources in real assets, while financial assets increased only very slightly. The value of the main housing and the value of other real assets increased significantly. However, financial liabilities also increased, but not to the same extent as real assets.

The main finding of the latest wave of the survey (HFCS, 2017) compared to the second wave of the survey (HFCS, 2014) is that the net wealth of Slovak households has increased. Net wealth includes real assets (household main residence and other real estate property, vehicles, valuables, and business property) and financial assets (deposits, mutual funds, bonds, shares, money owed to households, voluntary pension/whole life insurance, other financial assets) less financial liabilities (housing loans and other debts). The median net wealth of Slovakian households reached 70,3 thousand € in the third wave of HFCS. (Kucserová and Strachotová, 2019). The neighboring countries had a median net wealth as follows: Hungary (36,3 thousand €), Poland (60,5 thousand €), Austria (82,7 thousand €). The biggest median net wealth had Luxembourg (498,0 thousand €). Figure 3 shows a map of the median net wealth of selected countries. Median net wealth remained broadly stable between 2014 and 2017 at just under 100 thousand € (European Central Bank, 2020).


**Figure 3.** Median net wealth of households (HFCS, 2017). Source: HFCS dahsboard (Oesterreichische Nationalbank) https://oenb.shinyapps.io/HFCS_Keyfigures/#section-countries.

In terms of housing ownership, net wealth increased mainly in the large group of owners without a mortgage (an increase of 37% to a median of 82 thousand €). The highest growth of 69,2% and the highest net wealth of 95 thousand € (median) was achieved by a group of households with a reference person aged 55-64 (Kucserová and Strachotová, 2019). These numbers correspond to the preference of households in Slovakia to invest conservatively, especially in real estate.

The share of households with negative net worth, that is, debt greater than the sum of their real and financial assets, remained at approximately the same level (2,4%). Negative net wealth is widespread, especially among tenants (16,6%) and in younger age groups 16-34 (4,9%) (Kucserová and Strachotová, 2019).

Real assets contributed the most to the increase in net wealth, with a median increase of 35% to 74 000 €. Within real assets, it was mainly the main housing, which was owned by up to 88,8% of households. The median value increased by 40% to 70 thousand €. Housing was acquired mainly by younger households (reference person 16-34 years, participation rate increased by 10,4 pp to 76,1%) with middle and higher incomes, mainly due to loans. The share of households that own other real estate besides the main dwelling increased (by 8,6 pp to 28%); the share of households that own a vehicle (by 7,3 pp to 68%) and the share of households that own business assets (by 4,2 pp to 15%), Despite the high share of main housing in real property, the composition of real assets has changed slightly in favor of assets since 2014 from business.

Financial assets make up only 8% of total assets on average, and their stock is relatively stable in the long run compared to real assets. According to the HFCS 2017 survey, they increased by 9,3% to 2,8 thousand € (conditional median), thus contributing only slightly

to the growth of net wealth. Financial assets continue to be held mainly by households in deposits (approximately 92% of households say they own deposit products). The share of households with other financial assets (eg financial derivatives) decreased the most, from 3,6% in HFCS 2014 to 1% in HFCS 2017. Bonds continue to be owned by households only exceptionally (0,8% of households), but their median increased significantly from 2 400 € to 13 400 €. This means that existing owners of financial assets have significantly increased their financial investments. Households with the lowest incomes (the lower 20% of the income distribution) own financial assets only in the amount of approximately 1,1 thousand € and are almost exclusively depository products in banks.

The share of households with a mortgage for the main residence increased slightly (by 4,4 percentage points to 19,6%). However, the median household debt almost doubled (from 6 000 € to11,4 thousand €). The mortgage for the main residence contributed significantly to this, and its median increased from 21 thousand € to 31 thousand €. The debt more than doubled for the youngest from 16 to 34 years to a median of 23,6 thousand € and at the same time this age group became the group with the highest volume of debt. Within household liabilities, housing loans continue to lead, their share increasing from 82,4% to 89% in the last wave. This increase was mainly supported by the mortgage for the main residence. In 2017, all loans, other than housing loans, had a lower share of total liabilities. Figure 4 shows the net wealth of the households and its components.

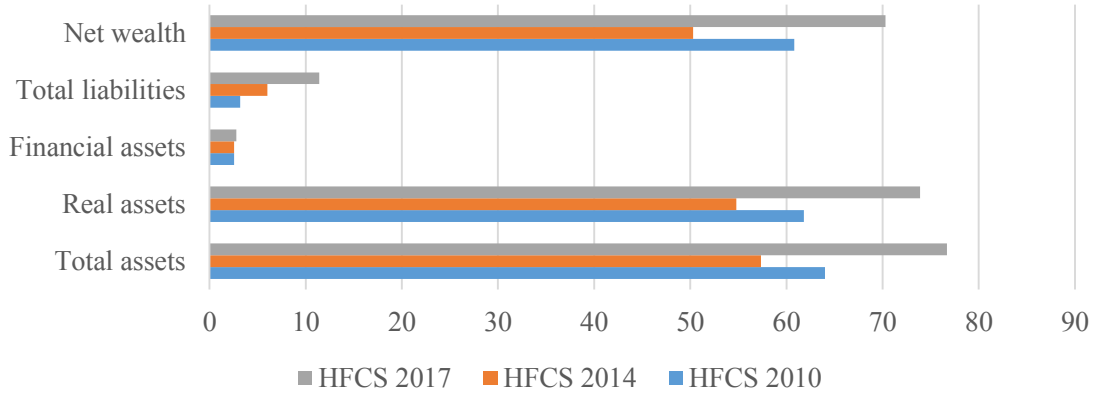


**Figure 4.** Net wealth of households in Slovakia and its components, conditional median (thd. €). Source: HFCS 2010, HFCS 2014, HFCS 2017.

The favorable development on the labor market since 2016 was reflected in the growth of median household incomes and food consumption and expenditure on consumer goods and services. The median gross annual income of households increased by 22% to 16 thousand €. The bottom 20% of income groups in particular improved (5 500 € out of the original 3 900 € in HFCS 2014). Figure 5 shows the median of the total household gross income in HFCS 2017 in the European countries.

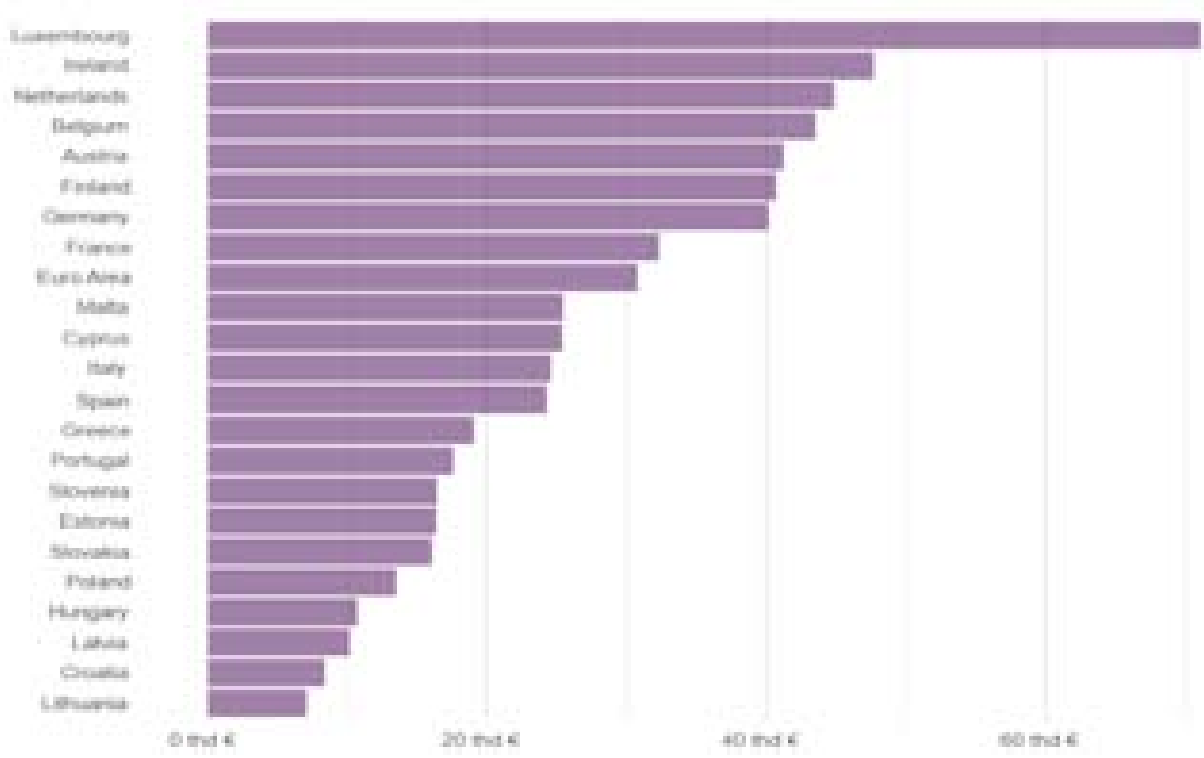

**Figure 5.** Total household gross income, median (HFCS, 2017). Source: HFCS dahsboard (Oesterreichische Nationalbank) https://oenb.shinyapps.io/HFCS_Keyfigures/#section-countries.

## 2.2. Structure of assets of households in Slovakia

Slovak households are considered conservative investors, who invest mainly in real estate and have a very small percentage of financial assets among European countries. These are also evidenced by the results of the latest HFCS 2017 survey, where financial assets in Slovak households accounted for almost half the conditional mean value of European countries. Figure 6 illustrates the conditional mean distribution of total assets between real assets and financial assets in Slovakia and in the Euro area during the last two HFCS surveys.

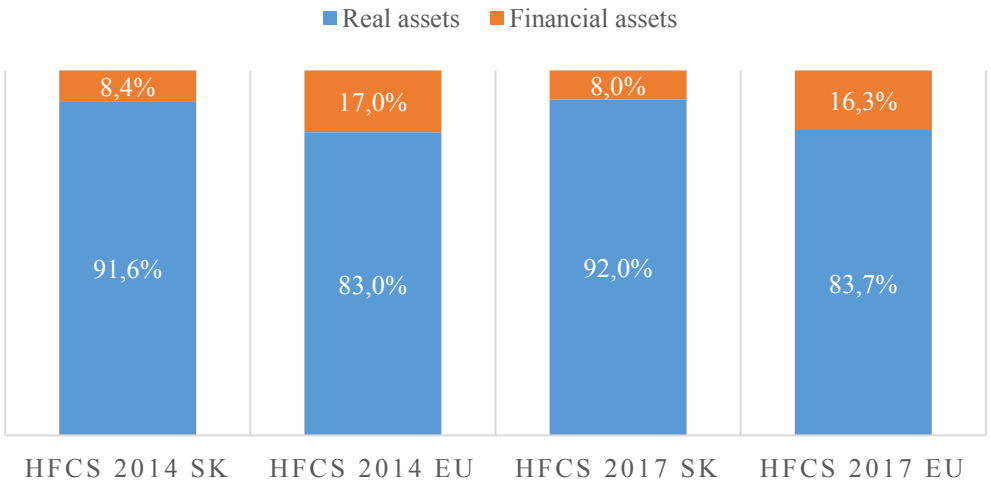


**Figure 6.** Structure of total household assets in Slovakia and the euro area (conditional mean). Source: HFCS 2014, HFCS 2017.

Table 1 reports statistics for the asset holdings of households in Slovakia and the euro area. During the same period, the median total asset value was lowered by 2,4% to 131 300 €. In Slovakia, the development was the opposite, where it increased by 34% to € 73.9 thd. €. The most important real asset remained the main residence of the households in Slovakia and also in the euro area. The conditional median value of the main residence rose from 161 300 € to 165 700 € (EU) and from 50 000 € to 70 000 € in Slovakia (European Central Bank, 2020) (Cupák and Strachtová, 2015) (Kucserová and Strachotová, 2019).

**Table 1.**
*Structure of real assets in Slovakia and the euro area (conditional median, thd. €)*

| Assets type | 2014 EU | 2014 SK | 2017 EU | 2017 SK |
|---|---|---|---|---|
| **Total real assets** | 132,6 | 54,8 | 131,0 | 73,9 |
| **Household main residence** | 161,3 | 50,0 | 165,7 | 70,0 |
| **Other real estate property** | 91,0 | 13,8 | 95,9 | 16,6 |
| **Vehicles** | 5,6 | 3,5 | 6,0 | 5,0 |
| **Valuables** | 3,0 | 0,5 | 3,0 | 0,6 |
| **Self – employment business wealth** | 30,4 | 5,8 | 30,0 | 5,7 |
| **Total financial assets** | 10,6 | 2,6 | 10,3 | 2,8 |
| **Deposits** | 5,9 | 1,8 | 6,1 | 2,0 |
| **Mutual funds** | 15,0 | 5,8 | 15,0 | 6,0 |
| **Bonds** | 19,5 | - | 20,0 | 13,4 |
| **Shares** | 7,4 | 0,4 | 8,0 | 0,8 |
| **Money owed to households** | 3,1 | 2,0 | 3,0 | 1,5 |
| **Voluntary pensions/whole life insurance** | 13,4 | 2,8 | 14,0 | 4,2 |
| **Other financial assets** | 3,1 | 0,6 | 2,5 | 4,9 |

Source: HFCS, 2014; HFCS, 2017; European Central Bank, 2020.

Deposits remained the most widely held financial asset in household portfolios. The conditional median value rose by 2,9% from 5 900 € in 2014 to 6 100 € in 2017 in euro area, and in Slovakia rose by 11% from 1 800 € to 2 000 €. The second most widely held financial asset was “voluntary pensions and whole life insurance”. The conditional median value rose from 13 400 € in 2014 to 14 000 € in 2017 (EU), and in Slovakia rose from 2 800 € in 2014 to 4 200 € in 2017. Other types of financial assets, such as publicly traded shares, bonds, and other financial assets, were held by less than one out of ten households. (European Central Bank, 2020)

92% of households own financial assets. The conservative approach prevails, so deposits (71.9%) and voluntary pensions/whole life insurance (15.6%) remain the most widely distributed products. Other financial instruments (mutual funds, shares, money owed to households, and other assets) are owned to a much lesser extent. Although deposits remain the dominant instrument, their share of total financial assets fell by 4 percentage points, mainly in favor of bonds, shares, and other assets. This change probably reflects a greater incentive for households to move savings from deposits to higher-yielding financial assets, as the interest rate on household savings is low in the long run. In 2017, a typical Slovak household owned deposits in the amount of 2 000 € and investment life insurance in 4 200 €. Only 4% of households owned mutual funds with a median value of 6 000 €. Figure 7 shows the portfolio of financial assets of Slovakian households (Kucserová and Strachotová, 2019).

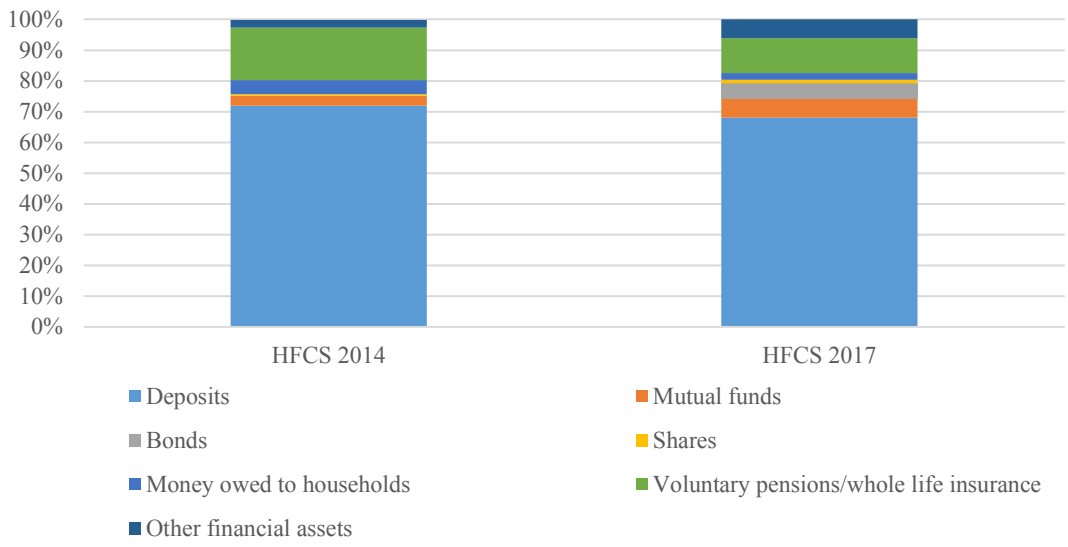


**Figure 7.** Portfolio of financial assets of Slovakian households. Source: HFCS, 2014; HFCS ,2017.

### 2.3. Change in the investment behavior of households in Slovakia during a Covid-19 pandemic

Due to the COVID-19 pandemic, Slovakia is likely to be in the deepest economic crisis in peacetime. Massive revenue shortfalls caused by quarantine measures, production shutdowns, and service cuts will affect tens of thousands of households. At the same time, 10% of Slovak households did not have any financial reserves before this crisis, 20% have reserves for a maximum of one month, and half of households have reserves for a maximum of six months. Households working in the most affected sectors of trade, services, and crafts are even worse, 30% have the most reserves for a month and 60% for less than six months. Therefore, it is essential that the measures to compensate for the loss of income of the most affected employees/enterprises be swift and flexible (Šuster, Cupák, and Klacso, 2020).

The positive trend of increasing reserves during the crisis was also confirmed by a survey by FOCUS and the PARTNERS Foundation from June 2020, which states that almost 78% of households make reserves for worse time, 20% have a reserve of 6 months, 24% have a reserve of two up to five-month income, and 16% have a reserve of twice the monthly income (PARTNERS GROUP SK, 2021).

Up to 54% of people felt the economic consequences of the pandemic more or less negatively on their finances. According to an IMAS survey (conducted on a sample of 500 respondents) for the Erste Group, approximately 7% of the pandemic had a significant negative impact on the financial situation, and almost half (47%) felt only negatively. The rest of the respondents (about 46%) stated that COVID-19 did not affect their financial situation. An important role in this case is played by several factors that are decisive – whether the individual (or household) had created a sufficient reserve for adverse situations in which sectors household members work and what their composition is. The loss of one income due to job loss will be different in a household with two parents and two children than in a household with

a single mother or families with many children, which are groups at high risk of poverty (Horňák, 2021).

Limited consumption opportunities, subdued economic activity, and its impact on wages could also have an impact on individuals' savings. Although about 18% of people reported saving less than usual at the time of a pandemic, two-thirds were able to save the same, and about 17% were able to postpone more per month than before the pandemic.

In these cases, it was mainly people who:

- found a job during the pandemic,
- feared the effects of the pandemic and therefore preferred to build a reserve,
- due to limitations, they did not have as many opportunities to spend.

Among the age groups, young people in particular were able to put off more, but their situation could often be simplified due to living with their parents. Young Slovaks leave their home nest very late, on average just before the age of 31, which could help their financial situation and provide more opportunities to save money (Horňák, 2021).

Almost two thirds of the respondents indicated that they plan to accumulate their savings in a current or savings account in the future, but investments that more than a third of the respondents consider as a way of saving in the future are increasingly coming to the fore. In general, we can see a growing proportion of people who have a positive attitude towards investing. Most still choose a more conservative portfolio, with a fifth preferring more risky investments with the potential for higher returns – but their share is growing over time. This group consists mainly of young people and men. Gradually, with increasing age, the willingness to take risks decreases, which is also a positive pattern, as some risky investments may require a long investment horizon, which at an old age may not correspond to the period when an individual will need funds (Horňák, 2021).

The mentioned trend of increasing Slovaks' interest in investing can also be seen in a survey conducted by the 2muse agency for OVB. According to the survey, up to 58% of respondents are expected to save for retirement, while at the beginning of the pandemic it was only 28%. At the same time, we are seeing a strong interest in increasing financial literacy, which is at a very low level in Slovakia. As many as 44% of respondents plan to supplement their education in the field of investing and valuing savings (OVB Allfinanz Slovensko a.s., 2021).

The increase in household interest in saving and investing, i.e. the appreciation of available funds, is also visible in other countries. People tend to save and invest more in times of crisis than in times of abundance.

Partners Group reports a year-on-year increase (2020-2021) of 9% in investment and 14% in the life insurance segment. In general, it increased its sales by 12% (PARTNERS GROUP SK, 2022).

The pandemic in Slovak households was also reflected in deferred consumption, when due to pandemic restrictions they could not spend the money earned. The value of money in banks thus increased year-on-year from 38 billion € in January 2020 to 41.25 bn. € in January 2021,

an increase of more than 8%. Money in current accounts even increased by as much as 17% to 23.2 billion. €. This increase is mainly attributed to reduced household consumption (PARTNERS GROUP SK, 2021).

Over the past year, environmentally and socially responsible investment has been on the rise worldwide. Firms that are trustworthy and socially responsible will be included by the rating agency among ESG companies. Everyone who cares about what they invest in has the opportunity in Slovakia to invest their money in environmental funds, through which these companies are financed. Responsible and ethical funds are referred to by the abbreviation ESG / SRI, which is derived from the three words "Environmnetal – Social – Governance", resp. Sustainable and Responsible Investments (TA3, 2022). ESG funds are experiencing a significant year-on-year increase. This trend will continue in the coming years. According to Ovčarík, the number of ESG funds has doubled in the last year and new ones are being added every day. Their advantage, in addition to environmental aspects, is also lower volatility and higher interest of the young generation (25-40 years old) in these funds (Pravda, 2021).

## 3. Summary

The results of the research presented clearly indicate a changing trend in the behavior of household investments. Strongly conservative households are gradually beginning to trust investment in mutual funds, bonds, and shares, and the share of funds deposited in deposits is gradually declining and is approaching the European average. The young generation is thinking more environmentally friendly and a stronger demand for ESG investments is beginning to show. The COVID-19 pandemic caused the closure of households, which began to spend less and available funds increased year on year. Restrictions related to the pandemic have positively affected the development of open investment and asset management applications that can be used from a distance. However, households lag behind the average in the European Union in terms of net financial assets. Due to the high percentage of deposits from the total financial assets of the household, Slovak households can feel the impact of high inflation the most.

Investment in real estate remains the most popular investment in Slovakia. These are often the main real estate used by households for housing or investment properties. The results of the HFCS survey, which was carried out in 2021, have not yet been published, and therefore the results from the first three waves of the HFCS surveys were used in the study. Slovak households lag behind the average of the euro area, as well as of OECD countries, in terms of investment and in the structure of assets. This is also caused by the annually sharply criticized low financial literacy of the Slovak population.

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## References

1. Cupák, A., Strachtová, A. (2015). *Výsledky Druhej Vlny HFCS.* Príležitostná Štúdia NBS. Národná Banka Slovenska.
2. European Central Bank (2020). *The household finance and consumption survey: results from the 2017 wave.* LU: Publications Office. Retrieved from https://data.europa.eu/doi/10.2866/776370.
3. HFCN (2013). *The Eurosystem Finance and Consumption Survey: Methodological Report for the Second Wave.* Household Finance and Consumption Network. ECB.
4. HFCN (2016). *The Eurosystem Finance and Consumption Survey: Methodological Report for the First Wave.* Household Finance and Consumption Network. ECB.
5. Horňák, M. (2021). *Viac než polovica ľudí pocítila negatívny vplyv pandémie na ich financie. Slovenská sporiteľňa*. Retrieved from https://cdn0.erstegroup.com/content/dam/sk/slsp/www_slsp_sk/documents/footer-pdfs/kratke-spravy/20211201-kratka-sprava-vplyv-covidu-na-financie-a-zvyky.pdf.
6. Household Finance and Consumption Network (n.d.). https://www.nbs.sk/en/research-at-nbs/working-groups/household-finance-and-consumption-network-hfcn, 17.05.2022.
7. Kucserová, J., Strachotová, A. (2019). *Výsledky Tretej Vlny Zisťovania o Financiách a Spotrebe Domácností (HFCS).* Národná Banka Slovenska. Retrieved from http://www.nbs.sk/_img/Documents/PUBLIK/OP_1_2019_Jurasekova_Strachotova_Vysledky_tretej_vlny_HFCS.pdf.
8. Oesterreichische Natinalbank (n.d.) HFCS Dashboard. https://oenb.shinyapps.io/HFCS_Keyfigures/#section-countries, 17.05.2022.
9. OVB Allfinanz Slovensko a.s. (2021). *Slováci sú vďaka pandémii zodpovednejší vo financiách, ukázal prieskum.* https://www.ovb.sk/blog/sprava/slovaci-su-vdaka-pandemii-zodpovednejsi-vo-financiach-ukazal-prieskum.html, 18.05.2022.
10. PARTNERS GROUP SK (2021). *Pandémia naučila slovákov sporiť. Otvorením obchodov hrozí, že na tento dobrý zvyk zabudnú.* https://www.partnersgroup.sk/detail/pandemia-

naucila-slovakov-sporit-otvorenim-obchodov-hrozi-ze-na-tento-dobry-zvyk-zabudnu, 18.05.2022.

11. PARTNERS GROUP SK (2022). *Rok 2021 v partners group sk: rástli investície i počet klientov.* https://www.partnersgroup.sk/detail/rok-2021-v-partners-group-sk-rastli-investicie-i-pocet-klientov, 18.05.2022.
12. Pravda (2021). *Rastie u nás nová generácia investorov. V kurze je zelené investovanie.* https://ekonomika.pravda.sk/ludia/clanok/583741-rastie-u-nas-nova-generacia-investorov-v-kurze-je-zelene-investovanie/, 18.05.2022.
13. Senaj, M., Zavadil, T. (2012). *Výsledky Prieskumu Finančnej Situácie Slovenských Domácností*, Príležitostná Štúdia. Národná Banka Slovenska.
14. Slovensko Získa Nové Dáta o Finančnej Situácii a Spotrebe Domácností (2021). https://www.nbs.sk/sk/informacie-pre-media/tlacove-spravy/spravy-vseobecne/detail-tlacovej-spravy/_slovensko-ziska-nove-data-o-financnej-situacii-a-spotrebe-domacnosti, 17.05.2022.
15. Statistics Eurostat (2022). https://ec.europa.eu/eurostat/databrowser/view/TEC00098__custom_2731813/default/table?lang=en, 17.05.2022.
16. Šuster, M., Cupák, A., Klacso, J. (2020). *Majú slovenské domácnosti rezervy pred krízou?* https://www.nbs.sk/_img/documents/_komentare/analytickekomentare/2020/ak78_financne_rezervy_domacnosti.pdf.
17. TA3 TC| T (2022). *Investovanie do zelenšej budúcnosti. Nový trend: investovanie do ESG fondov. Obehový biznis model v popredí – TA3*. Retrieved from https://www.ta3.com/relacia/24252/investovanie-do-zelensej-buducnosti-novy-trend-investovanie-do-esg-fondov-obehovy-biznis-model-v-popredi.

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# THE DEVELOPMENT OF THE E-COMMERCE MARKET AS A CHALLENGE FOR MARITIME TRANSPORT AND SHIPPING

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**Purpose:** The article deals with the development of the e-commerce market as a challenge for international maritime transport and shipping. The aim of the study is to analyze the current, post-andemic factors in the development of the e-commerce market and its impact on the functioning of the maritime transport and shipping market, with an indication of the synthetic implications for changes that should be introduced to improve the functioning of maritime transport, goods responding to the demand expressed on the global e-commerce market.
**Design/methodology/approach**: The article uses the method of analyzing the literature and the method of analyzing data from public statistics on the development and functioning of the e-commerce market as well as shipping and sea transport in 2012-2020.
**Findings:** The main factors of development and problems resulting from the development of the e-commerce market before and after the Covid 19 pandemic were identified as challenges for the transport and shipping of goods by sea.
**Practical implications:** Organization of the supply chain in the area of targeting the development of transport services and international freight forwarding based on maritime transport and shipping.
**Originality/value:** The value and originality of the articles results from a thorough review of the current literature on the subject and statistical data on the functioning of enterprises from the e-commerce market as well as transport and sea freight. The recipients of the results of this work may be managers and persons shaping the rules of functioning on the maritime transport and shipping market.

**Keywords:** organization of the shipping transport and maritime logistics market, development of e-commerce market, post-pandemic problems of international exchange, market development factors.

**Category of the paper:** Research paper/General review.

## 1. Introduction

The dynamic development of e-commerce, stimulated above all by the development of modern ICT technologies and the recent crisis of traditional forms of trade, caused by the global COVID-19 pandemic, have posed challenges for logistics and international shipping. The key issue has become to increase the efficiency of the flow of goods internationally and to search for ways to minimize the costs of the functioning of distribution channels in the conditions of the increasing volume of orders from the e-commerce market, inflationary pressure caused by the tense international situation and the temporary, pandemic suspension of demand and production processes that preceded them. At present, in the search for the most cost-effective solutions for the transport and forwarding of goods offered on the e-commerce market, the role of maritime transport, the most economical and environmentally friendly modes of transporting products, is even more revealed. Therefore, this article deals with the development of the e-commerce market as a challenge for this form of maritime shipping and transport in the international exchange system. information in the form of Acknowledgments (they should be placed before References).

## 2. E-commerce market: origins and development

When considering the origins and development of the e-commerce market, it is worth defining the concept of e-commerce itself, which is its synonym. As C. Żurak-Owczarek (2013) notes, the concept of electronic commerce (e-commerce) "concerns the process of selling and buying goods and services with the use of electronic means, usually conducted via the Internet. Electronic commerce refers to the external processes involved in how an enterprise interacts with its customers, suppliers, and business partners. These processes include sales, marketing, orders, customer service, supplies and payments" (Żurak-Owczarek, 2013). Today, e-commerce is closely related to the Internet. Nevertheless, the use of electrical equipment (telephone, fax, modems transmitting data over the telephone network) in generally understood trade began much earlier. Modems allowed for the construction of the first solutions for e-commerce as early as the 1960s (Konopielko, Wołoszyn, Wytrębowicz, 2016). Before the Internet was massively used in e-commerce, X.25 networks (from the mid-1970s), Frame Relay networks (from the late 1980s) and ATM networks (from the mid-1990s) were used for data transmission. Also at present, operators have the network infrastructure used in the last century, but it is mainly used to transfer internet data (Konopielko, Wołoszyn, Wytrębowicz, 2016). Initially, electronic data interchange was mainly carried out by means of Electronic Data Interchange (EDI). It was mainly exploited by large enterprises (e.g. banks, airlines, automotive

companies) (Konopielko, Wołoszyn, Wytrębowicz, 2016). The first common solution used in B2B and B2C relations was Minitel. This solution consisted in direct connection to telephone lines of simple alphanumeric terminals, which connected with service servers via the telephone network. The popularity of Minitel started to decline in the mid-1990s, when the same services began to be available on the Internet using web browsers (Konopielko, Wołoszyn, Wytrębowicz, 2016). The moment that completely revolutionized electronic commerce worldwide was building web services accessible through web browsers. Their main advantage was simplicity, which made them easy to use by any PC user (Konopielko, Wołoszyn, Wytrębowicz, 2016). The Internet plays a vital role in the lives of more and more people. The Internet is becoming more and more popular as people are looking for tools that will make their daily life easier. The increasing number of companies is using e-commerce as their primary source of access to customers. The Internet makes it possible to reach with its offers where people use the Internet, which means ensuring business all over the world (Błońska, Konieczek, Konieczek, 2015).

The first country to allow the use of the Internet for commercial purposes (1992), including trade via the Internet, was the United States. From that moment on, companies could not only post information about their products on the Internet, but also accept orders that previously could only be placed by telephone. The first online store was the Amazon.com bookstore, which was launched in 1995. In Poland, however, the first online store was established by Terent in 1997 (Błońska, Konieczek, Konieczek, 2015). The dynamics of the development of online stores is high. Increasingly, customers choose online stores instead of traditional, stationary stores. This way of shopping is cheaper and more convenient for both the customer and the seller. E-stores do not incur costs related to renting premises and hiring sellers, and the ordered products are delivered directly from the warehouse to the address indicated by the customer. As a result, products ordered online often offer more competitive prices than those in stationary stores. Ordering products online is also time-saving and convenient for customers – they can place an order at any time, from any place with Internet access. The customer also has the opportunity to read the opinions of other customers who have purchased the same or a similar product (Błońska, Konieczek, Konieczek, 2015).

The e-commerce market has grown rapidly in recent years. Both buying and selling have never been so easy. With the growing interest of customers in this form of shopping, the number of online stores also began to grow. In addition to the increased interest of customers, their expectations, needs and requirements for online stores are also growing, which affects the continuous development, improvement and innovation in this field. It should be remembered that innovation in e-commerce is understood here as the implementation of solutions specific to the process and related e-commerce business. Such improvements or solutions, whether product, process, organization or marketing – need creating specific value propositions for potential buyers. It is also becoming more and more important for entrepreneurs to create a community around their brand. Members of such a community express a common interest

(or even fascination) with a particular brand, which leads to the creation of a parallel reality (a subculture with its own myths, values, rituals, vocabulary and hierarchy (Borodo, Dębicka, Gutowski, 2019)).

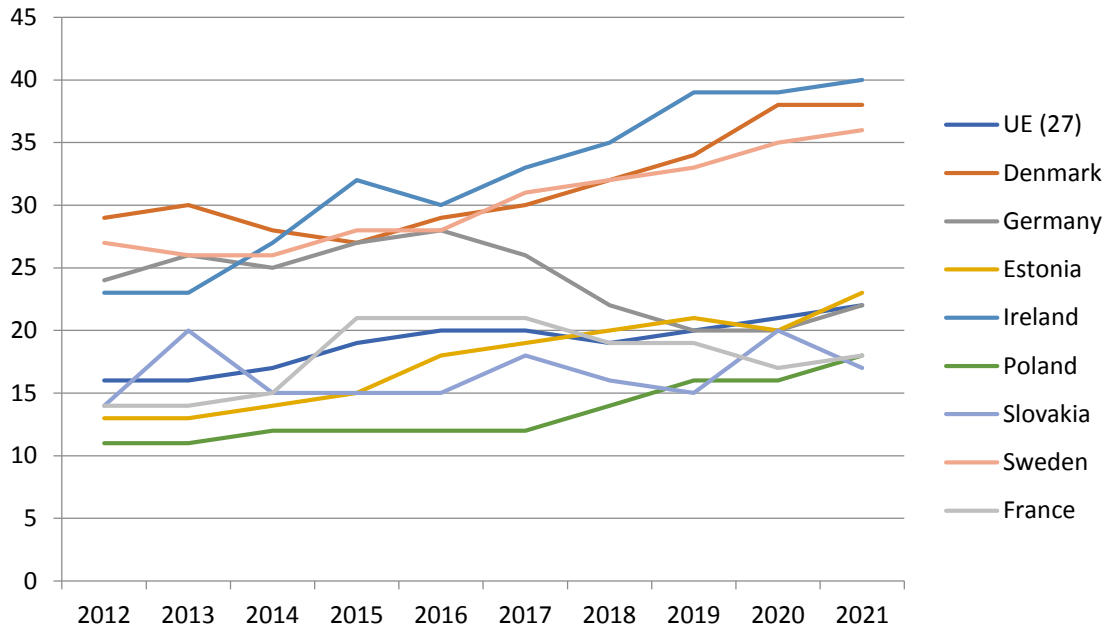


**Figure 1.** The percentage of enterprises conducting e-sales in selected countries (%). Source: own study based on Eurostat data https://ec.europa.eu/Eurostat.

The breakthrough period for the world economy is 2020, when the infectious disease SARS-COV-2 appeared. Due to numerous restrictions caused by the virus, many entrepreneurs moved their activities to the Internet. It gave an opportunity for the dynamic development of e-commerce.

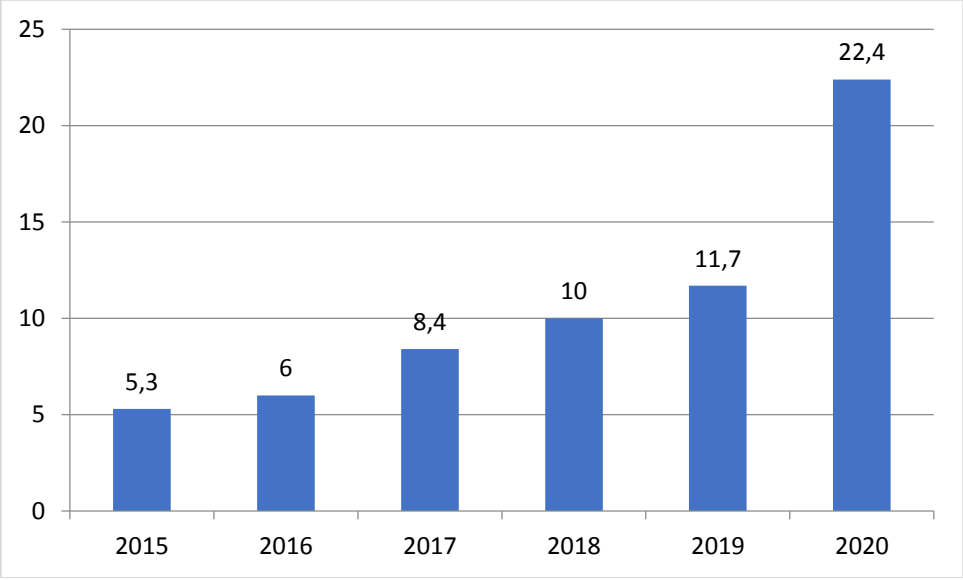


**Figure 2.** Internet sales in Poland in 2015-2020 (billion euro). Source: Tarasiuk, Dłużniewska, 2021.

Along with the development of e-commerce, maritime e-commerce also emerged. They can be defined as making (via the Internet) transactions of purchase and sale of goods and services related to the broadly understood maritime sector (Szyda, 2014). E-commerce emerged in the maritime sector around 2000, especially in B2B relations. In 1999, the Maritime e-Commerce Association (MeCA) was established in Great Britain, bringing together maritime business entrepreneurs and technical experts. MeCA in cooperation with IPMA and ISSA committed to accelerate economic operations related to the maritime sector thanks to the development of applications that meet interoperability standards. Since 2006, the concept of maritime e-commerce has also been indirectly granted by the European Union (Szyda, 2014). By 2018, the EU set out to introduce interoperability standards for ICT systems, improve port operations and integrate logistics chains. Also, initiatives such as e-freight (the introduction of electronic documents at the expense of paper documents) and e-custom (the introduction of an electronic customs office) are perceived favourably for the development of e-business in the maritime economy. Increasing the use of information technologies in the maritime transport sector and improving interoperability contributed to the creation of an infrastructure base for online trade in this sector of the economy (Szyda, 2014).

## 3. Importance of maritime transport and shipping in modern economies

When considering the importance of sea transport and forwarding in modern economies, it is worth first classifying sea transport according to the type of units transporting goods by sea. As Windeck (2012) notes "Within maritime transportation, ocean going ships can be mainly classified into bulk carrier which transport dry bulk products, tankers, carrying for example liquefied gas or crude oil, container ships, general cargo transporting ships and passenger ships" (Windeck, 2012).

Maritime transport and logistics have always been strategic areas that have had a key impact on the economies of many countries, determining their economic and social development. The growth trends of maritime transport were correlated with the growth of world economies over the centuries, but the longest period of growth was experienced by the world economy after World War II (Stanilewicz, 2015). At that time, there was also a rapid increase in maritime transport, which was also contributed to by the economic interference of countries in maritime transport, which was to give a competitive advantage to the economies of these countries over others in the long run. The 1960s also saw a change in the dominance of cargo – the volume of the value of liquid cargoes exceeded the volume of dry cargo. At the end of the 1950s and the beginning of the 1960s, containerization was born (Szyszko, 2010), which had a lasting impact on the models of supply chains in the global economy, in particular in retail trade. The development of maritime transport was so dynamic that at the beginning of the 1970s, the increase in maritime trade was greater than the increase in global GDP (Grzelakowski, 2012).

At the time when container transport was initiated, there was no electronic commerce, but if it were not for container ships, world trade, and in particular e-commerce, would be very limited. Therefore, since the 1990s, the share of container loads in the total maritime trade has been growing, and it has tripled between the year (Grzelakowski, 2012). Along with the increase in container loads, unprecedented problems appeared, which at the beginning of 2021 manifested themselves in the "container crisis", which reflected in congestion in maritime transport and large disruptions in supply chains. It is mainly related to the Chinese container production market, dominated by 3 entities responsible for 80% of global container production (Burdzik, 2021). The example of the crisis also shows the fundamental difference between maritime container transport, or maritime transport in general, and land transport. While the land part of goods logistics may take place in a different relationship between entities – B2B, B2C, C2B etc., modern maritime transport is carried out only in a B2B relationship (Tepe, Arabelen, 2022), which is associated with the emergence of a tendency to concentrate capital in the maritime logistics industry (Stefaniak, 2022).

Another factor exacerbating the container crisis is the impact of the COVID-19 pandemic and its effects on global production, supply chains and warehousing. The sustained increase in both the average capacity of sea-going vessels, including in particular container ships, as well as the growing complexity of global supply chains have forced supply chain planning strategies to specifically address the risk of their disruption (Marzantowicz, Nowicka, 2021). These disturbances were particularly noticeable in the first, most intense phase of the COVID-19 epidemic (Dąbrowska, Dołżyńska, Hryniewicka, 2020), but not only. Shortening supply chains may be a way to maintain sales volumes in specific situations (Brdulak, 2021), but there will still be a large part of global trade requiring maritime transport. As Oyenuga (2022) notes after the COVID-19 pandemic "consolidation in global supply chains may be one of several strategies adopted by MTS actors to mitigate heightened risks or to shore-up compressed margins through cost reductions and scale efficiency gains" (Oyenuga, 2021).

Today, 80% of world trade goods are transported by sea, in terms of their volume. Taking into account the criterion of transport performance, it is 90% (Stanielewicz, 2015), so the share of maritime transport is not only significant, but also dominant. Naturally, supply chains, in particular in e-commerce, are generally composed of various types of transport, in particular land, which is mostly used to deliver goods to retail recipients, but the very fact that China produces a large part of the world's production, in many cases it is almost impossible to shorten supply chains. The disruption of supply chains was particularly evident during the first global lockdown. Deliveries of computers, hardware and electronic components from Asia were disrupted, and at that time the demand for computers increased significantly, which was driven by the obligation or recommendation to work remotely in many industries, in particular education (Stefaniak, 2022). The situation with the container crisis is currently aggravated by another wave of the epidemic. The introduced restrictions resulted in an increase in the number of ships waiting for unloading in Shanghai by over 1/3. The situation is similar also in other

ports in China, which in turn means that the transport of goods from warehouses in China to warehouses in the USA takes more than 70 days longer than before (Rynek Infrastruktury, 2022). Reuters notes that this is consequently leading to a domino effect, as significantly delayed deliveries cause a shortage of available containers in other parts of the world, which translates, for example, into a delay in deliveries from Europe to the eastern shores of North America (Jones, 2022). How much problems in one part of the world translate into all maritime transport can be proved by the fact that when in March 2021 the Ever Green ship blocked the Suez Canal as a result of an accident, for two months 20% of global maritime transport was affected by it (Stefaniak, 2022).

It seems that one of the key elements influencing the development of the maritime transport and forwarding market is the efficiency of container terminals. As Wiśnicki et al. note "The terminal is a complex system, where the interaction between the terminal equipment, containers, and infrastructure is accompanied by uncertainty about the future container market" (Wiśnicki, Chybowski, Czarnecki, 2017).

The container crisis and its consequences perfectly illustrate the importance of maritime transport for the global economy. The increase in costs mainly resulting from this crisis is being translated into global inflation (Carrière-Swallow et al., 2022). This is particularly acute for island or other states whose trade is solely or almost exclusively based on maritime transport. Therefore, preventing the increase in transport costs, primarily by opening and improving the supply chains, in particular by sea, is today a problem not only economic, but also political, because the effects of the current crisis affect not only the economic sphere of countries, but also the social and political ones.

## 4. Changes in the e-commerce market as a challenge for maritime logistics

After the advent of the Internet, retail has undergone a significant transformation. The progressive digitization of modern life enables consumers from virtually every country to reap the benefits of online transactions. The number of online consumers is increasing every year. In 2020, more than two billion people worldwide bought goods or services online. In the same year, e-commerce sales exceeded 4.2 trillion US dollars (Coppola, 2022). According to data from statistica.com, in 2021 e-commerce retail sales amounted to 4.9 trillion US dollars worldwide. Over the next four years, it forecasts an increase in this value by 50%, and by 2025 it will reach a value of approximately 7.4 trillion dollars (Chevalier, 2022). E-commerce has become a significant part of retail. It is estimated that in 2021, e-commerce accounted for 19.6% of retail sales worldwide. It was an increase of 16.8% compared to the previous year. Forecasts for 2025 estimate that e-commerce will account for a quarter of total global retail sales (Coppola, 2022).

Currently, the country that has the most online buyers is China. They have more than the United States, Great Britain and Australia combined. The rapid expansion of e-commerce has transformed China's foreign trade. There are nationwide free-trade zones (FTZs) and 109 pilot import zones for Cross-Border E-Commerce (CBEC). Based on the FTZ, Hainan Province became the first Free-Trade Port (FTP) in the country. On November 15, 2020, 15 fines joined the Regional Comprehensive Economic Partnership (RCEP). It is the largest Free Trade Agreement (FTA) in Asia, accounting for 30.29% of the world's GDP and 30.52% of the world's population (Li, 2021).

According to the FLOW report, which compares data from 2021 to 2019, 76% of buyers made a purchase from a foreign store. In 2019, it was 69%. Barriers to cross-border shopping were similar to 2019. The high cost of shipping was the biggest problem for 45% of respondents. 38% of respondents prefer shopping at local retailers. Slow order delivery (36%) and concerns about site security (34%), lack of trust in cross-border sellers (26%) and high taxes (25%) also proved to be significant barriers. Half of customers buying abroad indicated high shipping costs (51%) or long delivery times (49%) as the main reason for not buying cross-border. High taxes were a barrier for 34% of respondents. By contrast, preference for local sellers was less important (15%). The level of distrust of cross-border sellers (10%) was also lower (FLOW, 2021).

The pandemic influenced purchasing decisions. Most buyers reckoned with the extension of the waiting time for delivery in the post-pandemic period. The exceptions were China and Japan. "Overall, respondents in 5 out of 8 markets stated they shopped more often online as a direct result of the pandemic. In fact, 3 out of 4 shoppers in the UK, China, Canada, Germany, and US agreed with this statement (78%, 77%, 75%, 74%, 74%). Conversely, only half of Japanese shoppers saw the pandemic impacting their shopping online (54%)" (FLOW, 2021).

Online trade has an impact on the efficiency of logistics processes, including transport. The influence of e-commerce on transport services is presented in various ways in the literature. Some authors claim that the development of e-commerce will increase freight transport, while others note that it may contribute to an increase in consumption (Milewski, 2019, p. 147). The involvement of large logistics operators can make e-commerce distribution more profitable. Thanks to the economies of scale, they are able to deliver goods to customers at lower costs without reducing the level of customer service. It may also reduce the negative impact on the natural environment (Milewski, 2019, p. 153). This should be done in accordance with the paradigm of sustainable development, which in a broader sense is understood as a balance between economy, society and the environment (Milewska, 2019).

The supply chain is going through a crisis, driven, among other things, by an increase in e-commerce sales. "The disruptions we are witnessing today in the form of blockades, port congestion, lack of goods, equipment and labour, and most of all global inflation and soaring freight rates, is just a textbook case of Keynesian over-demand against an aggregate supply that has declined for over more than one year"(Kent, Haralambides, 2022). These problems may

have been caused by an imperfect supply chain based on the Just-In-Time (JIT) paradigm. JIT and lean logistics practices encourage logistics service providers to continuously reduce costs. Logistics that relies on minimizing inventory costs depends on efficient transport systems. In the face of stiff competition, lead time can be an effective tool. Customers expect faster and faster deliveries of what they ordered. Due to the long waiting time to call at the port, the delivery time for orders by sea is significantly extended. The reasons for long queues in ports are primarily the inability to efficiently handle containers. This leads to a shortage of terminal capacity. There is talk of a global crisis related to the shortage of containers. The crisis is disrupting international trade with knock-on effects in the global supply chain. The main reasons for the shortage of containers include: reduction in the number of available containers, port congestion, decrease in the number of ships, increase in consumption (Burdzik, 2021). In the Los Angeles metropolitan region, the problem is the evacuation of containers. Their excess is stored outside the warehouse yards. Supply chain disruptions need to be addressed holistically, including through the development of supply chain emergency response plans (Kent, Haralambides, 2022). The implementation of blockchain-based technology may help in achieving higher volumes with the same asset base (Kuś, 2021).

Moreover, what is very important in the reality of the post-pandemic crisis, it is worth paying attention to the indications of the report of the UN Economic Commission for Europe (ECE), the Handbook for National Masterplans for Freight Transport and Logistics, which contains guidelines for governments on how transport and logistics services can contribute to economic recovery and economic growth during the post -pandemic period. Logistic operators, thanks to intermodal operations of Intelligent Transport Systems (ITA) and telematics, should be able to smoothly move cargo between different modes of transport and logistics networks (UNCTAD, 2021).

## 5. Conclusion

The COVID-19 pandemic, in addition to the currently observed global inflationary pressure, made consumers look for safe ways to meet their needs. This resulted in a sudden increase in e-commerce sales. As this article has shown, this increase, unfortunately, coincided with the deteriorating functioning of global logistics and maritime shipping channels caused, among other things, by inability to efficiently handle containers, their lack, port congestion, limited terminal capacity. The greater number of orders, combined with the expectation of quick delivery, created the need for better logistics facilities. Investment decisions and planning will be increasingly influenced by the port surroundings, in the vicinity of warehouse or distribution facilities and their end markets. There should be space for modern logistics in the ports. Port investments are related to technologies for monitoring supply chains, detecting potential

disruptions and tracking shipments to their destinations. To facilitate e-commerce logistics operations, port operators need to be able to process data efficiently. Logistics in ports should increasingly rely on digitization. Ports should be intelligent logistic nodes that use modern technology to connect different modes of transport. This will improve the supply chain at national, regional and international level. In times of congestion and disruptions, ports should operate in an agile manner, using data provided on an ongoing basis from the Internet of Things (IoT) technology and intermodal transport (UNCTAD, 2021). The presented analysis raises further important research questions that should in the future constitute a reason for undertaking extended research: will the maritime transport and shipping market continue to develop dynamically in the conditions of the observed inflationary pressure? Will the tense international situation and the related uncertainty change the rules of its functioning? Answers to these questions will require in the future an in-depth analysis of the literature and data on the functioning of the maritime transport and shipping market after the COVID-19 pandemic.

## References

1. Błońska, K., Konieczek, D., Konieczek, M. (2015). *Internet jako przestrzeń rynku*. Toruń: Rynek-Społeczeństwo-Kultura, Uniwersytet Mikołaja Kopernika w Toruniu.
2. Borodo, A., Dębicka, O., Gutowski, T. (2019). Innovations in e-commerce: value position for e-buyers. *Zeszyty Naukowe Akademii Morskiej w Szczecinie*.
3. Brdulak, H. (2021). *Wczoraj, dziś i jutro branży TSL – diagnoza i trendy*, https://forsal.pl/gospodarka/pkb/artykuly/8058002,wczoraj-dzis-i-jutro-branzy-tsl-diagnoza-i-trendy.html, 10.05.2022.
4. Burdzik, T. (2021). Gdz*ie są kontenery? Globalny kryzys kontenerowy opóźnia transport morski,* https://www.gospodarkamorska.pl/gdzie-sa-kontenery-globalny-kryzys-kontenerowy-opoznia-transport-morski-59960, 4.05.2022.
5. Burdzik, T. (2021). *W pogoni za kontenerem. Globalny kryzys kontenerowy nadal się pogłębia,* https://www.gospodarkamorska.pl/w-pogoni-za-kontenerem-globalny-kryzys-kontenerowy-nadal-sie-poglebia-60520, 9.05.2022.
6. Carrière-Swallow, Y. et al. (2022). *Shipping Costs and Inflation*. International Monetary Fund.
7. Chevalier, S. (2022). *Annual retail e-commerce sales growth worldwide from 2017 to 2025. Statista.* Available from: https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/, 4.05.2022.
8. Coppola, D. (2022). *E-commerce as percentage of total retail sales worldwide from 2015 to 2025.* Available from: https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/, 4.05.2022.

9. Coppola, D. (2022). *Annual retail e-commerce sales growth worldwide from 2017 to 2025.* Available from: https://www.statista.com/statistics/288487/forecast-of-global-b2c-e-commerce-growth/, 4.05.2022.
10. Coppola, D. (2022). E-commerce worldwide. Available from: https://www.statista.com/topics/871/online-shopping/#dossierKeyfigures, 4.05.2022.
11. Dąbrowska, J., Dołżyńska, E., Hryniewicka, G. (2020). Wpływ nieprzewidzianych zdarzeń na łańcuchy dostaw na przykładzie pandemii COVID-19. *Akademia Zarządzania, 4(2).*
12. Eurostat, https://ec.europa.eu/Eurostat.
13. FLOW (2021). *Cross-Border E-Commerce Consumer Report*. Available from: https://www.flow.io/, 5.05.2022.
14. Grzelakowski, A. (2012). Globalizacja i jej wpływ na rozwój transportu morskiego i globalnych łańcuchów dostaw. Wyzwania gospodarki globalnej. *Prace i Materiały Instytutu Handlu Zagranicznego Uniwersytetu Gdańskiego, no. 31*.
15. Jones, M. (2022). *Snarled-up ports point to worsening global supply chain woes – report,* https://www.reuters.com/business/snarled-up-ports-point-worsening-global-supply-chain-woes-report-2022-05-03/, 10.05.2022.
16. Kent, P., Haralambides, H. (2022). A perfect storm or an imperfect supply chain? The US supply chain crisis. *Maritime Economics & Logistics,* pp. 1-8.
17. Konopielko, Ł., Wołoszyn, M., Wytrębowicz, J. (2016). *Handel Elektroniczny – ewolucja i perspektywy.* Warszawa: Oficyna Wydawnicza Uczelni Łazarskiego.
18. Kuś, P. (2021). *Globalna przepustowość portów kontenerowych będzie miała trudności z nadążeniem za rosnącym popytem.* Available from: https://www.gospodarkamorska.pl/globalna-przepustowosc-portow-kontenerowych-bedzie-miala-trudnosci-z-nadazeniem-za-rosnacym-popytem-60122, 4.05.2022.
19. Li, Q. (2021). E-commerce, free-trade zones, and the linkage effect to China's foreign trade. *The Chinese Economy, 54(6),* pp. 441-449.
20. Marzantowicz, Ł., Nowicka, K. (2021). Disruption as an element of decisions in the supply chain under uncertainty conditions: A theoretical approach. *Scientific Journals of the Maritime University of Szczecin*.
21. Merk, O., Hoffmann, J., Haralambides, H. (2022). Post-COVID-19 scenarios for the governance of maritime transport and ports. *Maritime Economics & Logistics*, pp. 1-13.
22. Milewska, B. (2019). The e-commerce logistics models of Polish clothing companies and their impacts on sustainable development. *Scientific Journals of the Maritime University of Szczecin*, pp. 140-146.
23. Milewski, D. (2019). Impact of e-commerce on external transport costs. *Scientific Journals of the Maritime University of Szczecin,* pp. 147-153.
24. Oyenuga, A. (2021). Perspectives on the impact of the COVID-19 pandemic on the global and African maritime transport sectors, and the potential implications for Africa's maritime

governance. *WMU J. Marit. Affairs 20,* 215-245, https://doi.org/10.1007/s13437-021-00233-3.

25. Rynek Infrastruktury (2022). *Chiny: statki czekają na wejście do portu. „Oto strategia zero covid",* https://www.rynekinfrastruktury.pl/mobile/chiny-statki-czekaja-na-wejscie-do-portu-oto-strategia-zero-covid-81331.html, 11.05.2022.
26. Stanielewicz, J. (2015). *Wpływ kryzysów ekonomicznych na zmiany w morskiej żegludze światowej od końca XIX wieku.* Szczecin: Zeszyty Naukowe Uniwersytetu Szczecińskiego.
27. Stefaniak, P. (2022). *Trudna sztuka naprawiania zepsutej logistyki morskiej*, https://www.obserwatorfinansowy.pl/tematyka/makroekonomia/trendy-gospodarcze/trudna-sztuka-naprawiania-zepsutej-logistyki-morskiej/, 12.05.2022.
28. Szyda, M. (2014). Zastosowanie handlu internetowego w sektorze morskim. *Contemporary Economy*.
29. Szyszko, M. (2010). *Historia kontenerowych przewozów morskich na świecie*. Szczecin: Świat Morskich Publikacji. Biblioteka Cyfrowa.
30. Tarasiuk, W., Dłużniewska, J. (2021). *Wpływ pandemii COVID-19 na rozwój sektora e-commerce w Polsce.* Academy of Management.
31. Tepe, R., Arabelen, G. (2022). Relationship marketing strategies in the container shipping industry: A qualitative approach. *Scientific Journals of the Maritime University of Szczecin*.
32. UNCTAD (2021). Review of Maritime Transport 2021. Available from: https://unctad.org/system/files/official-document/rmt2021_en_0.pdf, 5.05.2022.
33. Windeck, V. (2013). Maritime Transportation. In: *A Liner Shipping Network Design. Produktion und Logistik.* Wiesbaden: Springer Gabler, https://doi.org/10.1007/978-3-658-00699-0_2.
34. Wiśnicki, B., Chybowski, L., Czarnecki, M. (2017). Analysis of the Efficiency of Port Container Terminals With the Use of the Data Envelopment Analysis Method of Relative Productivity Evaluation. *Management Systems in Production Engineering, No. 1(25),* pp. 9-15, DOI 10.1515/mspe-2017-0001.
35. Żurak-Owczarek, C. (2013). E-biznes w wymiarze globalnym i lokalnym. Analiza i próba oceny. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.

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# PERMIT TO WORK AND RISK ANALYSIS AS AN ELEMENT OF SAFETY MANAGEMENT SYSTEMS APPLIED ON OIL AND GAS INSTALLATIONS

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**Purpose:** To present the Permit to Work procedures used as a part of safety management systems applied on offshore oil and gas installations.
**Design/methodology/approach**: The analysis of Permit to Work systems and the Task Risk Assessments/Safety Job Analysis based on the current international regulations and guidance.
**Findings:** Permit to Work system is a process requiring continuous development and contribution from all parties involved in the activities carried out on the offshore oil and gas installations.
**Research limitations/implications**: Legal regulations and guidance only give a framework for development of the Permit to Work System thus there is no uniformity between the systems applied by various oil and gas operators.
**Practical implications:** International Safety Watchdogs could provide better guidance for development of the Permit to Work Systems. This would allow uniformity between different oil and gas companies.
**Social implications:** PTW systems allows elimination or at least mitigation of risk associated with potentially dangerous activities carried out on the offshore installations.
**Originality/value:** Recommendation to uniform Permit to Work Systems and to implement Dynamic Risk Assessment into Permit to Work Systems.

**Keywords:** Permit to Work System, Task Risk Analysis.

**Category of the paper:** Viewpoint and Research paper.

## 1. Introduction

On 6 July 1988 167 men died as a result of an explosion and fire on board the Piper Alpha platform in the UK Sector of the North Sea. A public inquiry into the disaster was held, headed by Lord Cullen, to investigate the cause of the disaster and to make recommendations to prevent a similar occurrence in the future. Lord Cullen issued his report in December 1990 which included 106 recommendations. He concluded that one of the primary causes of the disaster

was a failure in one of the key management systems – his report highlighted a number of deficiencies in the operation of the Permit to Work System. One of the most significant causes of the tragedy on Piper Alpha was the breakdown in coordination of hazardous activities. This should have been achieved through the Permit to Work procedures (Booth, Butler, 1992; Guidelines…, 1993; Kyle, 1991). According to study (Okoh, Haugen, 2014), 80 out of 183 major accidents which occurred in XXI century in the US and Europe, maintenance was linked to 80 (44%). The results also show that "lack of barrier maintenance" (50%), "deficient design, organization and resource management" (85%) and "deficient planning/scheduling/ fault diagnosis" (69%) are the most frequent causes in terms of the active accident process, the latent accident process and the work process respectively. Majority of those accidents could be attributed to poor PTW System performance. The petroleum industry handles, stores and processes large quantities of hazardous substances including flammable and toxic materials, so the potential for serious accidents is very high. To prevent such incidents it is vital that there should be effective management of hazards, including the use of safe systems of work with PTW System being the key safety management system. Permit to Work (PTW) is a key part of managing work activities that have inherently higher risks or unique aspects that could lead to a higher level of risk than routine or daily work activities. It is supported by other management policies, procedures and processes to regulate all work activities and to manage risk. When incidents do occur, human factors, such as failure to implement procedures properly, are often a root cause. These failures may in turn be attributable to a lack of training, instruction or understanding of either the purpose or practical application of a Permit to Work Systems (Kyle, 1991; HSG250…, 2005). Number of regulations were introduced in the Offshore Oil and Gas Industry requiring the implementation of Permit to Work Systems for certain specified activities (Kyle, 1991; HSG250…, 2005; Mines Safety and Inspection Act, 1994; Norwegian Oil…; HSG253…). For the floating offshore installations like e.g. Drill Ships, Floating Productions Offloading Storage (FPSO), drilling semisubmersibles etc. apart from Offshore Oil and Gas Industry regulations also International Marine Organization Conventions apply. IMO has established an international standard for the safe management and operation of ships at sea (International Convention…, 2015; The International Safety Management (ISM) Code, 2015; Code of Safe…, 2018) – the International Safety Management Code (ISM) which is partly applicable to the floating oil and gas installations.

## 2. Permit to Work Systems

A Permit to Work System is an integral part of an offshore installation safety management system and its main function is to manage the wide range of activities which can take place close together in a small space, e.g. drill floor, machinery room or process plant. Permit to Work

Systems form an essential part of the task risk assessment process. When a task is identified an appraisal should be carried out to identify the nature of the task and its associated hazards. Next, the risks associated with the task should be identified together with the necessary controls and precautions to mitigate the risks. The extent of the controls required will depend on the level of risk associated with the task and may include the need for a permit-to-work. A permit to work is not simply permission to carry out an activity. It is a part of a system which determines how the task is to be carried out in a safe manner. It also helps to communicate this to the work party. It should not be regarded as an easy way to mitigate or eliminate hazard or reduce risk. PTW does not make a job safe. That can only be achieved by persons preparing for the work, supervising the work and persons carrying it out. Additionally other precautions may need to be taken – e.g. isolation, or work areas access barriers – and these will need to be identified in the Task Risk Assessment (TRA) before any work is commenced.

The PTW System should ensure that authorized and competent people have thought about foreseeable risks and that such risks are avoided by using suitable precautions. Those carrying out the job should think about and understand what they are doing to carry out their work safely, and take the necessary precautions for which they have been trained and made responsible (Guidelines…, 1993; HSG250…, 2005). A PTW System is a formal written system designed to control certain types of work that are identified as potentially hazardous.

The UK Health and Safety Executive defines a PTW System as a formal and recorded process used to control work which is identified as potentially hazardous, and also a means of communication between site/installation management, plant supervisors and operators and those who carry out the hazardous work (HSG250…, 2005; Jahangiri et al., 2016). The PTW document involves the issuing party and the work party; both parties agree on the conditions, preparations, precautions and limitations. They have to be clearly specified and understood before work begin. The permit records the steps to be taken to prepare the equipment, or work area such as drill floor, process plant etc. for the work, and the safety precautions, safety equipment required on the work site and specific procedures that must be followed to enable the work to be performed in a safe manner. International regulations and guidelines specific for the Oil and Gas Industry provide the following general procedures required for the proper implementation of a PTW System:

- Clear identification of roles and responsibilities.
- Procedure for completing forms, instruction in the issue, use and closure of permits.
- Standardized identification of task, risk assessments, permitted task duration and supplemental or simultaneous activity and control measures along with the modes of communicating.
- Facilitate the flow of information between the various parties involved in the job.
- Monitoring and auditing to ensure that the system works as intended.

A Permit System could be paper-based or electronic and is devised by each company to meet specific requirements. There are permits which vary vastly in processes, procedure, terminology and system. The PTW System should have a clear communication between everyone involved, and it should be designed by the company taking into consideration individual site conditions and requirements. Different permit forms may be needed for separate tasks, such as hot work, working at height and confined space entry, so that enough emphasis can be given to the particular hazards present and the precautions required. A Permit to Work shall be used where there is an increased risk to personnel or the environment or the structural integrity of the oil and gas installation is compromised because of work on safety critical elements or where the work involves any of the oil and gas safety systems. Examples are:

- Working at a height.
- Work on safety critical equipment/ systems and or the isolation/ inhabitation of same.
- Work on machinery, which is normally started automatically or from a remote position.
- Work on systems, which contain fluid or gas under pressure.
- Work involving radioactive materials.
- Work on high voltage equipment.
- Work on watertight doors that could risk the integrity of the oil and gas installation.
- Work, which involves entry to enclosed spaces.

## 3. Risk assessment process

An essential part of the Permit to Work Systems is a task risk assessment process. The extent of the controls implemented by the PTW will depend on the level of identified risk. It is a legislative requirement that a detailed risk assessment of activities performed onboard offshore oil and gas installations is carried out to determine the associated hazards. It is essential to base assessments of each activity on practical knowledge of the tasks, the equipment and the skills required. Such assessments are to be conducted by appropriately experienced persons, who have knowledge of the conditions which could prevail at a specified worksite during a particular activity or combination of activities. By reviewing the various task a job consists of, it can be identified what can go wrong and the necessary safeguards needed to control or mitigate the risk from each stage of the work. This is a risk assessment but when carried out for a particular worksite task, it becomes task specific and is termed a Task Risk Assessment (TRA).

The TRA documents the analysis of a task-based activity focusing on the safety critical aspects and controls and clearly identifies hazards encountered within a job, risk rating (pre- and post-control measures), control measures to reduce and control the risks from each

hazard and safety equipment required when doing the job. Where risk cannot be engineered out or reduced by substitution, then suitable control measures (safe systems of work) shall be put in place e.g. permit to work. Where such control measures are implemented, it is essential that they are maintained up-to-date and used properly. The TRA may be used to develop operational procedures (work instructions) to allow work to be conducted in a controlled manner, which eliminates or reduces the risk or alternatively, revalidates existing procedures or instructions.

### 3.1. Risk Assessment Matrix

The TRA shall be utilised as the basis for job planning and worker briefings during toolbox talk meetings, supported by the Task Evaluation and Toolbox Talk Record. Oil and Gas Industry utilises a Risk Assessment Matrix to carry out qualitative risk assessment of the activities undertaken on offshore oil and gas installations. The three most popular sizes of a risk matrix used by the industry are 3x3, 4x4, 4x5 and 5x5. The Matrix allows individuals, work groups, etc. to determine the risk rating based upon the severity and probability of the hazard or potential hazard associated with the work area or task (ISO 45001, 2021; MIL-STD-882E, 2021; Kovačević et al., 2019). Figure 1 shows risk matrix 5x5 nowadays used by most of oil and gas companies.


**Figure 1.** HSE Risk Assessment Matrix. Source: HSG250 - HSE Guidance on permit-to-work systems: A guide for the petroleum, chemical and allied industries.

Such a risk matrix can be used as the starting point for assessment of the activities to be performed, whether by an individual or a dedicated workgroup. Once the requirement to undertake a task has been identified, the task must be subject to an initial assessment using the Risk Matrix. The initial assessment shall include the following steps:

- Determine the severity of conducting the task taking into consideration the potential consequences associated with personnel, asset, operations and environment. This will determine the overall severity rating, i.e. Major, Serious, Moderate, Minor and Negligible.
- Determine the probability that the potential consequences will occur.
- Follow the hazard severity across the line until it dissects with the identified probability rating to give an initial risk rating.

The risk ratings shown on the matrix are colour coded. If the initial risk rating is red or yellow, a full risk assessment shall be conducted. If the initial risk rating is green, only a task evaluation and toolbox talk meeting shall be held, prior to commencement of the task.

Key steps in conducting the risk assessment (with initial risk red or yellow) are:

- When a job is identified, the first action is to carry out an initial appraisal, which will identify the need for any special safety studies or assessments.
- Where a job is more complex and comprises a number of job steps, these shall be broken down into individual steps and assessed separately.
- Hazard identification and risk assessment shall include a visit to the worksite, where practicable.
- Consideration should be given to who might be harmed and how.
- The next stage involves identifying the hazards associated with the task, assessing the initial risk ratings and identifying the controls and precautions required to mitigate those risks.
- The extent of the controls identified will depend upon the level of risk - the higher the risk, the greater the degree of control.
- After identification of controls and precautions, the risk rating shall be re-assessed to provide the residual risk rating – rating after control measures are applied (The Management of Health…, 1999).

Figure 2 presents an example of the flow graph describing the process of issuing the TRA in the electronic Permit to Work System.

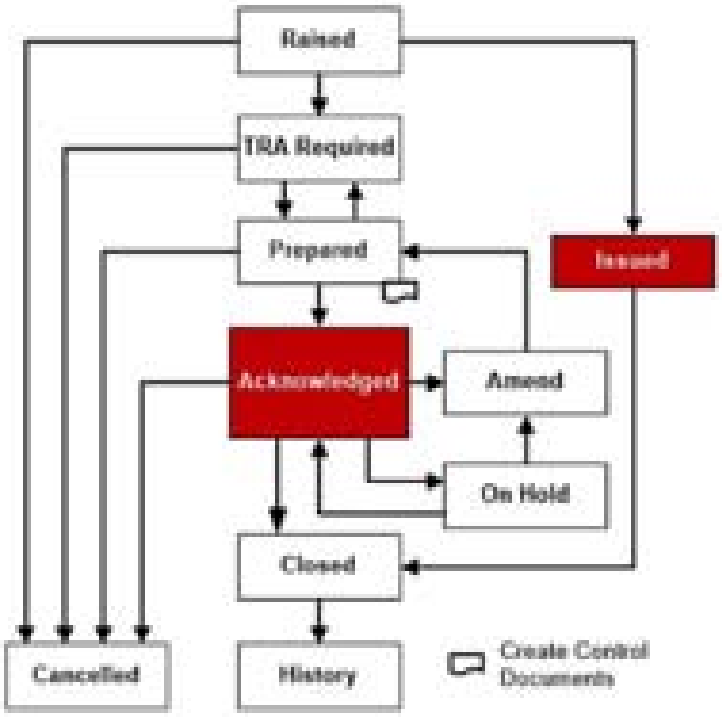


**Figure 2.** Task Risk Assessment state flow diagram. Source: Engica Q4 user guide.

### 3.2. Task Evaluation and Toolbox Talk

Task Evaluation (TE) and Toolbox Talk (TBT) Meetings (when initial risk rating is green) should be conducted prior to the commencement of a job, with all members of the workgroup present. Toolbox talk meetings are required, in order to ensure all members have a clear understanding of safety procedures, the job scope and its methodology, individual and collective responsibilities, hazards involved in the activities and control measures required to eliminate or mitigate the risk. All members of the work group should participate. If there is any identified change to the agreed job scope, methodology, worksite or environmental conditions or workgroup members, the job must be stopped and re-assessed. Further toolbox talk should be held prior to re-commencement of the job.

Where a Task Risk Assessment/ Permit to Work is in place, Task evaluation and Toolbox Talk Meetings should also be carried out and additionally the identified hazards/controls should be re-iterated to the workgroup/ individual as part of the toolbox talk.

### 3.3. Task Risk Assessment for a previously assessed task

Tasks that have previously been risk assessed should not need a new TRA each time they are done, however the TRA should be reviewed and adjusted accordingly prior to commencement of an activity to ensure that the content is applicable to the current workscope, workgroup and worksite. The following points should be considered when conducting a review of an existing TRA:

- Has the work site been revisited by the TRA team?
- Have any of the tasks' steps changed?
- Are there any additional hazards?
- Can the controls be improved?
- Are there any new external influences on the activity?

If, as part of this assessment, it is found that the previous assessment is inadequate and/or not relevant for the task in hand, then a new TRA should be performed.

### 3.4. Dynamic Risk Review (DRR)

Traditional TRA is about identifying risks in the workplace so that suitable controls can be implemented prior to commencement of the job. TRA limitations, such as its inability to update the risk picture, led to the development of several recent dynamic risk assessment approaches [17]. Dynamic Risk Assessment (DRA) is one of them. It can help people manage additional or unseen risks as they arise. Risk is an evaluation of hazard and likelihood, the only thing that changes is whether you are carrying out the assessment in advance (traditional TRA) or at the time (DRR). Dynamic Risk Assessment can be defined as "The continuous process of identifying hazards, assessing risk, taking action to eliminate or reduce risk in the rapidly changing circumstances of an operational incident."

Dynamic Risk Review (DRR) derives from the Dynamic Risk Assessment process and has been adopted by a growing number of organisations It has also been broadly implemented in the oil and gas sector in recent years. DRR complements the TE/TRA/TBT process and importantly helps workers identify hazards that may arise during the task. The DRR process should be used to assess the risks at the workplace during the task following any planned or unplanned interruptions, when any team members expresses safety concerns, at key stages of the task or whenever requested by work party (Villa et al. 2016).

## 4. Permit to Work System responsibilities and procedures

International regulations and guidelines related to Permit to Work System (including ISM Code) give only very general framework required to implement the system. Thus there will be many differences between PTW Systems established by offshore operators. The below chapters presents an example of one of the systems used by the international oil and gas company

### 4.1. Offshore Installation Manager

The Offshore Installation Manager (OIM) has overall responsibility for the function of the Permit to Work System onboard oil and gas installation. The responsibilities include:

- Personnel competence in the company PTW System.
- The planning, issue and return of Permits to Work is properly coordinated.
- A secure method of electrical and mechanical isolation is implemented.
- Adequate time is allowed during shift changes to ensure effective transfer of information relating to Permits to Work.
- The Permit to Work System is regularly monitored for effective implementation.

### 4.2. Responsible Person/Issuing Authority

Responsible Person (RP)/Issuing Authority is a person designated by the OIM, who has the authority to issue the Permit to Work to the person in charge of the work (Work Group Leader). The Responsible Person responsibility is to ascertain that all practicable steps have been taken to ensure the safety of the installation and the personnel before issuing a Permit to Work:

- The nature of the work is fully understood.
- All the hazards associated with the job are identified.
- All necessary precautions and protection measures as identified in the Task Risk.
- Assessment are detailed and implemented, including isolations, before work begins.
- All people, who may be affected by the work are informed before the work begins, when the work is suspended and when the work is complete.
- Permits to Work for tasks that may interact are cross-referenced.
- Effective arrangements are made for the work site to be examined before work begins, on completion of the work and as appropriate, when work is suspended.
- Sufficient time is spent on shift handover to discuss all ongoing or suspended Permits to Work with the oncoming Work Group Leaders.

### 4.3. Work Group Leader

Work Group Leader (WGL) is the person in charge of the work. The Work Group Leader is responsible for verifying that all required control measures and precautions (as detailed by the Responsible Person) are in place, prior to commencement of work. The Work Group Leader is specifically responsible to ensure that:

- The work group members have received adequate instruction in the Permit to Work System.
- The job is discussed fully with the person issuing the Permit to Work (Responsible Person).

- The work group are briefed on the details of the Permit to Work and supporting documentation, including any potential hazards and all the precautions that have to be taken through a task evaluation/toolbox talk.
- The precautions and protective measures are in place before the work commences and maintained for the duration of the work activity.
- The Permit to Work supporting documentation is clearly displayed at the worksite.
- The work group members understand that if circumstances change, the work must be stopped and the Work Group Leader informed immediately.
- The work group stays within the limitations set on the Permit to Work.
- In the event of a oil and gas installation emergency alarm, the Permit to Work is returned to the Permit Control Centre (where circumstances allow).
- On completion or suspension of the work, the worksite is left in a safe condition and the Responsible Person is informed accordingly.

### 4.4. Authorized Gas Tester

Authorized Gas Tester (AGT) – the OIM will appoint persons authorized to carry out gas testing on board. AGT must have the relevant certification to perform such duties and perform testing as per the requirements stipulated on the entry documents for the specific task.

### 4.5. Permit Coordinator

The OIM is responsible for appointment of the Permit Coordinator. Their main responsibilities is to co-ordinate work activities to ensure potential interactions associated with the work to be carried out are identified and conflicts resolved. Permit coordinator is also the administrator of the PTW System.

### 4.6. Workgroup

Workgroup Members are individuals working within the Permit to Work System. They will ensure that:

- They have received instruction and have a good understanding of the Permit to Work System.
- They do not start any work requiring a Permit to Work, until it has been properly authorized and issued.
- They receive a briefing from their Work Group Leader on the particular task and they understand the hazards and the precautions taken or precautions/protective measures to be taken.
- They follow the instructions specified on the Permit to Work and associated Task Risk Assessment.

- When they stop work, the site and any equipment they are using is left in a safe condition.
- If they have any doubt or if circumstances change, they must stop work immediately and discuss the matter with their Work Group Leader.
- In the event of an oil and gas installation emergency alarm, they stop work and make the worksite safe.

### 4.7. Daily Permit to Work Planning Meeting

OIM conducts a daily Permit to Work Planning Meeting with direct involvement of members of the offshore installation management team. The meeting ensures through careful planning, appropriate approval for the work activities, identification of potential conflicts of work, persons in charge of work areas, which may be affected by the work activity, are made aware and can take necessary precautions against possible interaction with other work.

### 4.8. Worksite Monitoring

Specific Permit to Work monitoring should be carried out to ensure that all procedural requirements, including precautions/protective measures as detailed on Permits to Work, are being complied with. Regular monitoring activities should take place, often on a daily basis.

### 4.9. Emergency situations

During an emergency all work is to cease. Permits to Work should be returned to the Permit Control Centre for formal suspension and the worksite left in a safe condition. However, where circumstances do not allow return of the Permits to Work to the Permit Control Centre, the worksite must be left in a safe condition. Post emergency situation, whereby normal operations can resume, it is necessary for Work Group Leaders to conduct a re-assessment of all work activities that are subject to Permits to Work. This is to ascertain that conditions have not altered as a result of the emergency and that the Permit to Work, conditions and precautions/ protective measures remain valid.

## 5. Different types of permits

As it has been mentioned before, regulations and guidelines only give general framework for development of the PTW System. Similar terminology may be used by different offshore companies for types of permits which are fundamentally different. Some of the permits may be called either permits or certificates. The chapter presents types of permits and certificates used

by one of the international offshore companies. Figure 3 shows typical permit flow diagram describing the process of issuing a permit (applicable to hot, cold and electrical permits).

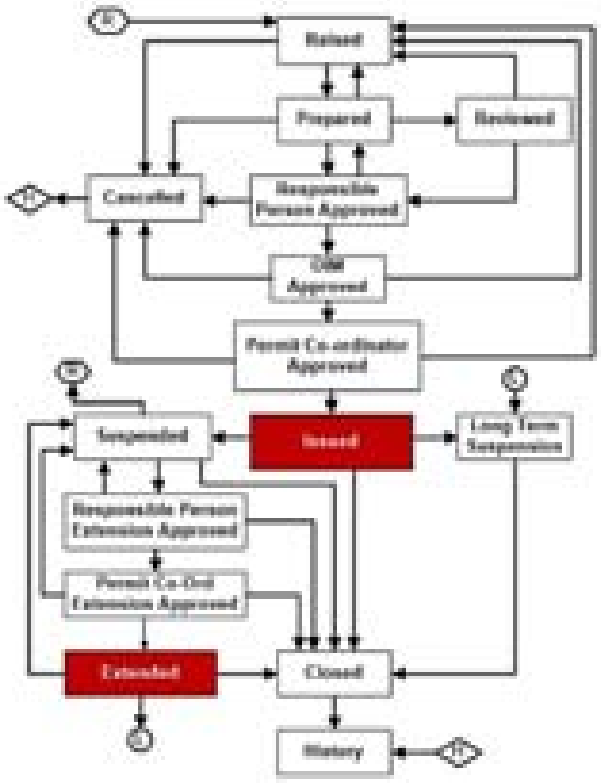


**Figure 3.** Permit state flow graph. Source: Engica Q4 user guide.

### 5.1. Hot work permit

Hot work is usually taken to apply to an operation that could include the application of heat, naked flames, welding, cutting, grinding or ignition sources to tanks, vessels, pipelines etc. which may contain or have contained flammable vapor, or in areas where flammable atmospheres may be present. Hot work permits, typically colored red, are more generally applied to any type of work which involves actual or potential sources of ignition and which is done in an area where there may be a risk of fire or explosion, or which involves the emission of toxic fumes from the application of heat. They are normally used for any welding or flame cutting, for the use of any tools which may produce sparks and for the use of any electrical equipment which is not intrinsically safe or of a suitably protected type.

### 5.2. Cold work permit

Cold work permits, typically coloured blue, are frequently used to cover a variety of potentially hazardous activities which are not of a type covered by a hot work permit. Cold work permits are issued when there is no reasonable source of ignition, and when all contact with harmful substances has been eliminated or appropriate precautions taken.

The activities for which a cold work permit may be appropriate will vary from site to site but should be clearly defined.

### 5.3. Electrical work permit

An electrical permit-to-work is primarily a statement that a circuit or item of equipment is safe to work on. A permit should not be issued on equipment that is live. Further guidance on electrical work permits is given in regulations (HSE HSG85, 2013).

### 5.4. Equipment disjointing certificate/breaking containment permit

This type of certificate is used for any operation that involves disconnecting equipment or pipe work that contains (or has contained) any hazardous or high-pressure fluids or other substances. This type of certificate will normally be used for the insertion of spades into pipe work, and for the removal of such spades. These permits are typically used in the upstream process plants

### 5.5. Confined spaces entry certificate

Once an area has been classified as a ‘‘confined space’’, a confined space entry permit is required for all entry or work to be conducted in a confined space. Confined space entry certificates (unless detailed on a hot work or cold work permit) are used to specify the precautions to be taken to eliminate exposure to dangerous fumes or to an oxygen-depleted atmosphere before a person is permitted to enter a confined space. The certificate should confirm that the space is free from dangerous fumes or asphyxiating gases. It should also recognise the possibility of fumes desorbing from residues, oxygen depletion of the atmosphere as a result of oxidation, or the ingress of airborne contaminants from adjacent sources. The certificate should specify the precautions to be taken to protect the enclosed atmosphere against these hazards, e.g. by forced ventilation, physical isolation or by the provision of personal protective equipment including breathing apparatus.

### 5.6. Isolation certificate

Equipment and plant that should be isolated before work is commenced include:

- Machinery – should be isolated from its power supply (electrical, pneumatic or hydraulic) or, if engine driven, the starting system or engine disconnected. Where necessary the equipment should be prevented from moving e.g. from gravity fall of release of pressure, by positive physical means.
- Pressurized systems – of all kinds should be isolated and depressurized.
- Chemical systems – where pipework, vessels or tanks containing fluids or materials which are hot, very cold, flammable, toxic, corrosive, or under pressure, they must be

isolated from their source of supply and drained, purged and decontaminated as necessary.

- Electrical systems – capable of causing a hazard to personnel working on it or of igniting a flammable atmosphere should be isolated, proved dead and earthed.
- Safety and emergency systems – require isolation or inhibition for maintenance. Where the intention is to avoid unnecessary operation of alarms or emergency systems, then inhibition or manual control is to be preferred.

Isolations are the major requirement before working on electrical or mechanical system. Before a PTW can be issued for a task, a risk assessment must be conducted to determine equipment isolation requirements. It is usually used as a means of ensuring that the particular equipment is mechanically and electrically isolated before it is worked on. It is possible that a similarly named certificate may be used for chemical isolation of plant before work is done on it or entry is made. If so, these should be cross-referenced to associated permits. Isolation tags are usually provided as a part of the isolation process. The purpose of these tags is to ensure clear identification of individual isolation in cases of multiple isolation works. The tag number (pre-printed) and lock-out number (to be inserted) is cross-referenced with the isolation certificate number. Figure 4 shows typical flow diagram describing the process of issuing the Isolation Certificate.

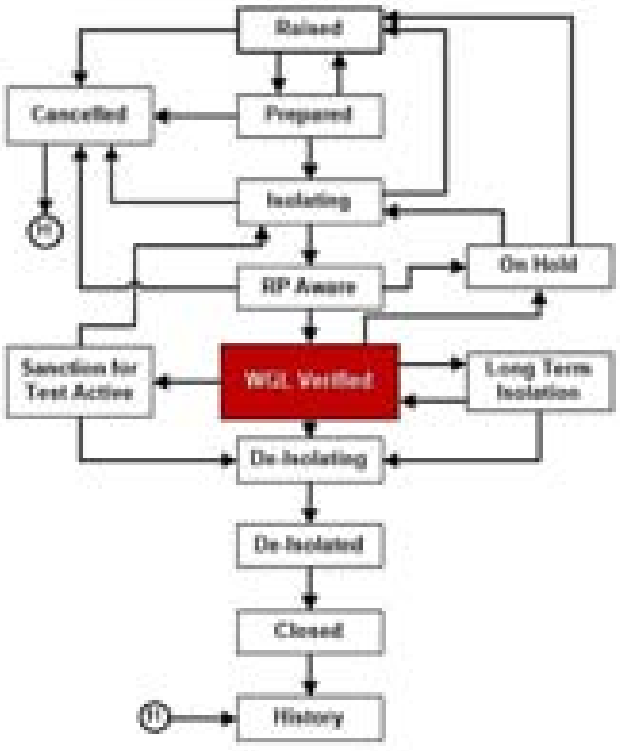


**Figure 4.** Isolation Certificate state flow graph. Source: Engica Q4 user guide.

### 5.7. Radiation certificate

Radiation certificates is used often on the drilling rigs, outline necessary control measures to minimise risks of exposure to radioactive sources including site inspection, controls on source exposure, access or containment barriers and radiation monitoring.

### 5.8. Diving certificate

Diving certificate can be used to control the diving activity itself and to ensure that there are no other activities taking place nearby which create unnecessary additional risks (eg over-side work, live firewater intake pumps). This kind of certificate is used on the offshore construction vessels and when underwater maintenance activities are carried out on the offshore installations

### 5.9. Working at heights

Some company use separate Working at heights permits which refer to any work-related activity being undertaken at an elevated position, above two metres where there is the potential to fall. Some companies use for this purpose Cold Work permits with associated paperwork. Regulations (The Work at Height Regulations, 2005) established the following guidelines for working at height:

- Ensure workers can get safely to and from where they work at height.
- Do as much work as possible from the ground.
- Make sure you do not overload or overreach when working at height.
- Take precaution when working on or near fragile surface.
- Provide protection from falling objects.
- Consider emergency evacuation and rescue procedures.

## 6. Development of the electronic Permit to Work Systems

The 21st century advancement in computing introduced electronic systems for managing permits and risks associated with maintenance activities. Transition from paper based system to electronic permitting was led by the oil and gas industry. Major oil industry operators in the North Sea are in the process of transition from paper work PTW System to its electronic versions. It is possible to maintain the same format and content of the paper permits within the electronic system. The electronic PTW system offers a combination of additional features including integration of the PTW System with Computerized Maintenance Management Systems, risk assessment, isolation of hazardous energy, competency management, lessons learned sharing, and continual improvement etc. (Viswanatha et al., 2015).

Paper permitting processes have numerous problems. The disadvantage of paper form of the PTW System is that it can create a "checkbox mentality". Work party often rush through a repetitive, unchanging paperwork process. Quite often permit validation is arbitrary, and may not be strictly followed up. In combination with the repetitive nature of paper permits, this can create the perception that PTW System is just a paperwork exercise. This can cause the Responsible Person and the Work Group Leader to miss the critical details or to make errors that put work party at risk. Permit to work processes, job safety analyses, risk assessments, and conflict management are subject to human error and inconsistency. Paper PTW System creates a high volume of (often redundant) written procedures. These is very time consuming to create, review, and follow. The result is very often paperwork for paperwork's sake. Even worse, it doesn't make the work environment safer or more productive.

By connecting the maintenance, safety and operations workflows, an electronic PTW System can streamline many maintenance repetitive tasks, from tag printing to isolation point validation, through to generating permit requests and issuing permits directly to Work Party. An electronic PTW System reduces the number of duplicates, conflicting, redundant procedures, the time spent on documentation, training etc. Electronic Task Risk Assessments (TRA) and Job Safety Analyses (JSA) provide consistency and standardization. Additionally, the electronic PTW System also allows to examine similar jobs executed in the past. It automatically associates the appropriate hazards and controls based on the information stored in the database. An electronic PTW System also eliminates the element of human error. Conflicts in the work scopes are identified automatically when they occur.

Electronic Permit to Work System also gives a better overview all maintenance activities on board of the offshore installation what is important especially in an emergency situation when all permits are being returned to the permit control center in the same time. It may prove difficult to assess the situation when all the work sites are controlled by the paper system. Electronic system makes it possible to display all the permits on the multimedia board. This allows a better control of the asset, especially in case of the emergency. Figure 5 shows the example of the eSmart electronic permit to work general arrangement dashboard with permits issued for different locations of the oil rig.

**Figure 5.** Electronic permit to work general arrangement dashboard. Source: eSmart permit user guide.

Figure 6 and 7 shows the example of the electronic PTW System workflow.

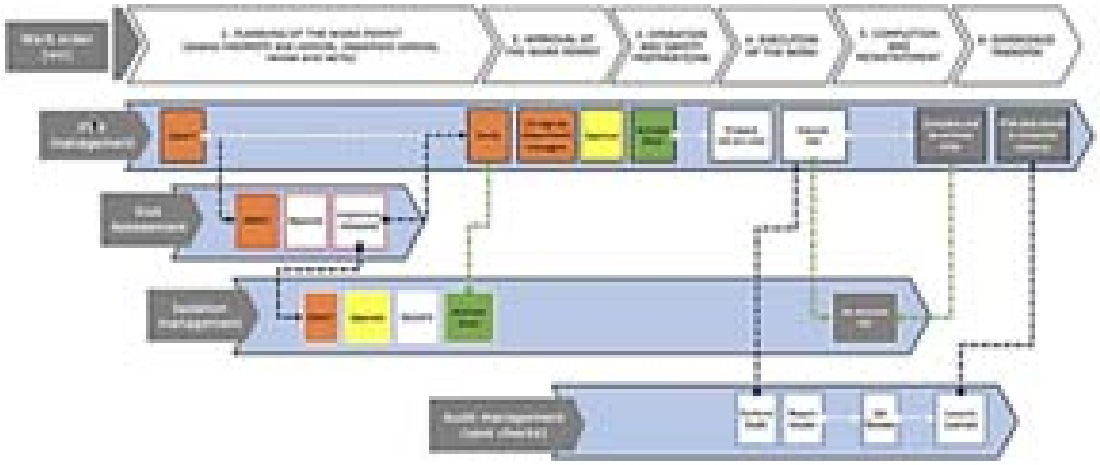

**Figure 6.** Electronic PTW System workflow. Source: eSmart permit user guide.

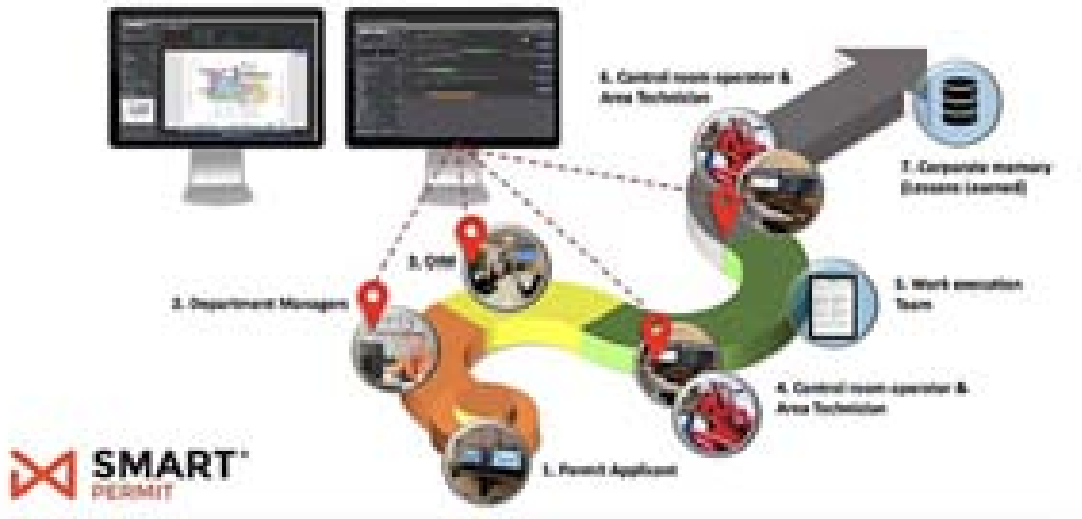


**Figure 7.** Electronic PTW System workflow. Source: eSmart permit user guide.

## Conclusions

1. Permit to work Systems are essential tools in any Safety Management Systems used within upstream installation.
2. Major PTW related accidents have common roots. High proportion of incidents are related to the maintenance errors which could coincide with poor management of PTW Systems.
3. Permit to Work requires contribution from all parties involved in the activities carried out on the offshore oil and gas installations.
4. Better international regulations are required for development of the Permit to Work Systems. This would allow uniformity in PTW between different oil and gas companies. Safety related lessons learnt from all the systems and the companies could be incorporated into one PTW System.
5. Paper permitting processes have numerous problems. Work party often rush through a repetitive, unchanging paperwork process. This can create the perception that PTW system is just a paperwork exercise. The result is very often paperwork for paperwork's sake.
6. An electronic PTW System can streamline many maintenance repetitive tasks by connecting the maintenance, safety and operations. It also allows identification of hazards and assess risks based on similar work executed in the past.

7. Electronic permit to work system gives a better overview all maintenance activities on board of the offshore installation, especially in the emergency situation when it is critical to have a full control of all the maintenance tasks.

## Acknowledgments

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## References

1. 088 – Norwegian Oil and Gas Recommended Guidelines for a Common Model for Work Permits (WP).
2. Booth, M., Butler, J.D. (1992). A new approach to permit to work systems offshore. *Safety Science, Vol., 15, Iss. 4-6,* pp. 309-326, ISSN 0925-7535.
3. Code of Safe Working Practices for Merchant Seafarers Chapter 01 – Managing Occupational Health and Safety.
4. Guidelines on permit to Work (P.T.W.) systems. Report No. 6.29/189, issued by The International Association of Oil & Gas Producers.
5. HSE HSG85 (Third edition) (2013).
6. HSG250 - HSE Guidance on permit-to-work systems: A guide for the petroleum, chemical and allied industries.
7. HSG253 – HSE The safe isolation of plant and equipment.
8. International Maritime Organization – International Convention for the Safety of Life at Sea (SOLAS), Chapter IX – Management for the Safe Operation of Ships.
9. International Maritime Organization – The International Safety Management (ISM) Code ISM Chapter 7 – Development of Plans for Shipboard Operations.
10. ISO 45001 Occupational Health and Safety Management.
11. Jahangiri, M., Hoboubi, N., Rostamabadi, A., Keshavarzi, S., Hosseini, A.A. (2016). Human Error Analysis in a Permit to Work System: A Case Study in a Chemical Plant. *Saf. Health Work, 1,* 6-11.
12. Kovačević, N., Stojiljković, A., & Kovač, M. (2019). Application of the matrix approach in risk assessment. *Operational Research in Engineering Sciences: Theory and Applications, 2(3),* 55-64.

13. Kyle, S.R. (1991). *Permit To Work Systems in the Offshore Industry*. Paper presented at the SPE Health, Safety and Environment in Oil and Gas Exploration and Production Conference, The Hague, Netherlands, November 1991. Paper Number: SPE-23240-MS.
14. MIL-STD-882E, Department of Defence Standard Practice – System Safety.
15. Mines Safety and Inspection Act 1994 (WA).
16. Okoh, P., Haugen, S. (2014). A study of maintenance-related major accident cases in the 21st century. *Process Safety and Environmental Protection, Vol. 92, Iss. 4,* pp. 346-356, ISSN 0957-5820.
17. The Management of Health and Safety at Work Regulations 1999; Regulation 3 – Risk Assessment (UK).
18. The Work at Height Regulations (2005).
19. Villa, V., Paltrinieri, N., Khan, F., Cozzani, V. (2016). Towards dynamic risk analysis: A review of the risk assessment approach and its limitations in the chemical process industry. *Safety Science, Vol. 89,* pp. 77-93, ISSN 0925-7535.
20. Viswanatha Reddy, Iragam Reddy (2015). Study Of Electronic Work Permit System In Oil And Gas Industry – Kuwait. *IJISET – International Journal of Innovative Science, Engineering & Technology, Vol. 2, Iss. 4.*

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# ENTREPRENEURIAL DIGITAL STRATEGY AS MANAGERIAL TOOL FOR BUILDING SMART HOSPITAL

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**Purpose:** to build the research model of Entrepreneurial Digital Strategy (EDS) as crucial managerial tool for shaping hospitals as smart, network oriented organisations.
**Design/methodology/approach**: the main research method is a systematic literature review in order to conceptualize the EDS as crucial driver of shaping hospitals as smart, network oriented organisations. Statistical analyses using data from OECD Health were used to present chosen input and output indicators of Polish national healthcare system.
**Findings:** the proposition of research model of EDS as the digital technology road map towards building the smart hospital based on cost and quality performance healthcare processes. Additionally, using chosen statistical data, the Polish national healthcare system in the world context is presented.
**Research limitations/implications**: the concept of smart organization is still not widely recognized in management science, so it is difficult to create detailed model of hospital assessment as a smart organization. Simultaneously, the current scientific output consulting company knowledge in this field is enough to create especially strategic concepts of smart hospital.
**Practical implications:** the draft of practical managerial tool for hospital managers who are going to transform their hospitals towards smart ones is presented in the article.
**Social implications:** the article has a special social impact which consist of strategic management concept oriented towards managing the challenges of today hospitals (esp. public ones). These challenges are concentrated on simultaneous need for quality growth and cost reduction.
**Originality/value:** the concept presented in the article is the part of assumptions of new managerial model suited for hospital transformation towards smart organization.

**Keywords:** entrepreneurial strategy, digital strategy, entrepreneurial digital strategy, smart hospital.

**Category of the paper:** research paper.

## 1. Introduction

According to Siemens (Siemens, 2020) among the most important challenges facing today hospitals are:

- high pressure on cost productivity, the potential of cost improvements in hospitality is very high and the operational margins are dropping,
- changing care models, shifting from quantity based to quality and value based,
- personalization and consumerization of healthcare,
- digitalization of healthcare and cybersecurity,
- WHO predicts the deficiency of two million health professionals across the EU by 2020.

In the context of above listed challenges the very promising idea in management science is smart organisation which in the reality of hospitals can be translated into smart hospital. The main purpose of this paper is to describe the theoretical assumptions of Entrepreneurial Digital Strategy (EDS) as a kind of vehicle which support the hospital managers to bring their hospitals closer to the concept of smart organisation. The main method used in the paper is wide systematic literature review based both on scientific articles and consulting firms publications. Although the category of smart organisation is not very well recognized in management science the existing scientific output is enough to create conceptual proposition especially on the strategic level.

The most important feature of smart organisation is resilience understood as organisational ability to develop in complex and unpredictable environment. According to Khan and Haleem (Khan, Halem, 2012) smart organisations are based on knowledge and network abilities, dynamically adopting new organisational forms and practices, they are learning and agile in their ability to opportunity identification and exploitation. Among the most important theoretical categories reviewed in the article are following constructs: entrepreneurial strategy, digital strategy as basics for new category of EDS and the smart hospital as an industrial specification of smart organisation category. The concept of EDS supported by two basic managerial tools, i.e. market opportunity navigator and balanced scorecard is presented in the paper. In other words the author proposes the agile strategic management concept EDS, which exploits both executive and emergent natures of organizational strategy, in order to support hospital managers on their way of building smart hospitals.

## 2. Entrepreneurial digital strategy

Entrepreneurial Digital Strategy (EDS) is a new concept in management science. In the nature of this strategic model is the well known concept of disciplined entrepreneurship (Sull, 2004) and strategic entrepreneurship (Ireland, 2001). Strategy and entrepreneurship create a paradoxical synthesis which stands for long-term organisational development which in complex and unpredictable environment is both executed and emergent. The central organizational competence in EDS strategy is digitalization, in other words digital resources are essential both for accomplishing strategic goals and identifying/exploiting strategic opportunities. The overall concept of EDS scientific category is presented in the figure 1.

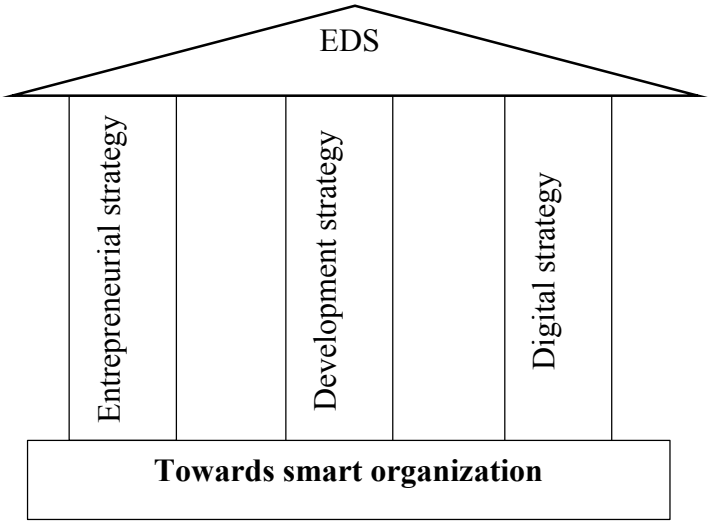



**Figure 1.** Entrepreneurial digital strategy of organizational development. Source: own study.

The above concept regards the new strategic model of organizational long-term development, which is both entrepreneurial and digital. In other words, the long-term competitive advantage of the organization is rooted in its entrepreneurial and digital competencies. Entrepreneurial development means strategic development model which is based on proactiveness, innovativeness and creativity (Kordel, 2018), in turn digital means development model which exploits digital technologies, including (Wolniak, Gajdzik, 2021): big data, new generation of sensors, artificial intelligence, machine learning, internet-of-services, internet-of-things, cloud computing, cybersecurity, mechatronics and advanced robotics, additive manufacturing, machine to machine communication and digital twin. The three key words creating the EDS category are: entrepreneurial, digital and strategy. After putting these words with the conjuction „and" (i.e. entrepreneurial AND digital AND strategy) in Scopus engine with the option to search in titles, keywords and abstracts only one scientific article was generated (Drummond et al., 2020). The article concerns only the social media marketing.

Two the most important scientific categories which create the basic pillars for EDS are digitalisation strategy and digital entrepreneurship. The same literature searching method was used to analyze these categories like in previously described case of EDS with one narrowing difference being that searching key words only in article titles. However, the outcomes are entirely opposite, in case of digital strategy 193 scientific articles have been founded with the oldest dated on 1995 (Sakakibara, 1995), in case of entrepreneurial strategy 182 scientific articles have been founded with the oldest dated on 1984 (Murray, 1984). The visualisation analysis of theoretical research outcomes regarding two above described categories is presented on figure 2 and 3.

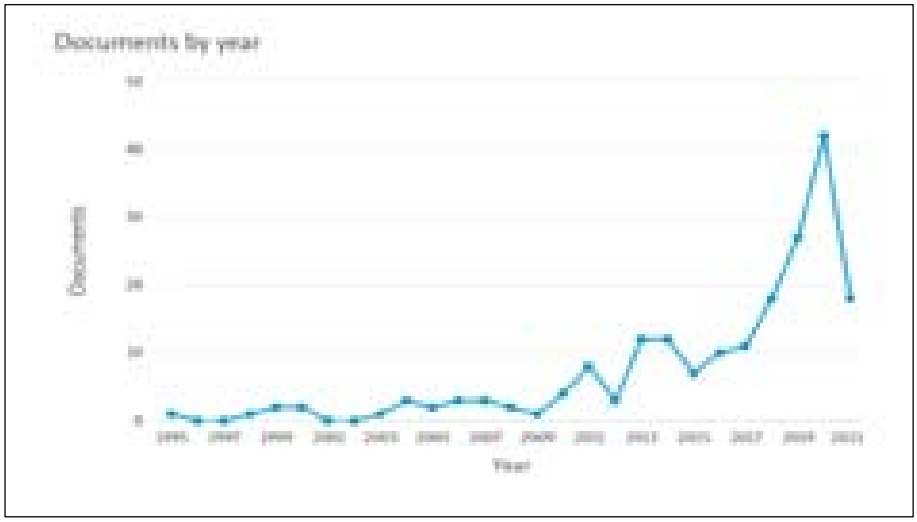



**Figure 2.** Outcomes of theoretical analysis of digital strategy category. Source: own study.

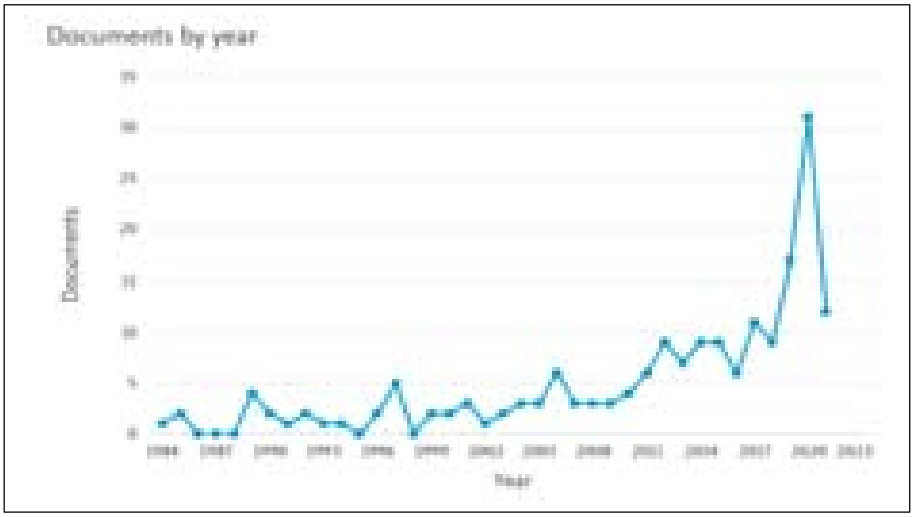



**Figure 3.** Outcomes of theoretical analysis of entrepreneurial strategy category. Source: own study.

Both above figures show the similar growth trend of no of scientific articles regarding digital and entrepreneurial strategies. Although the entrepreneurial strategy is elder scientific issue, both categories are marked by a clear jump in interest in 2020. It proves that the subjects are today very timely, and their merging into one concept of EDS would be scientifically very

interesting. The present quantity of articles (i.e. 193 in case of digital strategy and 182 in case of entrepreneurial strategy) is big enough to merge them multidimensionally in one.

The digital strategy is defined as (Bharadwaj et al., 2013) organizational strategy formulated and executed by leveraging digital resources to create differential value. This definition puts the digital business strategy over the functional strategies (e.g. human resource and marketing strategies) and emphasizes the general value of digital resources. The digital business strategy is based on digital mission, vision, tasks and targets, directly responsible for creating differential business value and connected with achieving KPIs as measures of organizational competitive advantage. The four essential themes connected with digital business strategy are (Bharadwaj et al., 2013): (1) the scope of digital business strategy; (2) the scale of digital business strategy; (3) the speed of digital business strategy; (4) the sources of business value creation and capture in digital business strategy. The scope of digital business strategy emphasizes its wide – transfunctional business process nature, includes the digitization of products and services and the information around them, exceeds traditional firm boundaries and supply chains and transform them into dynamic ecosystems that cross traditional industry boundaries. The scale of digital business strategy is connected with cloud computing services which provides a strategic dynamic capability for firms to scale up or down its infrastructure, network effects within multisided platforms that create rapid scale potential, information abundance and interorganizational networks (e.g. alliances and partnerships). The speed of digital business strategy is connected with time as an important driver of competitive advantage and regards time of new product introduction to the market, speed of decision making, time of supply chain orchestration and speed of network formation and adaptation. The sources of business value creation and capture in digital business strategy leveraging value from information, creation of multisided business models, capturing value through coordinated business models in networks, appropriating value through the control of the firm's digital architecture. The popular managerial tool for strategy formulation and execution is Balanced Scorecard with Dashboard (Rahimi et al., 2018).

Digital entrepreneurship (Nambisan et al., 2019) is a subcategory of entrepreneurship, maybe more specifically technology entrepreneurship, in which some or all of what would be traditionally physical has been digitized (Hull et al., 2007). In other words the most important parts of entrepreneurship phenomenon like entrepreneur, opportunity and entrepreneurial organization has been partly or entirely digitized according to the digital entrepreneurship category. The six most important topics connected with digital entrepreneurship are (Kraus et al., 2019): (1) digital business models; (2) digital entrepreneurship process; (3) platform strategies; (4) digital ecosystems; (5) entrepreneurship education; (6) social digital entrepreneurship. Digital entrepreneurship is strongly connected with three following essential categories: digital ecosystem as a context within which the digital entrepreneurship occurs, platform based digital business models as basic structures for the emergence of digital entrepreneurship and digital entrepreneurship process which is based on two generic phases,

i.e. digital opportunity formulation and exploitation. Digital ecosystem is (Sussan, Acs, 2017) "a self-organizing, scalable and sustainable system composed of heterogenous digital entities and their interrelations focusing on interactions among entities to increase system utility, gain benefits, and promote information sharing, inner and inter cooperation and system innovation". Platform based digital business model are defined three dimensionally (McIntyre, Srinivasan, 2017): the economists emphasize the existence of direct and indirect network effects in this model, the strategists put the light on the ability of platform firm to stimulate value co-creation with their network of complementors as competitive advantage base and technology management specialists are focusing on technological architectures on which platform sponsors and complementors seek to innovate. Digital entrepreneurship process (Le Dinh et al., 2018) is defined as digital opportunity formulating and exploiting. Digital entrepreneurship is defined as the reconciliation of traditional entrepreneurship with the new way of creating and doing business in the digital era. The very popular managerial tool for digital entrepreneurship is Market Opportunity Navigator with Dartboard (Shepherd, Gruber, 2020). Merging the theoretically reviewed categories of digital strategy and entrepreneurship the following definition of entrepreneurial digital strategy can be formulated: organizational activity based on long term forecasting/planning and opportunity formulation/exploitation concentrated on leveraging digital resources to create innovation based competitive advantage (see tab. 1).

**Table 1.**
*EDS as mix of digital strategy and entrepreneurship*

| Digital strategy | Digital entrepreneurship | EDS |
|---|---|---|
| Organizational activity based on long-term forecasting concentrated on leveraging digital resources to create competitive advantage | Organizational activity based on opportunity formulation and exploitation concentrated on leveraging digital resources to create innovations for customers | Organizational activity based on long term forecasting and opportunity formulation and exploitation concentrated on leveraging digital resources to create innovation based competitive advantage. |
| The most important categories: network effect as central phenomenon, dynamic ecosystem, multisided platform and information abundance | The most important categories: network effect as central phenomenon, digital ecosystem, multisided platform and information abundance | The most important categories: network effect as central phenomenon, digital ecosystem, multisided platform and information abundance |
| Managerial tool: Balanced Scorecard - Dashboard | Managerial tool: Market Opportunity Navigator – Dartboard | Managerial tool: balanced scorecard enhanced by innovation navigator |

Source: own study.

The most important categories which are included in the pool of EDS are: network effect as central phenomenon, digital ecosystem, multisided platform and information abundance. Two basic managerial tools which support EDS are balanced scorecard with dashboard as strategy formulation and execution dimension and market opportunity navigator with dartboard as strategy emergence dimension.

## 3. Entrepreneurial digital strategy managerial tools towards building smart hospital

Building a digital hospital needs entrepreneurial digital strategy, in other words it requires investments in people, technology, processes, and premises. Every hospital is unique and specific with its own set of pain points, constraints, strategic objectives (incl. measures, targets and initiatives). Among the most important measures of hospital performance include (Tortorella et al., 2021): cost, productivity, quality, patient satisfaction, and patient safety. These investment should be concentrated on two basic measures, i.e. quality of healthcare delivery and cost productivity.

According to Deloitte (Deloitte, 2021) the six following core elements of an enterprise digital strategy are crucial at the beginning of building digital hospital: (a) create a culture for digital transformation, it is essential that senior management understands the importance of a digital future and drives support for its implementation at all organizational levels; (b) consider technology that communicates, digital implementation is complex. Connecting disparate applications, devices, and technologies—all highly interdependent—and making certain they talk to each other can be critical to a successful digital implementation; (c) play the long game, since digital technologies are ever evolving, flexibility and scalability during implementation can be critical. The planning team should confirm that project scope includes adding, modifying, or replacing technology at lower costs; (d) focus on data, while the requirements of data interoperability, scalability, productivity, and flexibility are important, they should be built upon a solid foundation of capturing, storing, securing, and analyzing data. According to Siemens (Siemens, 2021) the most important bases for implementing successful digital strategy are: (a) develop a multi-stakeholder group to manage and drive the smart hospital initiative; (b) clearly understand the hospital's current state in terms of technological and process constraints; (d) focus on outcome-based solutions that mitigate the key pain points; (e) valuate solutions that have demonstrable value across multiple areas and support process re-engineering; (f) futureproof investments by ensuring solutions that are scalable and can support future integrations. The above described activities are necessary to overcome the digital strategy barriers. According to empirical research (Tortorella et al., 2020) two the most important groups of such digital strategy obstacles are social barriers and technical barriers. The first group includes misalignment with hospital's strategy, poor knowledge about technologies, absence of a qualified team and difficulties in finding good partners. The second group includes information security risks, implementing costs, regulatory changes and incorporated IT infrastructure.

The basic side of digital strategy towards building the smart hospital is knowledge in the field of spectrum of digital technologies which are available. According to McKinsey (McKinsey, 2018) the six the most cost effective digital solution are following: (a) paperless

data (incl. unified electronic health record/exchange, e-prescribing, intrahospital staff communication, clinicians' virtual assistants (AI)); (b) online interaction (incl. teleconsultation, remote monitoring of chronic disease patients, E-triage); (c) work flow/automation (incl. nurse mobile connectivity, barcoding medication administration, RFID tracking, vital parameter tracking, hospital logistics robotics, process automation through robots, e-referrals); d) outcome transparency/decision support (incl. performance dashboards, patient flow management, clinical decision support, advanced payor analytics, genetic testing); (e) patient self-care (incl. chronic disease management tools, medical chatbots, disease prevention tools, patient support networks, digital diagnostic tools, virtual reality for pain management); (f) patient self-service (incl. e-booking (electronic appointment system). In this context, according to earlier mentioned empirical research (Tortorella et al., 2020) the technological side of digital strategy in hospitals can be divided in two bundles: (a) technologies used for capturing (sensing) and communicating information about patient, equipment, material or process, this bundle can be named sensing–communication technologies. It includes biomedical/digital sensors, IoT, big data, cloud computing and remote control/monitoring technologies; (b) technologies that process data producing actual information, moving or controlling a system, mechanism or software based on such information, this boundle can be named 'Processing–Actuation'. It includes 3D printing, collaborative robots, machine/deep learning and augmented reality/simulation.

According to Siemens (Siemens, 2020) the digital strategy provides a true competitive advantage by: increasing revenues, i.e exploring diversified, innovative revenue streams and boosting outpatient market share and by reducing costs, ie. sustainable cost control and innovative approaches to expense reduction. Two, the most important digital strategy activites are engaging hospital stakeholders and perform a prioritization exercise. Engage hospital stakeholders to understand the key challenges and pain points across hospital operations and how these factors map to priority outcomes such as decreasing operating costs, reducing patient accidents, or dealing with staff shortages. Perform a prioritization exercise of these pain points and objectives to help focus investment decisions and identify relevant technologies that would mitigate the high-impact challenges and support key objectives. In this process two earlier mentioned EDS managerial tools, i.e. balanced scorecard and market opportunity navigator cane be very helpful. Balanced scorecard method engaged the most important stakeholders in strategy formulation and execution processes. The most important purpose of this engagement are to build the strategy as kind of common consensus and mechanism of self-motivation based on responsibility for purposes which are authored by ourselfes. The most important parts of strategy according to balanced scorecard including: mission, vision, key values and next objectives, measures and targets in four interconnected fields – i.e. financial, customer, process and R&D, should be formulated and executed commonly by the most important stakeholders. The market opportunity navigator is consisted of three stages: generation of market opportunity set according to customers and application, evaluation of market opportunity attractiveness

according to their market potential and challenge for organization, and designing the agile strategy (i.e. consisted of both growth options and backup options) according to market and product relatedness of formulated set of opportunities. Using both tools in accordance with entrepreneurial digital strategy idea allows for exploiting the potentials of strategy as ordered execution of earlier formulated long term plans and strategy as emergent phenomenon based on opportunities sensing and seizing.

## 4. Smart hospital, the case of Poland

Although the concept of smart organization is not very mature in management science, the existing research output allows for formulation the most important features of such an organization (Khan, Haleem, 2012; Filos, 2006): agility, adaptability, flexible form, learning form, knowledge-driven form and networking capabilities. The concept of smart organization arose from the need to respond dynamically to the changing landscape of a digital economy. A smart organization is composed of internetworked and knowledge-driven org., and therefore able to adapt to new organizational challenges rapidly. It is sufficiently agile to respond to opportunities of the digital age. The three networking dimensions of smart organizations are following aspects (Filos, 2006): the ICT dimension, the organizational dimension and the knowledge dimension (see fig. 4.).

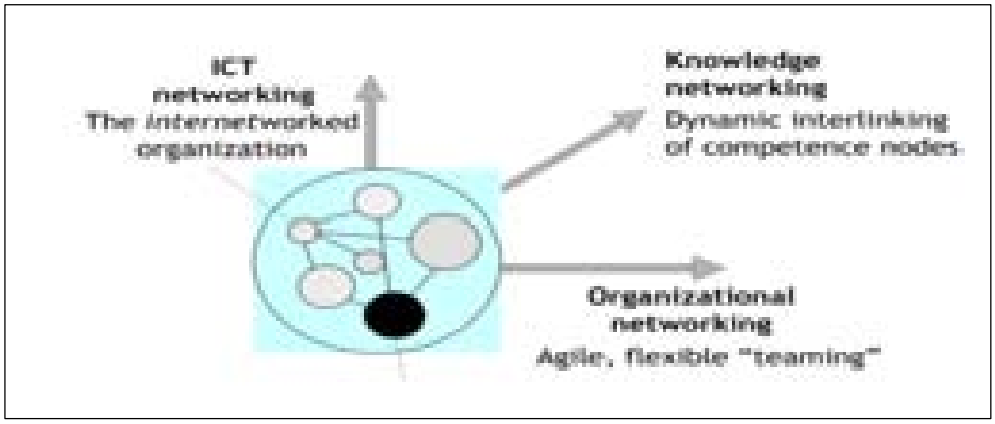



**Figure 4.** The three networking dimensions of smart organization. Source: Filos, E. (2006). *Smart organizations in the digital age. Integration of ICT in smart organizations.* Brussels: European Commission, Directorate-General Information Society and Media.

Networking at the ICT level enables organizations to move into extended or virtual organizational forms. The organizational dimension is based on collaborative partnerships which have become central to competitive success in fast changing global markets. The knowledge dimension is made up by three interconnected contexts, i.e. the business system, the project teams and the organizational knowledge base. Among the key enablers of smart organization are following pillars (Khan, Haleem, 2012): (a) partnership and collaboration;

(b) technology support, especially information technology (IT); (c) customer relationships management (CRM); (d) change management; (e) leadership and top management support; (f) continuous learning and worker empowering (HRM); (g) knowledge management and performance management; (h) innovativeness and creativity; (i ) team working and concurrent engineering (CE)/integration and coordination; (j) continuous improvement; (k) flexibility and adaptability. The category of smart organization is not widely recognized in the literature, the category of smart hospital is especially new in the theory of management science. On one hand hospital is very promising type of smart organization because of very intensive data, information and knowledge flows, on the other hand the hospital is very complex and dynamic kind of organization with many unpredictable processes and in consequence very difficult to manage as smart organization. Building the integrated and ready for implementation concept of smart hospital is very demanding challenge.

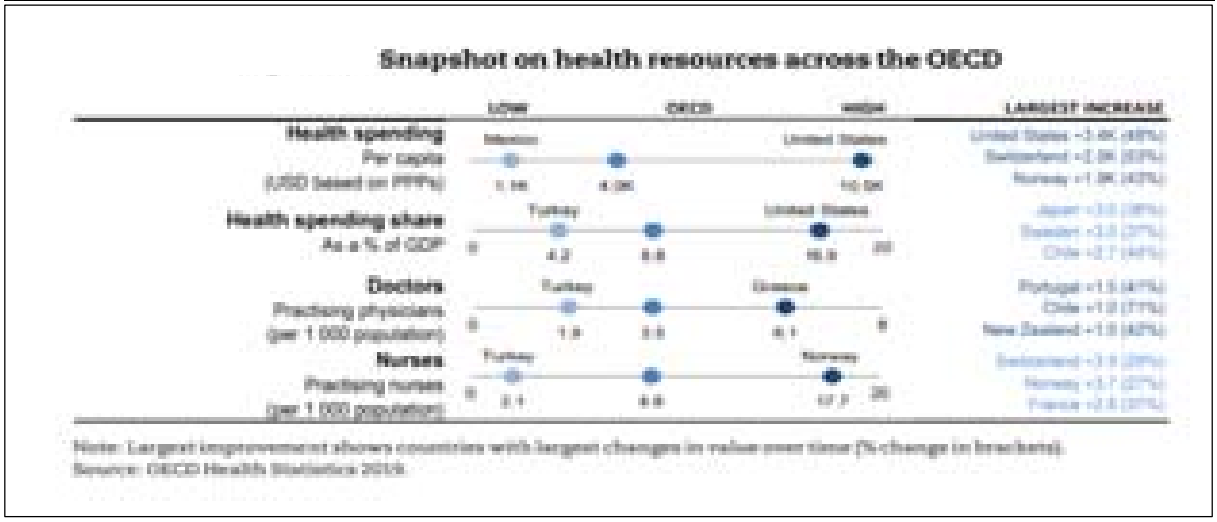
The majority of countries and many international political organisations are very strongly interested in digital strategies as ways for building smart hospitals (UE Commission, 2018). According to Deloitte (Deloitte, 2017) the digital hospital of the future can leverage technologies that transform the value processes in five following dimensions: (a) redefined care delivery; (b) patient experience; (c) staff management; (d) operations management and hospital design. Redefined care delivery will be based on centralized digital centers to enable decision-making, continuous clinical monitoring, targeted treatments (e.g. 3-D printing for surgeries), and the use of smaller, portable devices will help characterize acute care hospitals. The pillars of digital patient experience are digital and artificial intelligence (AI) technologies that can help enable on-demand interaction and seamless processes through a choice of devices to improve patient experience. Staff management will concentrate on enhanced talent development. Robotic process automation (RPA) and AI can allow caregivers to spend more time providing care and less time documenting it, as well as help enhance development and learning among caregivers. Next future digital hospital dimension, operation management and operational efficiencies through technology, will be based on digital supply chains, automation, robotics, and next-generation interoperability. These operation management digital technologies can drive operations management and back-office efficiencies. The last dimension, healing and well-being designs, is oriented both towards patients and staff members. An emphasis on the importance of environment and experience in healing will likely be important in future hospital designs. According to Siemens (Siemens, 2020) the crucial features of a smart hospital are: (a) greater efficiency through automation, for example integration of lighting, HVAC, shading systems reduces installation costs and enables patients to control the whole room; (b) improving outcomes via solutions that cut across historical silos. For example, use of Real Time Location Services (RTLS); (c) leveraging data (from multiple sources) to gain maximum value from the underlying technology; (d) overcoming technological choke points in a way that is scalable. For example hospitals are installing IoT sensors on a long range low power network to complement data collection.

The literature review in the field of smart hospital shows that although consulting companies (e.g. Deloitte, Siemens) offer very interesting implementation concepts of smart hospital and management science literature offers a lot in the field of smart organization there is a gap regarding the mature theory of smart hospital in the field of management science. The concepts of consulting companies are strongly technologically oriented without very important management aspects like organizational structure incl. culture as well, organizational leadership and organizational development strategy. The theoretical concept of smart organization should be unfolded towards hospitals as very complex organizations.

Building smart organization model for hospitals in Poland and EDS as smart vehicle of Polish public hospitals towards smart ones requires taking into account the analysis of Polish national healthcare system. Various parameters which describe this system can be divided into input parameters and output parameters. The most important input parameters according to OECD are presented in the table 2.

**Table 2.**
*Dashboard on health resources in 2019*

| | **Health spending** | **Health spending share** | **Doctors** | **Nurses** |
|---|---|---|---|---|
| | Per capita (USD based on purchasing power parities) | As a % of Gross Domestic Product (GDP) | Practising physicians (per 1 000 population) | Practising nurses (per 1 000 population) |
| World leader – US | 10 586 | 16.9 | 2.6 | 11.7 |
| Lider UE – Sweden | 5 447 | 11.0 | 4.1 | 10.9 |
| Outsider world – Mexico | 1 138 | 5.5 | 2.4 | 2.9 |
| Outsider UE – Latvia | 1 749 | 5.9 | 3.2 | 4,6 |
| Poland | 2 056 | 6.3 | 2.4 | 5,1 |
| OECD average | 3 994 | 8.8 | 3.5 | 8.8 |




Source: OECD Health at a Glance 2019.

Every input parameter, incl. health spending (per capita and as a % of Gross Domestic Product) and numbers of doctors and nurses is clearly below OECD average and near to EU outsider – Latvia. Very interesting data on Polish hospital resources especially in the context of digitalization strategy are published by OECD (see fig. 5).

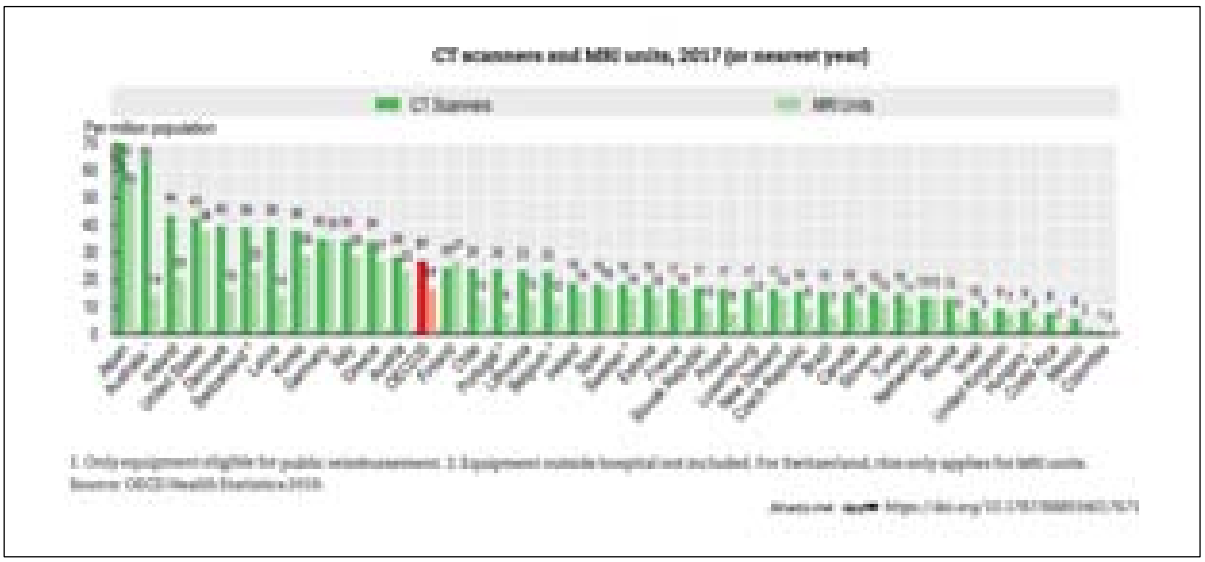


**Figure 5.** The level of digitalization of hospitals measured by no of CT scanners and MRI units. Source: OECD Health Statistics 2019.

According to the no of CT scanners and MRI units public hospitals in Poland ranks eleventh among OECD countries, and this position is also clearly below OECD average. The most important output parameters characterizing Polish public hospitals system according to OECD are presented in the table 3.

**Table 3.**
*Dashboard on public health effectiveness in 2019*

| | **Safe prescribing** | **Effective primary care** | **Effective secondary care** | **Effective cancer care** |
|---|---|---|---|---|
| | Antibiotics prescribed (defined daily dose per 1 000 people) | Avoidable asthma/ COPD* admissions (per 100 000 people, age-sex standardised) | 30-day mortality following AMI** (per 100 000 people, age-sex standardised) | Breast cancer 5-year net survival (%, age standardised) |
| World leader – United States* | No data | 268 | 5.0 | 90.2 |
| Lider UE –Sweden* | 10.2 | 169 | 3.9 | 88.8 |
| Outsider world – Mexico* | | 85 | 27.5 | No data |
| Outsider UE – Latvia* | 12.1 | 242 | 13.4 | 76.9 |
| Poland | 23.8 | 236 | 4.1 | 76.5 |
| OECD average | 17.8 | 225 | 6,9 | 84.5 |
| *COPD Chronic Obstructive Pulmonary Disease.<br>**AMI Acute Myocardial Infarction. | | | | |

Source: OECD Health at a Glance 2019.

The output parameters for Polish healthcare is rather close to OECD avarege, only in the field of no of antibiotics prescribed the situation in Poland is clearly below OECD average. Very interesting standardized tool for performance assessment in hospitals was published by WHO (The Performance Assessment Tool for Quality Improvement in Hospitals – PATH). According to this method the most important dimensions of hospital performance are: (a) clinical effectiveness and safety; (b) efficiency, (c) staff orientation and staff safety, (d) patient centeredness.

After reviewing both healthcare measures system (see table 2 and table 3) and hospital level effectiveness measures on input and output sides one can conclude generally that hospital effectiveness measures system are well developed. Of course taking into account the EDS the performance measurement system should be complemented.

## 5. Conclusions

In the context of the most important challenges facing hospital system described in the introduction to this paper, i.e. (Siemens, 2020):

- high pressure on cost productivity, the potential of cost improvements in hospitality is very high and the operational margins are dropping,
- changing care models, shifting from quantity based to quality and value based,
- personalization and consumerization of healthcare,
- digitalization of healthcare and cybersecurity,
- WHO predicts the deficiency of two million health professionals across the EU by 2020.

Today hospitals should transform towards smart organisation. The first step in this process is diagnosis of hospital maturity as a smart organisation. This diagnosis can be made on three following levels (Filos, 2006; Khan, Haleem, 2012): digital technologies, partnership collaboration and knowledge contexts. After this strategic diagnosis the entrepreneurial digital strategy should be formulated using balanced scorecard and innovation navigator (Rahimi et al., 2018). This two strategic tools are complementary and ensure dual nature of strategy consisted of executive and emergent dimensions. This strategy should be measured by well developed, multidimensional system of effectiveness monitoring. The example of such a measurement dedicated to hospitals is described in chapter 4 PATH tool. The entire three steps process of EDS implementation is presented on below figure (see fig. 6).

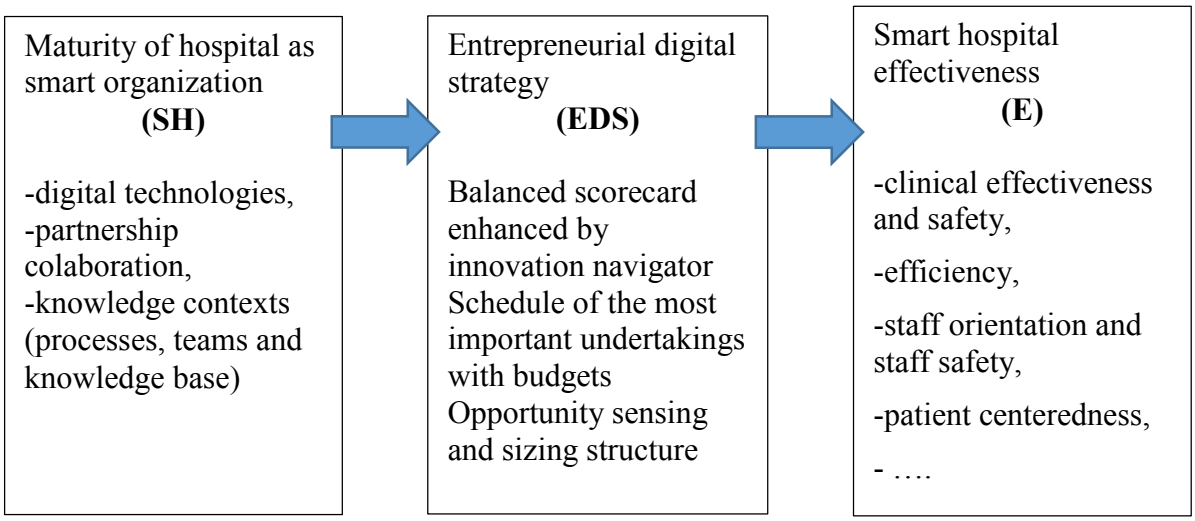



**Figure 6.** Draft of entrepreneurial (both executive and emergent) strategy of building smart hospital. Source: own study.

The above proposed model is conceptual, based on literature review (both scientific and published by consulting companies). It should be discussed and empirically validated. The model of smart organization maturity should be developed, operationalized and adjusted to the hospital environment. The entrepreneurial digital strategy as central mechanism of transforming hospital towards smart organization should be developed regarding issues like smart leadership and smart organizational structures incl. cultural aspects. Smart functional strategies, especially marketing and human resource strategies as crucial parts of EDS should be also developed. The multidimensional performance measurement system need to be complemented with measures specific for smart organisation concept.

It should also be remembered that the vast majority of hospitality in Poland is part of the national health care system. Any changes on hospital level should be enhanced or inspired by changes on national health care system. Meanwhile, the analysis of OECD data on health care expenditure presented in the table 2 (i.e. national health spending per capita and as a % of GDP, no of doctors and nurses per 1 000 population) compared to OECD associated countries show that polish indicators are drastically lower than the leaders indicators and below the average, but quite close to outsiders. Similar situation is when taking into account no of CT scanners and MRI units which is presented in figure 5. In the context of this it is obvious that success of EDS implementation on hospital level as part of national healthcare system should be preceded by drastic increase in national healthcare expenses. The adequate national healthcare programs should be formulated and next the hospital can implement strategic tools like EDS.

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## References

1. Bharadwaj, A., El Sawy, O.A., Pavlou, P.A., Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly: Management Information Systems, 37*/2, pp. 471-482.
2. Champagne, F., Guisset, A., Veillard, J., Trabut, I. (2005). *The Performance Assessment Tool for Quality Improvement in Hospitals*. Montreal: Universite de Montreal.
3. Deloitte (2017). *The hospital of the future: How digital technologies can change hospitals globally*. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/us-lshc-hospital-of-the-future.pdf, 20.06.2021.
4. Drummond, C., Toole, T., McGrath, H. (2020). Leveraging the network-building potential of social media marketing: an examination of digital engagement strategies and tactics for entrepreneurial firms. *Strategic Direction, 36/6,* pp. 9-11.
5. Filos, E. (2006). *Smart organizations in the digital age. Integration of ICT in smart organizations.* Brussels: European Commission, Directorate-General Information Society and Media.
6. 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*, pp. 303-321.
7. Hull, C.E., Hung, Y.-T.C., Hair, N., Perotti, V., De Martino, R. (2007). Taking advantage of digital opportunities: a typology of digital entrepreneurship. *International Journal of Networking and Virtual Organization, 4/3,* pp. 290-303.
8. Ireland, R.D. (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. *Academy of Management Executive, 15/1,* pp. 49-63.
9. Khan, U., Haleem, A. (2012). Smart organisations: Modelling of enablers using an integrated ISM and fuzzy-MICMAC approach. *International Journal of Intelligent Enterprise, 1/3,* pp. 248-269.

10. Kordel, P. (2018). Technology entrepreneurship attributes on enterprises from aviation valley in Poland: fuzzy sets approach. In: C. Costa, M. Au-Yong-Oliveira, M.P. Castro Amorim (Eds.), *13th European Conference on Innovation and Entrepreneurship* (pp. 366-375). Academic Conferences and Publishing International.
11. Kraus, S., Roig-Tierno, N., Bouncken, R.B. (2019). Digital innovation and venturing: An introduction into the digitalization of entrepreneurship. *Review of Managerial Science, 13/3,* pp. 519-528.
12. Le Dinh, T., Vu, M.C., Ayayi, A. (2018). Towards a living lab for promoting the digital entrepreneurship process. *International Journal of Entrepreneurship, 22*/1, pp. 1-17.
13. McIntyre, D.P., Srinivasan, A. (2017). Networks, platforms, and strategy: Emerging views and next steps. *Strategic Management Journal, 38*/1, pp. 141-160.
14. McKinsey. (2018). Digitizing healthcare – opportunities for Germany. Retrieved from https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/digitizing-healthcare-opportunities-for-germany, 20.06.2021.
15. Murray, J.A. (1984). A concept of entrepreneurial strategy. *Strategic Management Journal, 5*/1, pp. 1-13.
16. Nambisan, S., Wright, M., Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy, 48/8*.
17. Rahimi, H., Bahmaei, J., Shojaei, P., Kavosi, Z., & Khavasi, M. (2018). Developing a strategy map to improve public hospitals performance with balanced scorecard and dematel approach. *Medical Journal, 9*/7, pp. 1-12.
18. Sakakibara, K., Lindholm, C., Ainamo, A. (1995). Product development strategies in emerging markets: The case of personal digital assistants. *Business Strategy Review, 6/4,* pp. 23-38.
19. Shepherd, D.A., Gruber, M. (2020). The lean startup framework: closing the academic–practitioner divide. *Entrepreneurship Theory and Practice, 45/2,* pp. 1-31.
20. Siemens (2020). *Digitalization to reach new levels of operational performance: A smart hospital concept by Siemens*. Retrieved from https://new.siemens.com/us/en/products/buildingtechnologies/markets/healthcare/smart-hospital-concept-white-paper.html, 20.06.2021.
21. Sull, D.N. (2004). Disciplined entrepreneurship. *MIT Sloan Management Review, 46*/1, pp. 71-77.
22. Sussan, F., Acs, Z. (2017). The digital entrepreneurial ecosystem. *Small Business Economics, 49/1,* pp. 55-73.
23. Tortorella, G. L., Fogliatto, F.S., Espôsto, K.F., Mac Cawley Vergara, A., Vassolo R., Tlapa Mendoza, D., Narayanamurthy, G. (2020). Measuring the effect of Healthcare 4.0 implementation on hospitals' performance. *Production Planning & Control*, *33/4,* pp. 1-16.

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# SATISFACTION AND PERFORMANCE OF GENERATION Z IN VIRTUAL AND FACE-TO-FACE TEAMS

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**Purpose:** There are several factors that affect the satisfaction and performance of virtual and face-to-face teams. Literature shows however, that there is a research gap as to the influence regarding the analysis of those factors in regards to different generations. The purpose of the paper is the youngest generation – Gen Z functions in virtual and face-to-face teams and how the type of team influences the performance and satisfaction of team members.
**Design/methodology/approach:** Adopting a generational approach, a research design, including an experiment and a survey, was developed in order to analyze if the type of teamwork affects performance and satisfaction of Generation Z representatives.
**Findings:** Findings suggest that the youngest, tech-savvy generation functions easier and more naturally in virtual teams, showing no significant differences in performance in virtual and face-to-face teams, and even indicate that working in virtual teams is more satisfying than working in traditional teams.
**Practical implications:** The results of the research can provide a basis for managerial decisions when selecting members of real and virtual teams.
**Originality/value:** The paper contributes to the ongoing scientific debate by presenting the perspective of Generation Z on virtual work, which, to a certain extent, contradicts current beliefs about performance and satisfaction in traditional and virtual teams. It shows that the generational approach should be included in team design in order improve team and organizational competitiveness.

**Keywords:** Virtual teams; Generation Z; virtual work; face-to-face teams; satisfaction; performance.

## 1. Introduction

Virtual or distributed workplaces where employees and managers work separately from each other are a reality and will become even more popular over time (Cascio, 2000). Already over a decade ago, more than 60 per cent of managers worked regularly in virtual teams (Hertel et al., 2005). However, individuals face additional challenges when working in virtual teams

(Furumo, 2009). Collaboration within virtual teams differs from traditional face-to-face teams due to the degree of physical interaction, the level of virtuality and team member distance (Foster et al., 2015; Hertel et al., 2005). Although over the last two decades a great deal has been written about such teams, there is still a lack of clarity as to what virtual teams are as well as what influences their effectiveness and performance (Lin et al., 2008). As the conducted literature review demonstrated, there are several internal factors that may affect teamwork, including personality (Brown et al., 2004; Luse et al., 2013), norms, beliefs and values (Stewart & Gosain, 2006), trust (Crisp & Jarvenpaa, 2013; De Jong et al., 2016) or even the perception of trust or commitment (Joshi et al., 2009). Currently, there are four generations of employees active on the labor market - baby boomers, Generation X, Generation Y and Generation Z – which differ from each other in regards to values, work ethic but also strengths, weaknesses and preferences (Balan & Vreja, 2018). As determined by Ferrara et al. (2017), baby boomers and millennials (defined as born after 1981) have different views in regards to time, technology and workplace. The youngest generation – Generation Z – differs from the previous ones, especially in regards to their approach to the virtual world and social media (Bejtkovsky, 2016). In addition, their attitudes towards using new technologies differs from those of previous generations (Morris & Venkatesh, 2000). As indicated by researchers (Burton et al., 2019; Furst et al.,1999) the increase in using virtual teams has not been accompanied by parallel and sufficient research in the socio-psychological determinants of their efficiency. As pointed out by Gilson et al. (2015), one of the research gaps in regards to virtual teams is the generational impact, as the issue whether different generations perceive virtual teams differently has not received much attention. Research on the functioning of the Generation Z in virtual teams has not yet been conducted. This study explores the relation between the type of teamwork and performance and satisfaction of Generation Z. Furthermore, it attempts to answer the question of whether the type of teamwork (virtual or face-to-face) influences the performance and satisfaction of Generation Z. Therefore, an experiment on representatives of Generation Z has been conducted.

Establishing the results of virtual work for Generation Z is important for several reasons. First of all, although they only recently entered the labor market, they will dominate it for the next decades (Maurer, 2016). Thus, it is essential to analyze the determinants of their performance and satisfaction. Secondly, working in virtual teams may align with other values and expectations of this generation, described in more detail in the third section of the paper, resulting in the fact that virtual work may be perceived as the norm and face-to-face contacts as an exception (Gilson et al., 2015). Finally, as mentioned, little research has been done wherein age or familiarity with technology were the main variables. Considering diversity dimensions, researchers have investigated primarily the influence of cultural (Daim et al., 2012; Hardin et al., 2007; Staples & Zhao, 2006) or national background (Curseu & Schruijer, 2010), gender (Curseu & Schruijer, 2010), and functional diversity (Peters & Karren, 2009). Age as a variable has been included in a few studies focusing, however, not on Generation Z but millennials, who entered the labor market in 2004 (Orta et al., 2019; Orta-Castanon et al., 2018)

and baby boomers (Ferrara et al., 2017). Due to the different characteristics of Generation Z, they may bring some advantages to virtual work or help to eliminate some of the barriers of virtual work identified in the literature (Gilson et al., 2015). In addition, the issue of satisfaction and performance of virtual teams becomes even more crucial in light of unforeseen events like the COVID-19 pandemic, which has forced organisations into virtual work and created challenges for managers, human resources departments (Carnevale & Hatak, 2020), and employees alike (Gao & Sai 2020).

The paper has been organized as follows. First, the theoretical dimension in regards to virtual and face-to-face teams are laid out with a focus on performance, satisfaction and cohesion of virtual teams. Secondly, the characteristics of the Generation Z, their value system, strengths, weaknesses and attitudes towards the workplace are presented. Then the research design is presented followed by the research results. The paper ends with the discussion and conclusion section, including theoretical and practical implications based on the findings.

## 2. Theoretical background

### 2.1. Virtual and face-to-face teams

Although researchers have studied virtual work for decades now, they have yet to grasp the full diversity within virtual teams, especially because the changes experienced by organizations due to the development of new communication media and scope of virtuality are unprecedented (Bailey et al., 2012). Furthermore, the growing complexity and dynamic nature of work itself have led to an increase in the importance of virtual work (Bell & Kozlowski, 2002).

However, it has to be noted that there is a great variety of working arrangements which may fall into the concept of virtual teams. Bell and Kozlowski (2002) have distinguished virtual teams from conventional face-to-face teams and emphasized that virtual teams may differ due to temporal distribution (distributed vs. real time), member roles (multiple vs. singular), lifecycle (discrete vs. continuous) and boundaries (single vs. multiple). Bailey et al. (2012) also added a typology of virtual work distinguishing between virtual teams, remote control and simulations. Other researchers have proposed scales and indexes to measure the level of virtuality, as they believe that there is no simple opposition to face-to-face teams but rather a continuum of virtuality (Chudoba et al., 2005). In order to measure the level of virtuality, Chudoba et al. (2005) used 18 items grouped into 6 categories: geography, temporal, culture, work practices, organization and technology. Therefore, the level of virtuality has to be considered as there are several factors which may influence the team's performance and may be responsible for significant differences between various virtual teams. In this paper, virtual

teams have been defined as an interdependent group working on a task across space and relying on communication technologies (Lin et al., 2008; Lipnack & Stamps, 2000).

Researchers have conducted several studies comparing virtual and face-to-face teams (Alge et al., 2003; Breuer et al., 2016; Hardin et al., 2007; Majchrzak et al., 2004). Comparative analyses and also analyses focusing on virtual teams identified the many advantages but also challenges for virtual teams. For example, Lipnack and Stamps (2000) determined that virtual teams, especially in their early stages, tend to focus on the task due to the restraints of computer-mediated communication (CMC). Thus, it has been stressed that CMC is not optimal when it comes to problem-solving tasks (Straus, 1996). O'Neill et al. (2016) suggest that virtual teams do worse with tasks that have one solution. In addition, real teams have done better in terms of decision behavior: amount of information exchanged and discussed, discussion length, performance and unique information. Shwarts-Asher et al. (2009), however, showed that while virtual teams have comparable successes to face-to-face teams, they have a lower level of satisfaction and need more time to complete a task. On the whole, virtual teams may experience difficulties in sharing norms, behaviors and attitudes (Oshri et al., 2007). They also show greater difficulties in the communication process, such as in understanding and interpreting salience of information (Cramton, 2001), differences in speed of access to information (Cramton, 2001) and lack of feedback (Geister et al., 2006). This may result in insufficient mutual understanding between team members (Alavi & Tiwana, 2002) and lower communication quality (Lowry et al., 2006) and may lead to failure in sharing and retaining contextual knowledge (Alavi & Tiwana, 2002). However, as noted by Rhoads (2010), face-to-face communication is not necessarily superior to CMC in many processes requiring collaboration. Members of virtual teams also face some psychological challenges like the risk of isolation and difficulties building team identity (Kirkman et al., 2002), and lower trust and openness (Alge et al., 2003). On the other hand, several strengths of virtual teams have been identified, including quicker decision making (Majchrzak et al., 2004), better availability of knowledge resources (Paul, 2006) and greater effectiveness of decision making (Schmidt et al., 2001). Additionally, when virtual teams included a diverse group of members, they were found to perform better (Staples & Zhao, 2006). Therefore, virtuality and diversity may lead to better competitive advantage (Majchrzak et al., 2004).

Researchers have conducted studies in order to identify the determinants of virtual team success. The main areas under investigation are performance, satisfaction and conflict, trust, cohesion, communication, and knowledge sharing. For the purpose of this study, it was decided to narrow down the focus to performance, satisfaction, conflict and cohesion, as trust was identified as moderator between communication and performance (Jarvenpaa et al, 2004) and also between ideology and performance (Stewart & Gosain, 2006). It has also been identified as mediator between communication media and satisfaction and performance (Geister et al., 2006). What is more, trust as well as communication were identified as determinants of

performance (De Jong et al., 2016; Marlow et al, 2018) and satisfaction (Edwards, 2005; Lin et al., 2008). Thus, the concepts are related to one another.

Among various other determinants of virtual team performance, researchers identified, inter alia, group characteristics (Chidambaram & Tung, 2005; Gao et al., 2016), team empowerment (Kirkman, Rosen, Tesluk, & Gibson, 2004), leadership styles (Kashive, Khanna, & Powale 2022; Zhang, Zhao, & Yu, 2022) team goals (Brahm & Kunze, 2012), task complexity and interdependence (Handke et al., 2020), coordination and cooperation (Breuer et al., 2016), and personality types (Brown et al., 2004). Among determinants of conflict, cohesion and satisfaction determinants like the above-mentioned trust and communication, but also team goals (Edwards, 2005), group roles (Furumo, 2009) or social dimensions like relationship building (Lin et al., 2008) were identified.

Research shows that performance and satisfaction are the two major measures for virtual team effectiveness (Lin et al., 2008). Performance can be defined as the extent to which a group output meets the requirements (Lurey & Raisinghani, 2001). Satisfaction can be defined as the extent to which the individuals' perception of the decision-making process and the group's outcome fits the final agreements (Chidambaram, 1996). Cohesion, on the other hand, has been identified as one of the most important variables for small groups (Lott & Lott, 1965) and can be defined as the degree to which team members identify with the group and the particular team members (Chidambaram, 1996), as well as the level of integration (Lin et al., 2008) within the group. As research shows, it positively influences both satisfaction (Lurey & Raisinghani, 2001; Maznevski & Chudoba, 2000) and team performance (Chang & Bordia, 2001).

### 2.2. Generational perspective – Generation Z

A generation can be defined as a group of individuals of similar age, experiencing "significant life events at critical developmental stages (times)" (Kupperschmidt, 2000, p. 66). Generations are distinguished based on the timeframe they were born, however, also common experiences when growing up form a generation (Kupperschmidt, 2000). Researchers generally agree as to the first generations, with small differences as to the timeframes of particular groups. The first generation are the traditional employees (also called the silent generation), born before 1940-45, the second one is the baby boomers, born between (1940/45-1960/64), followed by Generation X, born between (1960/65-1980) (Ferrara et al., 2017; Kupperschmidt, 2000). However, after that, some differences start to emerge. As indicated in section 1, some researchers stated that after Generation X come the millennials. Ferrara et al. (2017, p. 135) defined them as born between 1980 and 2001. However, there are researchers, who, although acknowledging some similarities, divide millennials into two generations: Generation Y and Generation Z (with some differences also as to the naming of the last generation) (Maloni et al., 2019). The conducted literature review also revealed discrepancies as to the age range of Generation Z, which have been presented in Table 1.

**Table 1.**
*Generation Z – age range*

| Age range | Author |
|---|---|
| born after 1990 | (Dolot, 2018) |
| born between 1991 and 2000 | (Herrando et al., 2019) |
| born between 1995-2010 | (Balan & Vreja, 2018; Dabija et al., 2017; Hradiska, 2013) |
| born between 1995-2012 | (Maloni et al., 2019) |
| born after 1995 | (Bencsik et al., 2016; Cilliers, 2017; Gupta & Gulati, 2014) |
| born between 1996 and 2003 | (Zhitomirsky-Geffet & Blau, 2016) |
| born after 1997 | (Chang & Wang, 2018; Duffett, 2017; Ng et al., 2019; Vo, 2019) |
| born after 2000 | (Bejtkovsky, 2016) |

Generation Z, also called the post-millennials (Maloni et al., 2019), iGen (Mladkova, 2017) or digitally natives (Gupta & Gulati, 2014). The differences in conceptualising generations may result from different political, socioeconomic and cultural differences shaping societies (Schwartz et al., 2010). Also, as pointed out by Scholtz (2019), differences within Generation Z in different societies need to be acknowledged.

As indicated by Maloni et. al. (2019) and confirmed by the conducted literature review, Generation Z has so far received little attention. Nonetheless, due to the fact that Generation Z grew up when the Internet was widely accessible and knows the world only with constant access to the Internet and social media (Duffett, 2017), they should have ideal competencies for working in virtual teams. They are tech-savvy and socially connected through social media (Wiedmer, 2015). They grew up in an era of instant messaging (WhatsApp, Facebook Messenger), mobile, smart devices (smartphones, tablets, iPads, iPhones, smartwatches), picture and video-sharing (Instagram, YouTube, Snapchat, TikTok), micro-blogs (Twitter), and many other Internet platforms that enable them to communicate and socialise online (Duffett, 2017; Parry & Battista, 2019; Stokes, 2011). They perceive this technology as a natural element of their life since they grew up using it (Zhitomirsky-Geffet & Blau, 2016) and prefer it to traditional media (Scholz & Vyugina, 2019). Thus, they have a high level of "intuitive technology literacy" (Scholz & Vyugina, 2019, p. 278). Generation Z is able to multitask, and they are creative, expressive and individualistic. They are able quickly filter out boring and irrelevant information (Duffett, 2017). They communicate globally without boundaries (Scholz & Vyugina, 2019), and virtual communication can be as comfortable or even more so compared to face-to-face communication (Velez-Calle et al., 2020).

However, they are also impatient. They seek instant gratification and are not used to waiting (Duffett, 2017). They are less concerned with accuracy and more with interaction (Gentilviso & Aikat, 2019), and do not necessarily understand how technology is embedded into society (Scholz & Vyugina, 2019). They are characterised as lazy, having problems concentrating and dependent on online sources (Wiktorowicz & Warwas, 2016).

Among the values of Generation Z, researchers point towards the ability to see the results of their work (Maloni et al., 2019), making an impact and reflecting their interest in meaningful work (Maloni et al., 2019; Parry & Battista, 2019). As the most important extrinsic values, researchers point towards promotion and salary (Maloni et al., 2019). Generation Z values security as well (Maloni et al., 2019). Maloni et al. (2019) also identified a shift towards greater importance of making friends and contact with people than was the case for Generation Y. However, Bencsik et al. (2016) described their relationships as superficial and established that they have no sense of commitment. They are more open to a flexible labor market and have a higher need for achievement than Generation Y (Frunzaru & Cismaru, 2018). Furthermore, they are perceived as disloyal (Scholz & Vyugina, 2019).

As noted by Velez-Calle et al. (2020), cultural differences between team members are not experienced as the primary challenge in making way for task-based and interpersonal issues. Rather, it is age of the virtual team members that will determine the efficiency of such teams, as the shift away from cultural issues is visible in the youngest generations (Velez-Calle et al., 2020). With the task-based issues in the centre, the theory of cooperation and competition can be the foundation for explaining the research problem (Johnson & Johnson, 1989). According to this theory, the perception of goals as competitively or cooperatively linked influences the team members' motivation, trust level and, most importantly, it influences the outcome. A common task which team members must achieve together fosters better problem-solving, better performance and higher efficiency.

Due to their high tech-savviness, constant connection and Internet presence, but also due to the cooperative nature of the chosen task and the fact that it has one expert solution the author believes that, the mentioned lower performance of virtual teams (O'Neill et al., 2016) will not apply in this case, thus the following hypotheses were developed:

*H1: Virtual teams composed of Generation Z representatives will perform better than face-to-face teams composed of Generation Z representatives*.

Also, due to Generation Z's constant Internet use, their high ICT communication skills, and, in general, because of their value system the author believes that in opposition to previous research (Shwarts-Asher et al., 2009; Warkentin et al., 1997) virtual teams composed of representatives of Generation Z will have a higher satisfaction level than face-to-face teams, thus a second hypothesis was developed:

*H2: Virtual teams composed of Generation Z representatives will have a higher level of satisfaction than face-to-face teams composed of Generation Z representatives*.

## 3. Research objective, methodology and data

The research adopted a pluralistic approach using a literature review, an experiment and a follow-up survey. The use of multiple methods increases the reliability of the study (Lin et al., 2008) and was also dictated by the research goal. The first stage – the literature review was conducted to develop the primary framework for team performance and satisfaction and to develop the hypothesis. The second stage was the experiment, which tested the effectiveness of virtual and face-to-face teams, followed by the third stage – a survey aimed at testing the satisfaction of the participants. In order to avoid influencing the perception of the experiment, the solution of the task was explained by the researcher after completing the survey.

For the experiment, a decision-making task was chosen, which required communication and had an expert solution (to test the team's performance). It was decided to choose the Desert Survival Task (Johnson & Johnson, 2006). This exercise was chosen due to the low probability that the participants had had experience that could help them solve this task (Staples & Zhao, 2006). It has also been previously used in small group research (Staples & Zhao, 2006; Straus, 1996). Furthermore, this task has several similarities to problems which employees face in real life. It requires a task to be solved with one correct solution, and has elements of a decision-making and negotiation process. The task tests the performance of each group by comparing their results to the key – the expert's answer (Thompson & Coovert, 2003). The participants of the face-to-face groups worked together in a room. The researcher left the room for the time of the discussion to minimize the possibility that the presence of the researcher would influence the outcome. The participants of the virtual teams were led to different rooms and given computers and headsets. They interacted through a web-based teleconference application with a built-in synchronous chat function. The cameras were disabled so that the participants could not see each other. This was aimed at creating additional barriers to communication, e.g. reducing the visibility of communication styles, negative/positive reactions and body language (Staples & Zhao, 2006). After completing the experiment, the participants were asked to fill out a questionnaire to test their satisfaction. The questionnaire measured the participants satisfaction using Green and Taber's (1980) and Lind's (1999) scales. The Polish adoption of the scales was made using a back-translation procedure (Paolillo et al., 2017). The scales included 7 indexes. Lind's (1999) scale measured group cohesion (Index 1 – Cronbach's alpha = 0.77), group conflict (Index 2 – Cronbach's alpha = 0.73) and group quality (Index 3 – Cronbach's alpha = 0.62). Green and Taber's (1980) scale measured personal task participation (Index 4 – Cronbach's alpha = 0.76), negative socio-emotional behaviour (Index 5 – Cronbach's alpha = 0.73), solution satisfaction (Index 6 – Cronbach's alpha = 0.70) and decision scheme satisfaction (Index 7 – Cronbach's alpha = 0.94).

Forty-one teams participated in the study, bringing the total number of participants in the experiment to 145 (Table 2). Team size was designed to be 3 or 4 people. For adequate power, a minimum of 15 teams per setting (Thompson & Coovert, 2003) was required and exceeded.

**Table 2.**
*Sample information*

| Communication mode | Number of teams and participants |
|---|---|
| Face-to-face | 19 teams<br>11 teams*4 members + 8 teams*3 members (n=68) |
| Virtual | 22 teams<br>11 teams*4 members+ 11 teams*3 members (n=77) |

The participants were university students born from 1995 to 1999, so they were all members of Generation Z. Among the participants, 55.86% were women and 44.14% were men. The groups were designed to include both men and women but there were also only female and only male groups (both virtual and face-to-face). The teams were homogeneous in terms of cultural and ethnic background. Participation in the study was voluntary and was not linked to any course credit by the researcher. Subjects were invited across multiple study majors to minimize the previous history of the team members. Students registered online for the experiment by choosing a suitable date, and they did not see other registrations or even the number of participants already registered. The participants were then randomly assigned to virtual or face-to-face teams.

## 4. Results and Discussion

As the independent variable was nominal (communication mode) in order to analyze if differences between the performance and satisfaction of face-to-face and virtual teams are statistically significant, the Mann–Whitney U was conducted. The group results were developed from means of the group members responses. The results are presented in Table 3

**Table 3.**
*Research results*

| | Communication mode | | | | | | | | | Mann-Whitney U test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Virtual teams (n = 77) | | | Face-to-face teams (n = 68) | | | Total (n=145) | | | | |
| | **M** | **SD** | **ME** | **M** | **SD** | **ME** | **M** | **SD** | **ME** | **Z** | **p** |
| Index1 | 1,77 | 0,48 | 1,80 | 1,63 | 0,47 | 1,60 | 1,71 | 0,48 | 1,60 | **-2,169** | **0,030*** |
| Index2 | 4,06 | 0,55 | 4,00 | 4,27 | 0,58 | 4,40 | 4,16 | 0,58 | 4,20 | **-2,672** | **0,008**** |

Cont. table 3.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Index3 | 1,99 | 0,54 | 2,00 | 1,79 | 0,55 | 1,67 | 1,90 | 0,55 | 2,00 | **-2,442** | **0,015*** |
| Index4 | 2,45 | 0,54 | 2,40 | 2,20 | 0,54 | 2,18 | 2,34 | 0,55 | 2,25 | **-2,960** | **0,003**** |
| Index5 | 4,48 | 0,56 | 4,64 | 4,46 | 0,64 | 4,60 | 4,47 | 0,60 | 4,64 | -0,391 | 0,696 |
| Index6 | 2,20 | 0,49 | 2,20 | 2,00 | 0,57 | 2,00 | 2,10 | 0,54 | 2,00 | **-2,712** | **0,007**** |
| Index7 | 1,96 | 1,04 | 1,60 | 1,72 | 0,90 | 1,40 | 1,85 | 0,98 | 1,60 | -1,673 | 0,094 |
| Performance | 48,25 | 7,33 | 50,00 | 48,50 | 9,67 | 52,00 | 48,37 | 8,48 | 52,00 | -1,157 | 0,247 |

* $p < 0,05$.
** $p < 0,01$.

The results show statistically significant differences for five indexes. The virtual teams achieved higher results than face-to-face teams when it comes to group cohesion (1.77+/-0.48 vs. 163+/-0.48.), group quality (1.99+/-0.54 vs. 1.79+/-0.55), personal task participation (2.45+/-0.54 vs. 2.2+/- 0.55) and solution satisfaction (2.2+/-0.49 vs. 2+/- 0.54). Face-to-face teams demonstrated a higher level of conflict (4.27+/-0.58) than virtual teams (4.06+/-0.55). The analysis showed no statistically significant differences between negative socio-economic behaviour, decision-scheme satisfaction or performance. Therefore, the first hypothesis could not be confirmed, and the second hypothesis was confirmed partially.

The conducted research makes a key contribution to the existing literature on virtual teams by supplementing it with knowledge about the functioning of Generation Z in virtual and face-to-face teams, but also by challenging some of the previous studies and beliefs.

Warketin et al. (1997) found that virtual teams report lower levels of satisfaction than face-to-face teams. Staples and Zhao (2006) found no differences within any of the analyzed team attitudes or conflict levels in regards to their culturally homogenous teams of Generation Y representatives. The research presented in this paper shows, however, that Generation Z is more internally diverse, as there were differences between virtual and face-to-face teams, and, in regards to some satisfaction indicators, the virtual teams reported higher results. This may be a consequence of their mentioned tech-savviness and a natural approach towards internet mediated communication (Zhitomirsky-Geffet & Blau, 2016). Consequently, these findings support the necessity to consider the generational approach in studying team work processes, behaviors and attitudes.

Research has suggested that virtual teams face challenges when developing relationships and cohesion (Ocker & Morand, 2002). Such teams were also believed to have higher levels of conflict (Valacich et al., 2002). The conducted research, however, showed that, in actuality, virtual teams and face-to-face teams with higher levels of conflict achieved higher cohesion than face-to-face teams without conflict. Thus, the CMC seems to benefit teams consisting of representatives of Generation Z.

Furthermore, the conducted research found no statistically significant differences in team performance. This is of importance especially since it challenges the current views that virtual teams do worse with tasks that have one solution (O'Neill et al., 2016) or findings suggesting

that virtual teams need additional time upon formation to become as effective as traditional teams. In this case, the characteristics of Generation Z may help to overcome potential barriers, which, for other groups, could significantly impact performance when working in virtual teams (Tan et al., 2000). Nevertheless, this would require further analysis to compare virtual and face-to-face teams across other generations.

Several studies indicated time as an important variable, whereby the moment the team was established influences behaviors within the team (Massey et al., 2003) like trust (Jarvenpaa et al., 2004; Kanawattanachai & Yoo, 2002; Wilson et al., 2006), communication (Alge et al., 2003) or effects of diversity on team outcome (Carte & Chidambaram, 2004; Staples & Zhao, 2006). Thus, the author is of the opinion that the chosen time frame was too short to allow for the development of a team identity. Therefore, it would be beneficial to conduct longitudinal studies measuring changes in team identity, team processes and the performance and satisfaction of the teams. Additionally, an analysis using more complex CMC tools or social collaboration platforms, which are designed to enable social interaction and with whom millennials and Generation Z are well-acquainted (Orta-Castanon et al., 2018), could be beneficial, as it would provide more insight into the importance of team identity and social interaction for performance and satisfaction.

## 5. Conclusions

The objective of the study was to explore the relation between the type of teamwork and performance and satisfaction of Generation Z. The conducted research, including an experiment and a survey, indicated that the attitudes of virtual and face-to-face teams consisting of representatives of Generation Z differ from previously analyzed teams. The characteristics of the youngest generation on the labor market and especially their tech-savviness and literacy make it easier for them to function in virtual teams. Consequently, this invalidates earlier restrictions and barriers. In general, the performance level of virtual and face-to-face teams is similar, and the satisfaction of the virtual team members is even higher. This has significant consequences not only for the ongoing scientific debate but also for practitioners, as it seems that, with Generation Z, they can enjoy all the benefits of virtual work without bearing the costs that are normally associated with it.

The research study fills a gap in the literature, as, for the first time, it analyses how representatives of Generation Z work in both virtual and face-to-face teams. This knowledge is significant as differences between generations affect recruitment and development of teams (Bejtkovsky, 2016). Therefore, the presented research also has managerial implications, as it shows that, in contrast to other groups, representatives of Generations Z may work in virtual teams, allowing them to make use of all the benefits of this form of work without the loss of

performance. Overall, virtual Generation Z teams demonstrate greater cohesion, group quality, personal task participation and solution satisfaction. Thus, it seems that managers can gain from this kind of work arrangement without the fear of performance loss. Particularly in light of the increase in the amount of virtual and remote work as a consequence of the COVID-19 pandemic (Deloitte, 2020), it is perhaps a positive sign that the youngest generation may not be affected in a way similar to the older generations by loss of performance or lower satisfaction.

In conclusion, the conducted research is not free of limitations. The experiment teams were homogenous in regards to cultural background and age. Therefore, this research could be expanded by including culturally heterogenous teams in order to verify if the cultural aspect is, in fact, no longer the primary challenge for virtual teams (Velez-Calle et al., 2020). Furthermore, expanding the experiment to include other generations but with the same settings would provide additional arguments in the debate on the influence of the type of work on performance and satisfaction.

## References

1. Alavi, M., & Tiwana, A. (2002). Knowledge integration in virtual teams: The potential role of KMS. *Journal of the American Society for Information Science and Technology, 53*(12), 1029-1037. doi:10.1002/asi.10107.
2. Alge, B.J., Wiethoff, C., & Klein, H.J. (2003). When does the medium matter? Knowledge-building experiences and opportunities in decision-making teams. *Organizational Behavior and Human Decision Processes, 91*(1), 26-37. doi:10.1016/s0749-5978(02)00524-1.
3. Aubert, B.A., & Kelsey, B.L. (2003). Further understanding of trust and performance in virtual teams. *Small Group Research, 34*(5), 575-618. doi:10.1177/1046496403256011.
4. Bailey, D.E., Leonardi, P.M., & Barley, S.R. (2012). The Lure of the Virtual. *Organization Science, 23*(5), 1485-1504. doi:10.1287/orsc.1110.0703.
5. Balan, S., & Vreja, L.O. (2018, Nov 01-02). *Generation Z: Challendes for Management and Leadership.* Paper presented at the 12th International Management Conference on Management Perspectives in the Digital Era (IMC), Bucharest, Romania.
6. Bejtkovsky, J. (2016). The Employees of Baby Boomers Generation, Generation X, Generation Y and Generation Z in Selected Czech Corporations as Conceivers of Development and Competitiveness in their Corporation. *Journal of Competitiveness, 8*(4), 105-123. doi:10.7441/joc.2016.04.07.
7. Bell, B.S., & Kozlowski, S.W.J. (2002). A typology of virtual teams – Imp lications for effective leadership. *Group & Organization Management, 27*(1), 14-49. doi:10.1177/1059601102027001003.

8. Bencsik, A., Horvath-Csikos, G., & Juhasz, T. (2016). Y and Z Generations at Workplaces. *Journal of Competitiveness, 8*(3), 90-106. doi:10.7441/joc.2016.03.06.
9. Brahm, T., & Kunze, F. (2012). The role of trust climate in virtual teams. *Journal of Managerial Psychology, 27*(5-6), 595-614. doi:10.1108/02683941211252446.
10. Breuer, C., Huffmeier, J., & Hertel, G. (2016). Does Trust Matter More in Virtual Teams? A Meta-Analysis of Trust and Team Effectiveness Considering Virtuality and Documentation as Moderators. *Journal of Applied Psychology, 101*(8), 1151-1177. doi:10.1037/apl0000113.
11. Brown, H.G., Poole, M.S., & Rodgers, T.L. (2004). Interpersonal traits, complementarity, and trust in virtual collaboration. *Journal of Management Information Systems, 20*(4), 115-137. doi:10.1080/07421222.2004.11045785.
12. Burton, C.M., Mayhall, C., Cross, J., & Patterson, P. (2019). Critical elements for multigenerational teams: a systematic review. *Team Performance Management: An International Journal, 25*(7/8), 369-401. doi:10.1108/TPM-12-2018-0075.
13. Carnevale, J.B., & Hatak, I. (2020). Employee adjustment and well-being in the era of COVID-19: Implications for human resource management. *Journal of Business Research, 116*, 183-187. doi:10.1016/j.jbusres.2020.05.037.
14. Carte, T., & Chidambaram, L. (2004). A Capabilities-Based Theory of Technology Deployment in Diverse Teams: Leapfrogging the Pitfalls of Diversity and Leveraging Its Potential with Collaborative Technology. *Journal of the Association for Information Systems, 5*(11/12), 448-471.
15. Cascio, W.F. (2000). Managing a virtual workplace. *Academy of Management Executive, 14*(3), 81-90. doi:10.5465/ame.2000.4468068.
16. Chang, A., & Bordia, P. (2001). A multidimensional approach to the group cohesion-group performance relationship. *Small Group Research, 32*(4), 379-405. doi:10.1177/104649640103200401.
17. Chang, W.L., & Wang, J.Y. (2018). Mine is yours? Using sentiment analysis to explore the degree of risk in the sharing economy. *Electronic Commerce Research and Applications, 28*, 141-158. doi:10.1016/j.elerap.2018.01.014.
18. Chidambaram, L. (1996). Relational development in computer-supported groups. *Mis Quarterly, 20*(2), 143-165. doi:10.2307/249476.
19. Chidambaram, L., & Tung, L.L. (2005). Is out of sight, out of mind? An empirical study of social loafing in technology-supported groups. *Information Systems Research, 16*(2), 149-168. doi:10.1287/isre.1050.0051.
20. Chudoba, K.M., Wynn, E., Lu, M., & Watson-Manheim, M.B. (2005). How virtual are we? Measuring virtuality and understanding its impact in a global organization. *Information Systems Journal, 15*(4), 279-306. doi:10.1111/j.1365-2575.2005.00200.x.
21. Cilliers, E.J. (2017). The challenge of teaching generation Z. *PEOPLE: International Journal of Social Sciences, 3*(1). doi: 10.20319/pijss.2017.31.188198.

22. Cramton, C.D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science, 12*(3), 346-371. doi:10.1287/orsc.12.3.346.10098.
23. Crisp, C.B., & Jarvenpaa, S.L. (2013). Swift Trust in Global Virtual Teams Trusting Beliefs and Normative Actions. *Journal of Personnel Psychology, 12*(1), 45-56. doi:10.1027/1866-5888/a000075.
24. Curseu, P.L., & Schruijer, S.G.L. (2010). Does Conflict Shatter Trust or Does Trust Obliterate Conflict? Revisiting the Relationships Between Team Diversity, Conflict, and Trust. *Group Dynamics-Theory Research and Practice, 14*(1), 66-79. doi:10.1037/a0017104.
25. Dabija, D.C., Babut, T., Dinu, V., & Lugojan, M.I. (2017). Cross-Generational Analysis of Iformation Searching Based on Social Media in Romania. *Transformations in Business & Economics, 16*(2), 248-270.
26. Daim, T.U., Ha, A., Reutiman, S., Hughes, B., Pathak, U., Bynum, W., & Bhatla, A. (2012). Exploring the communication breakdown in global virtual teams. *International Journal of Project Management, 30*(2), 199-212. doi:10.1016/j.ijproman.2011.06.004.
27. De Jong, B.A., Dirks, K.T., & Gillespie, N. (2016). Trust and Team Performance: A Meta-Analysis of Main Effects, Moderators, and Covariates. *Journal of Applied Psychology, 101*(8), 1134-1150. doi:10.1037/apl0000110.
28. Deloitte (2020) COVID-19. Workforce Strategies for Post-COVID Recovery, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/workforce-strategies-for-post-covid-19-recovery.pdf, 29 July 2020.
29. Dolot, A. (2018). The Characteristics of Generation Z. *E-Mentor, 2,* 44-50. doi:10.15219/em74.1351.
30. Duffett, R.G. (2017). Influence of social media marketing communications on young consumers' attitudes. *Young Consumers, 18*(1), 19-39. doi:10.1108/yc-07-2016-00622.
31. Edwards, H.K. (2005). Analysis of software requirements engineering exercises in a global virtual team setup. *Journal of Global Information Management, 13*(2), 21-41. doi:10.4018/jgim.2005040102.
32. Ferrara, S. J., Mohammadi, N., Taylor, J. E., & Javernick-Will, A. N. (2017). Generational Differences in Virtual Teaming in the United States: Culture, Time and Technology. *Journal of Information Technology in Construction, 22*, 132-144.
33. Fiol, C.M., & O'Connor, E.J. (2005). Identification in face-to-face, hybrid, and pure virtual teams: Untangling the contradictions. *Organization Science, 16*(1), 19-32. doi:10.1287/orsc.1040.0101.
34. Foster, M.K., Abbey, A., Callow, M.A., Zu, X.X., & Wilbon, A.D. (2015). Rethinking Virtuality and Its Impact on Teams. *Small Group Research, 46*(3), 267-299. doi:10.1177/1046496415573795.

35. Frunzaru, V., & Cismaru, D.M. (2018). The impact of individual entrepreneurial orientation and education on generation Z's intention towards entrepreneurship. *Kybernetes*. doi:10.1108/K-05-2018-0272.
36. Furst, S., Blackburn, R., & Rosen, B. (1999). Virtual team effectiveness: a proposed research agenda. *Information Systems Journal, 9*(4), 249-269. doi:10.1046/j.1365-2575.1999.00064.x.
37. Furumo, K. (2009). The Impact of Conflict and Conflict Management Style on Deadbeats and Deserters in Virtual Teams. *Journal of Computer Information Systems, 49*(4), 66-73.
38. Gao, G., & Sai, L.N. (2020). Towards a 'virtual' world: Social isolation and struggles during the COVID-19 pandemic as single women living alone. *Gender Work and Organization*, *9*. doi:10.1111/gwao.12468.
39. Gao, S.L., Guo, Y.L., Chen, J.B., & Li, L. (2016). Factors affecting the performance of knowledge collaboration in virtual team based on capital appreciation. *Information Technology & Management, 17*(2), 119-131. doi:10.1007/s10799-015-0248-y.
40. Geister, S., Konradt, U., & Hertel, G. (2006). Effects of process feedback on motivation, satisfaction, and performance in virtual teams. *Small Group Research, 37*(5), 459-489. doi:10.1177/1046496406292337.
41. Gentilviso, C., & Aikat, D. (2019). Embracing the Visual, Verbal, and Viral Media: How Post-Millennial Consumption Habits are Reshaping the News. In: J. Schulz, L. Robinson, A. Khilnani, J. Baldwin, H. Pait, A. Williams, J. Davis & G. Ignatow, (Eds), *Mediated Millennials* (pp. 147-171). Emerald Publishing Limited.
42. Gilson, L.L., Maynard, M.T., Young, N.C.J., Vartiainen, M., & Hakonen, M. (2015). Virtual Teams Research: 10 Years, 10 Themes, and 10 Opportunities. *Journal of Management, 41*(5), 1313-1337. doi:10.1177/0149206314559946.
43. Green, S.G., & Taber, T.D. (1980). The effects of three social decision schemes on decision group process. *Organizational Behavior and Human Performance, 25*(1), 97-106. doi:10.1016/0030-5073(80)90027-6.
44. Griffith, T.L., & Neale, M.A. (2001). Information processing in traditional, hybrid, and virtual teams: From nascent knowledge to transactive memory. *Research in Organizational Behavior, Vol. 23,* 379-421. doi:10.1016/s0191-3085(01)23009-3.
45. Guo, Z.X., D'Ambra, J., Turner, T., & Zhang, H.Y. (2009). Improving the Effectiveness of Virtual Teams: A Comparison of Video-Conferencing and Face-to-Face Communication in China. *IEEE Transactions on Professional Communication, 52*(1), 1-16. doi:10.1109/tpc.2008.2012284.
46. Gupta, O., & Gulati, G. (2014). Psycho-analysis of Mobile applications usage among Generation Z Teens. *International Journal on Global Business Management & Research, 3*(1), 80.

47. Handke, L., Klonek, F.E., Parker, S.K., & Kauffeld, S. (2020). Interactive Effects of Team Virtuality and Work Design on Team Functioning. *Small Group Research, 51*(1), 3-47. doi:10.1177/1046496419863490.
48. Hardin, A.M., Fuller, M.A., & Davison, R.M. (2007). I know I can but can we? Culture and efficacy beliefs in global virtual teams. *Small Group Research, 38*(1), 130-155. doi:10.1177/1046496406297041.
49. Herrando, C., Jimenez-Martinez, J., & Martin-De Hoyos, M.J. (2019). Tell me your age and I tell you what you trust: the moderating effect of generations. *Internet Research, 29*(4), 799-817. doi:10.1108/IntR-03-2017-0135.
50. Hertel, G., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review, 15*(1), 69-95. doi:10.1016/j.hrmr.2005.01.002.
51. Hradiska, E. (2013). Identity and Consumer Behavior of the Generation Z. *Marketing Identity: Design That Sells*, 199-214.
52. Jarvenpaa, S.L., Shaw, T.R., & Staples, D.S. (2004). Toward contextualized theories of trust: The role of trust in global virtual teams. *Information Systems Research, 15*(3), 250-267. doi:10.1287/isre.1040.0028.
53. Johnson, D.W., & Johnson, F.P. (2006). *Joining together: group theory and group skills*. Boston: Pearson Allyn and Bacon.
54. Johnson, D.W., & Johnson, R.T. (1989). *Cooperation and competition: Theory and research.* Interaction Book Company.
55. Joshi, A., Lazarova, M.B., & Liao, H. (2009). Getting Everyone on Board: The Role of Inspirational Leadership in Geographically Dispersed Teams. *Organization Science, 20*(1), 240-252. doi:10.1287/Orsc.1080.0383.
56. Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems, 11*(3-4), 187-213. doi:10.1016/s0963-8687(02)00019-7.
57. Kashive, N., Khanna, V.T., & Powale, L. Virtual team performance: E-leadership roles in the era of COVID-19. *Journal of Management Development*. doi:10.1108/jmd-05-2021-0151.
58. Kirkman, B.L., Rosen, B., Gibson, C.B., Tesluk, P.E., & McPherson, S.O. (2002). Five challenges to virtual team success: Lessons from Sabre, Inc. *Academy of Management Executive, 16*(3), 67-79. doi:10.5465/ame.2002.8540322.
59. Kirkman, B.L., Rosen, B., Tesluk, P.E., & Gibson, C.B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal, 47*(2), 175-192. doi:10.2307/20159571.
60. Kupperschmidt, B.R. (2000). Multigeneration employees: strategies for effective management. *The health care manager, 19*(1), 65-76. doi:10.1097/00126450-200019010-00011.

61. Lin, C., Standing, C., & Liu, Y.C. (2008). A model to develop effective virtual teams. *Decision Support Systems, 45*(4), 1031-1045. doi:10.1016/j.dss.2008.04.002.
62. Lind, M.R. (1999). The gender impact of temporary virtual work groups. *IEEE Transactions on Professional Communication, 42*(4), 276-285. doi:10.1109/47.807966.
63. Lipnack, J., & Stamps, J. (2000). *Virtual teams: People working across boundaries with technology*: John Wiley & Sons.
64. Lira, E.M., Ripoll, P., Peiro, J.M., & Orengo, V. (2008). How do different types of intragroup conflict affect group potency in virtual compared with face-to-face teams? A longitudinal study. *Behaviour & Information Technology, 27*(2), 107-114. doi:10.1080/01449290600875151.
65. Lott, A.J., & Lott, B.E. (1965). Group cohesiveness as interpersonal attraction: A review of relationships with antecedent and consequent variables. *Psychological Bulletin, 64*(4), 259-309. doi:10.1037/h0022386.
66. Lowry, P.B., Roberts, T.L., Romano, N.C., Cheney, P.D., & Hightower, R.T. (2006). The impact of group size and social presence on small-group communication – Does computer-mediated communication make a difference? *Small Group Research, 37*(6), 631-661. doi:10.1177/1046496406294322.
67. Lurey, J.S., & Raisinghani, M.S. (2001). An empirical study of best practices in virtual teams. *Information & Management, 38*(8), 523-544. doi:10.1016/s0378-7206(01)00074-x.
68. Luse, A., McElroy, J.C., Townsend, A.M., & DeMarie, S. (2013). Personality and cognitive style as predictors of preference for working in virtual teams. *Computers in Human Behavior, 29*(4), 1825-1832. doi:10.1016/j.chb.2013.02.007.
69. Majchrzak, A., Malhotra, A., Stamps, J., & Lipnack, J. (2004). Can absence make a team grow stronger. *Harvard Business Review, 82*(5), 131-137.
70. Maloni, M., Hiatt, M.S., & Campbell, S. (2019). Understanding the work values of Gen Z business students. *International Journal of Management Education, 17*(3), 13. doi:10.1016/j.ijme.2019.100320.
71. Marlow, S.L., Lacerenza, C.N., Paoletti, J., Burke, C.S., & Salas, E. (2018). Does team communication represent a one-size-fits-all approach? A meta analysis of team communication and performance. *Organizational Behavior and Human Decision Processes, 144*, 145-170. doi:10.1016/j.obhdp.2017.08.001.
72. Massey, A.P., Montoya-Weiss, M.M., & Hung, Y.T. (2003). Because time matters: Temporal coordination in global virtual project teams. *Journal of Management Information Systems, 19*(4), 129-155.
73. Maurer, R. (2016). What HR should know about Generation Z. https://www.shrm.org/resourcesandtools/hr-topics/talent-acquisition/pages/what-hr-should-know-about-generation-z.aspx, 29 July 2020.

74. Maznevski, M.L., & Chudoba, K.M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science, 11*(5), 473-492. doi:10.1287/orsc.11.5.473.15200.
75. Mladkova, L. (2017). *Generation Z in the Literature*. Proceedings of the 14th International Conference Efficiency and Responsibility in Education 2017 (ERIE 2017), 255-261.
76. Morris, M.G., & Venkatesh, V. (2000). Age differences in technology adoption decisions: Implications for a changing work force. *Personnel Psychology, 53*(2), 375-403. doi:10.1111/j.1744-6570.2000.tb00206.x.
77. Ng, S.I., Ho, J.A., Lim, X.J., Chong, K.L., & Latiff, K. (2019). Mirror, mirror on the wall, are we ready for Gen-Z in marketplace? A study of smart retailing technology in Malaysia. *Young Consumers*. doi:10.1108/YC-06-2019-1006.
78. Ocker, R.J., & Morand, D. (2002). Exploring the Mediating Effect of Group Development on Satisfaction in Virtual and Mixed-Mode Environments. *e-Service Journal, 1*(3), 25. doi:10.2979/ESJ.2002.1.3.25.
79. O'Neill, T.A., Hancock, S.E., Zivkov, K., Larson, N.L., & Law, S.J. (2016). Team Decision Making in Virtual and Face-to-Face Environments. *Group Decision and Negotiation, 25*(5), 995-1020. doi:10.1007/s10726-015-9465-3.
80. Orta, P., Urbina-Coronado, P.D., Ramirez-Mendoza, R.A., & Ahuett-Garza, H. (2019). *Multicultural Experiences in Global Projects.* Paper presented at the 10th IEEE Global Engineering Education Conference (EDUCON), Dubai, U. Arab Emirates.
81. Orta-Castanon, P., Urbina-Coronado, P., Ahuett-Garza, H., Hernandez-de-Menendez, M., & Morales-Menendez, R. (2018). Social collaboration software for virtual teams: case studies. *International Journal of Interactive Design and Manufacturing – Ijidem, 12*(1), 15-24. doi:10.1007/s12008-017-0372-5.
82. Oshri, I., Kotlarsky, J., & Willcocks, L.P. (2007). Global software development: Exploring socialization and face-to-face meetings in distributed strategic projects. *Journal of Strategic Information Systems, 16*(1), 25-49. doi:10.1016/j.jsis.2007.01.001.
83. Paolillo, A., Pasini, M., Silva, S.A., & Magnano, P. (2017). Psychometric properties of the Italian adaptation of the Mor Barak et al. diversity climate scale. *Quality & Quantity, 51*(2), 873-890. doi:10.1007/s11135-016-0316-3.
84. Parry, E., & Battista, V. (2019). Generation Z in the UK: More of the Same – High Standards and Demands. In C. Scholz & A. Renning (Eds) *Generations Z in Europe* (pp. 89-107). Emerald Publishing Limited.
85. Paul, D.L. (2006). Collaborative activities in virtual settings: A knowledge management perspective of telemedicine. *Journal of Management Information Systems, 22*(4), 143-176. doi:10.2753/mis0742-1222220406.

86. Peters, L., & Karren, R.J. (2009). An Examination of the Roles of Trust and Functional Diversity on Virtual Team Performance Ratings. *Group & Organization Management, 34*(4), 479-504. doi:10.1177/1059601107312170.
87. Rhoads, M. (2010). Face-to-Face and Computer-Mediated Communication: What Does Theory Tell Us and What Have We Learned so Far? *Journal of Planning Literature, 25*(2), 111-122. doi:10.1177/0885412210382984.
88. Schmidt, J.B., Montoya-Weiss, M.M., & Massey, A.P. (2001). New product development decision-making effectiveness: Comparing individuals, face-to-face teams, and virtual teams. *Decision Sciences, 32*(4), 575-600. doi:10.1111/j.1540-5915.2001.tb00973.x.
89. Scholz, C. (2019). The Generations Z in Europe – An Introduction. In: C. Scholz & A. Renning (Eds), *Generations Z in Europe* (pp. 3-31). Emerald Publishing Limited.
90. Scholz, T., & Vyugina, D. (2019). Looking into the Future: What We Are Expecting from Generation Z. In: C. Scholz & A. Renning (Eds), *Generations Z in Europe* (pp. 277-284). Emerald Publishing Limited.
91. Schwartz, J., Hole, D., & Zhong, L. (2010). Talking about whose Generation? Why Western generational models can't account for a global workforce. https://www2.deloitte.com/us/en/insights/deloitte-review/issue-6/talking-about-whose-generation-ages-and-attitudes-among-the-global-workforce.html, 29 July 2020.
92. Shwarts-Asher, D., Ahituv, N., & Etzion, D. (2009). Modelling the characteristics of virtual teams' structure. *International Journal of Business Intelligence and Data Mining, 4*(2), 195-212. doi:10.1504/IJBIDM.2009.026908.
93. Staples, D.S., & Zhao, L. (2006). The effects of cultural diversity in virtual teams versus face-to-face teams. *Group Decision and Negotiation, 15*(4), 389-406. doi:10.1007/s10726-006-9042-x.
94. Stewart, K.J., & Gosain, S. (2006). The impact of ideology on effectiveness in open source software development teams. *Mis Quarterly, 30*(2), 291-314.
95. Stokes, R. (2011). *eMarketing: The essential guide to digital marketing*. Quirk eMarketing.
96. Straus, S.G. (1996). Getting a clue: The effects of communication media and information distribution on participation and performance in computer-mediated and face-to-face groups. *Small Group Research, 27*(1), 115-142. doi:10.1177/1046496496271006.
97. Tan, B.C.Y., Wei, K.K., Huang, W.W., & Ng, G.N. (2000). A dialogue technique to enhance electronic communication in virtual teams. *Ieee Transactions on Professional Communication, 43*(2), 153-165. doi:10.1109/47.843643.
98. Thompson, L.F., & Coovert, M.D. (2003). Teamwork online: The effects of computer conferencing on perceived confusion, satisfaction, and postdiscussion accuracy. *Group Dynamics-Theory Research and Practice, 7*(2), 135-151. doi:10.1037/1089-2699.7.2.135.

99. Valacich, J.S., Sarker, S., Pratt, J., & Groomer, M. (2002). *Computer-mediated and face-to-face groups: who makes riskier decisions?* Paper presented at the 35th Annual Hawaii International Conference on System Sciences.
100. Velez-Calle, A., Mariam, M., Gonzalez-Perez, M.A., Jimenez, A., Eisenberg, J., & Santamaria-Alvarez, S.M. (2020). When technological savviness overcomes cultural differences: millennials in global virtual teams. *Critical Perspectives on International Business*, *25*. doi:10.1108/cpoib-01-2018-0012.
101. Vo, M. (2019). *Engaging Generation Z through Corporate Social Responsibility*. Thesis Centria University of Applied Sciences.
102. Warkentin, M.E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system. *Decision Sciences, 28*(4), 975-996. doi:10.1111/j.1540-5915.1997.tb01338.x.
103. Wiedmer, T. (2015). Generations do differ: Best practices in leading traditionalists, boomers, and generations X, Y, and Z. *Delta Kappa Gamma Bulletin, 82*(1), 51-58.
104. Wiktorowicz, J., & Warwas, I. (2016). Pokolenia na rynku pracy. In: J. Wiktorowicz, I. Warwas, M. Kuba, E. Staszewska, P. Woszczyk, A. Stankiewicz, & J. Kliombka-Jarzyna (Eds.), *Pokolenia-co się zmienia? Kompendium zarządzania multigeneraycjnego* (pp. 19-37). Warsaw: Wolters Kluwer.
105. Wilson, J.M., Straus, S.G., & McEvily, B. (2006). All in due time: The development of trust in computer-mediated and face-to-face teams. *Organizational Behavior and Human Decision Processes, 99*(1), 16-33. doi:10.1016/j.obhdp.2005.08.001.
106. Zhang, Y.X., Zhao, R.N., & Yu, X. (2022). Enhancing virtual team performance via high-quality interpersonal relationships: effects of authentic leadership. *International Journal of Manpower, 43*(4), 982-1000. doi:10.1108/ijm-08-2020-0378.
107. Zhitomirsky-Geffet, M., & Blau, M. (2016). Cross-generational analysis of predictive factors of addictive behavior in smartphone usage. *Computers in Human Behavior, 64*, 682-693. doi:10.1016/j.chb.2016.07.061.

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# COVID PANDEMIC AS A DISRUPTIVE FACTOR ENHANCING ICT USE IN SOCIAL SCIENCES' TEACHING PRACTICES

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**Purpose:** Our research attempts to understand a change in social sciences' academics' teaching practices that can be observed during the COVID pandemic and that are predicted after the pandemic.
**Design**: We investigate – in the light of the Blin's and Munro's activity theory (2008) – whether the COVID pandemic is a disruptive factor that may lead to the transformation of social sciences academics' teaching practices. The research instrument was a worldwide survey conducted among social sciences' academics.
**Findings:** COVID pandemic has already introduced changes into academics' teaching practices in a form of broad ICT usage as well as initiated changes in the teaching activities design.
**Research limitations**: The number of responses is limited to 382 with only a collection of 77 responses from outside of Europe. We applied a general approach for ICT means not asking respondents about particular ICT tools. COVID as a pandemic evolves continuously indicating the need for further, in-depth research in this field.
**Practical implications:** COVID pandemic might serve as a disruptive factor enforcing further changes in social sciences' academic teaching practices after the pandemic.
**Social implications:** Our results indicate that the quality of social sciences teaching has worsened during the pandemic and most of the respondents do not predict significant changes in the quality of teaching after the pandemic compared to the quality of teaching before the pandemic.
**Originality:** We contribute by showing that introduction of a new tool (ICT) and modified teaching activity design resulted in a serious alteration of the teaching practice of social sciences' academics. We did not confirm that COVID disruption was expansive enough to permanently transform teaching practices of social sciences academics, hence we suggest that obstacles to successful incorporation of ICT in teaching practices are still present. We showed that ICT is predicted to be used more frequently rather than before (when it was only utilised as a platform to transfer traditional material) and will not modify the well-established practices referring to instructional tools. Our study suggests that the relation between teacher and teaching activity design is not mediated by ICT tools, which may result in resistance from the teachers.

**Keywords:** Covid, technology in teaching, activity theory, ICT use, higher education.

**Category of the paper:** research paper.

## 1. Introduction

The teaching process in higher education, and in teaching itself, is, on the one hand, a dynamic process which goes through constant changes. Still, on the other, it is a very stable activity, which is resistant to an introduction of changes within well-established teaching practices and tools. One of the main areas where higher education has been remarkably immune to changes was the adoption of e-learning as well as information and communication technologies (ICT) in distance teaching and online learning. Researchers interested in the topic of the use of new technologies in teaching assumed that academics would easily accept new technologies because they would allow them to perform specific tasks faster and more efficiently, ”re-vision” the teaching, or simply create opportunities impossible in the real class (Kellner, 2004; Burbules, Callister, 2000). Unfortunately, those predictions did not meet reality. Although universities had introduced ICT and e-learning tools, their significance for teaching and learning strategies was very low, as a large body of evidence confirmed (Tearle, 2003; Conole, 2004; Kirkup, Kirkwood, 2005; Lövström, Nevgi, 2007; Selwyn, 2007; Blin, Munro, 2008; Kirkwood, 2009; Bond et al., 2018; Liu et al., 2020).

Blin and Munro (2008) performed a study based on the activity theory (AT), in which they investigated academics' resistance to changing their teaching practices. Their principal findings indicated that the digital transformation had impacted the universities, mainly the administration processes. In contrast, it has not significantly affected teaching itself to enforce the transformation of teaching practices. In addition, they showed that academic teachers used ICT and e-learning to replicate existing teaching tools and methods rather than create new and innovative teaching methods. They suggested that one of the possible reasons is the lack of proper competencies among academics, as there were no programs and curriculums dedicated to training and developing such competencies. Blin and Munro (2008) concluded that, based on the activity theory model, there is a need for a more radical transformation or event to occur, creating a substantial disruption and allowing the evolution of the existing academics’ teaching practices. Also, other studies confirm the need for a motivator or other radical factor to change the current use of ICT in teaching at universities (Bond et al., 2018; Marks et al., 2020).

Year 2020 has shown that nothing is "set in stone" in the world and that one event can dramatically influence everyone’s lives and habits. The COVID pandemic has rapidly changed how people work, communicate, and function. The daily impact of the COVID pandemic on people’s lives can be measured in various ways. Many researchers focus on business-related issues and the problem of how the COVID pandemic has impacted businesses (Hea, Harris, 2020; Carnevale, Hatak, 2020; Pisz, 2021). Others stress the increase in ICT use during the COVID pandemic, but mainly as the tools for online meetings which replaced or superseded face-to-face ones (Byrnes et al., 2020, Ramkissoon et al., 2020). The researchers also emphasise the psychological impact of the COVID pandemic, arguing that, in general, the prevalence of

stress, anxiety, and depression is significantly higher in populations than before this COVID pandemic (Salari et al., 2020; Tee et al., 2020). However, we noticed a lack of investigation regarding the widespread ICT use in academic teaching practices. Taking Blin's and Munro's conclusions as the underpinnings for our consideration, the aim of this paper is to investigate, in the light of the activity theory, whether the COVID pandemic is a disruptive factor that may lead to the evolution of the academics' teaching practices? Thus, we used a survey questionnaire to find out, in the opinion of academic teachers, whether the COVID pandemic is a disruptive factor that has changed academics' teaching practices.

The remainder of this paper is organised in parts. First, to provide a theoretical basis for the research, the following sections describe the COVID pandemic and its impact on teaching practices and universities and provide the theoretical background of the activity theory. Further on, we describe our survey's methodology in detail and present the results. The final section discusses these results and outlines the study's implications, limitations, and conclusion.

## 2. Literature review

### 2.1. Covid pandemic and its impact on academics and universities

The COVID pandemic, also known as the coronavirus pandemic, is a pandemic caused by severe acute respiratory syndrome SARS‑CoV‑2 (WHO, 2020a). The disease was first identified in December 2019 in Wuhan, China. The World Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11, 2020 (WHO, 2020b). The outbreak has spread to every province of mainland China and 221 other countries and regions.

The onset of the COVID global pandemic has led to fundamental changes worldwide. Healthcare systems, economies, and citizens' lives have altered in unimaginable ways at the beginning of 2020. People were encouraged or forced to maintain social distancing, wear face masks in public places and work from home (WFH) or switch to distance/online teaching (Brynjolfsson et al., 2020; Weill et al., 2020). Uncertainty about the pandemic's duration and future infection waves led enterprises to view WFH as a "new normal" way of working (Bonacini et al., 2021). Large event organisers, sports events (e.g., Olympic Committee), enterprises and public sector organisations have also taken a range of precautions, including travel restrictions, event cancellations, remote work mandates, and events being held without spectators (Zraick, Garcia, 2020).

The higher education sector has been impacted profoundly by the pandemic as well. The lockdowns imposed in most countries shortly after the pandemic outbreak resulted in the immediate closure of universities and colleges and the move to the remote delivery of all

academic activities and related support services (Sangster et al., 2020). As a result, the functioning of the higher education institutions was limited and rapidly moved into an online mode initially for a few weeks, but was quickly extended for a longer period, depending on the country, to the fall of 2021 or even longer (Desvars-Larrive et al., 2020; MSHE, 2020; Rizun, Strzelecki, 2020).

Some researchers claimed it was a test of organisational agility (Wu, 2020). Many academics initially focused on transitioning content to an online environment (Crawford et al., 2020). Crawford et al. (2020) studied a series of universities and noticed that universities worldwide rapidly closed their face-to-face operations and moved to digitalised distance teaching. The observed phenomena were more noticeable, particularly in countries categorised as developing economies. According to the OECD data (2021), 95% of students in Switzerland, Norway, and Austria have computers to use for their schoolwork, whilst only 34% in Indonesia.

The research on governments' interventions and decisions related to rapidly changing Covid-19 epidemiological situations showed that despite the drawbacks of online teaching listed above, mandatory WFH and closure of educational institutions is the most effective intervention to fight the pandemic (Haug et al., 2020). It meant that universities and other higher education institutions had to implement ICT for distance teaching and online learning, which has become a prominent way of teaching.

### 2.2. Tools for online teaching before and during the pandemic

Remote teaching and learning have been used for years, but often in a simple form as a supplemental way of teaching. Currently, higher education institutions can use numerous ICTs that are constantly developed and upgraded to enhance teaching strategy. Among different ICTs, one can list e-learning platforms, e.g., Moodle, Google Classroom, Docebo, Wiz IQ, and ATutor; communication apps, e.g., Skype, WhatsApp, and Google Meet; as well as social media, e.g., Facebook, Twitter, LinkedIn, Youtube, and Instagram.

Indisputably, a considerable number of higher education institutions have been using Moodle or other e-learning platforms for years now to enrich traditional teaching methods and to make the classes more interesting for the students (Ramkissoon et al., 2020; Klimkiewicz, 2016; Huang, Hew, 2018). The experience with e-learning platforms made it easier for universities to switch from mainly traditional but supported by Moodle or other e-learning platforms to purely online teaching. E-learning platforms seemed to confer the main advantage for the higher education institutions at the beginning of the COVID-19 lockdown in 2020. Some universities have decided to implement other software and online solutions, such as Microsoft Teams and Zoom, which instantly provide convenient features and tools (Almarzooq et al., 2020). Others had implemented Google online solutions. Google Classroom is accessible directly through web browsers as well as intelligent applications on Chrome OS, iOS and Android. The main advantage of Google Classroom is that it is easy to access, simple but flexible and convenient, quickly enabling anyone to use it (Azhar, Iqbal, 2018). Kumar, Bervell

(2019) stated that Google Classroom is an online communication platform that makes it easier for teachers to post announcements, share learning materials, assess students' work, and evaluate their assignments.

Regardless of e-learning platforms and communications apps, universities have implemented well-known social media to enhance teaching methods and communication with students and co-workers (Carpenter et al., 2020). Ramkissoon et al. (2020) concluded that higher education institutions should consider a shift from classic e-learning platforms to more suitable forms of communication and interactions like social media to enhance their teaching and learning process. Their results indicate that students preferred WhatsApp due to its knowledge sharing and construction facility, interactivity, usability, respect for privacy, and instant communication compared to Moodle, which was recognised as less pedagogically efficient. On top of that, many universities enabled online access to their software resources as it was necessary to ensure the smoothness of the classes.

Based on the above, we argue that this coronavirus pandemic has rapidly changed academic teaching practices. However, as the subject literature review suggests, these changes have not occurred in the previous years, even though the tools were available for academic teachers to implement them in their teaching practices. In other words, academics had access to the right software and all the resources needed to improve their teaching practices and start using e-learning platforms on a large scale, but they have not done it.

### 2.3. Activity theory in academics' teaching practices

As Thompson (2004) said, "activity theory is less of a 'theory,' in the sense of a well-defined approach and set of constructs than an explicit focus on the interaction between actors and their surrounding environment." In other words, the activity theory (AT), also known as cultural, historical activity theory (CHAT) (Lu et al., 2018), is a construct that allows explaining how various means in the world influence each other and the human as well. It creates a specific model representing a current situation appearing in the real world or investigating the proposed situation in the future and the possibility of enforcing it. In accordance with the activity theory, the particular activities are motivated by the need to transform an object (physical or conceptual) into the desired goal (outcome) and influenced by the use of instruments (tools), which can again be physical or conceptual (Leont'ev, 1978). The motive directs action, which is carried out by individuals or groups of people (subject). The theory was further developed by Engelström (1987, 2001), who provided the representation of socio-cultural context (community), the restrictions imposed by legislation (rules) and the allocation of responsibilities (division of labour). The concept is presented in the form of a triangle to represent possible interrelations between the elements described (Figure 1).

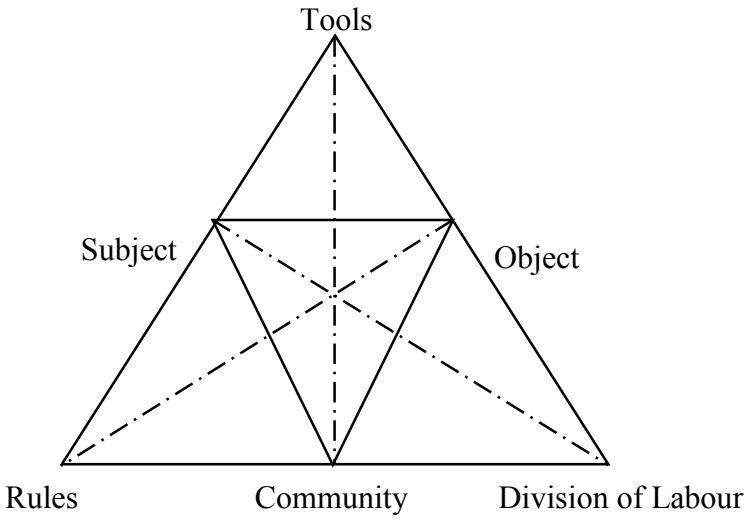


**Figure 1.** The design of the activity system based on the activity theory. Source: (Blin, Munro, 2008).

Figure 1 shows that each of the vertices of the triangle influences each other, consequently affecting the desired outcome.

The AT framework is universal and has been widely used over the years in many disciplines and contexts to explain the complexities of learning and teaching (Kirby, Anwar, 2020). One of the areas where AT has been utilised is the investigation of Human-Computer Interaction (Kapterlinin, Nardi, 2006), where it was used to diagnose interaction and adoption issues related to the implementation of new technology (McAndrew et al., 2006; Blin, Munro, 2008; Karasavvdis, 2009; Peña-Ayala et al., 2014; Kirby, Anwar 2020). Even though the concept was initially created in 1978, the extended version from 1987 is repeatedly used in research regarding university teaching, evaluating learning or building e-learning (Clemmensen et al., 2016; Chung et al., 2019; Liu et al., 2020).

While using the AT, the researchers may take various approaches. For example, they can use AT to explain a particular activity (Nguyen, Habók, 2021; Lee et al., 2021) and how specific indices of the AT triangle influence each other (McAndrew et al., 2006; Reid et al., 2015), use of AT in the teaching process (Fletcher, 2021) or how a particular disruptive element: event or factor, can change the activity represented by the triangle (Barab et al., 2002; Engelström, 1987, 2001; Helle, 2000; Blin, Munro, 2008; Holen et al., 2017; Lei, Hu, 2019).

The literature uses the expressions "disruption" and "contradiction" as synonyms. Disruption in teaching is understood as a severe transformation or alteration of the structure of teaching and learning activities in formal education, focusing on those transformations arising from an institution-wide deployment of e-learning technologies (Blin, Munro, 2008).

A severe interruption in an existing AT model canfollowingly either:

- evolve by accepting new components or replacing previous components; or
- remain unchanged by rejecting new components.

The recalled studies identified tools as e-books, tablets and digital pens, curricula content or technology, while subjects were teachers, students, tutors and educational technologists. Further, the construction of a unit of learning, pedagogical environment to provide personalised education, online course design or the supply of tablets were treated as objects in case of investigation of learning practices. Educational law, cognitive theory, academic structure or teaching strategies served as a rule in the past research. Unit coordinators, device providers, students, teachers, and colleagues from a discipline were meant to represent the community under investigation. Finally, division of labour was represented by members' functions and responsibilities or those who control the teaching process.

## 3. Research question and hypotheses

Our research attempts to understand a change in academics' teaching practices that can be observed during the COVID-19 pandemic. In particular, we try to assess whether the pandemic is a sufficiently strong disruptive factor that changes teaching activity and, consequently, can affect the outcome, i.e. academics' teaching practices. Consequently, we formulated the following research question:

**RQ**: Is COVID a disruptive factor that has changed academics' teaching practices (outcome)?

Blin and Munro (2008) argued that a severe and powerful contradiction needs to occur to result in the everyday use of ICT in daily academic teaching practice. In our opinion, that happened in 2020 as the coronavirus pandemic forced almost all universities to move to fully online teaching. We assume that such rules will not prevail after the pandemic, thus allowing us to infer whether the pandemic is a strong enough contradiction to change academics' teaching practices. Based on the above-described distinction, the research design encompasses three time spans: before COVID pandemic (T0), during COVID pandemic (T1), and after COVID pandemic (T2), was is presented in Figure 2.

The rules are conceptualised as the national regulations together with the university law regarding mostly traditional (on-campus) teaching before (T0), the obligatory online teaching during (T1) COVID pandemic, and a projected departure from obligatory online teaching after (T2) COVID pandemic. The community encompasses a society of teachers and other university staff taking an active part in the teaching processes. At the same time, the division of labour is linked to the position at the university, which means that we implement a vertical approach.

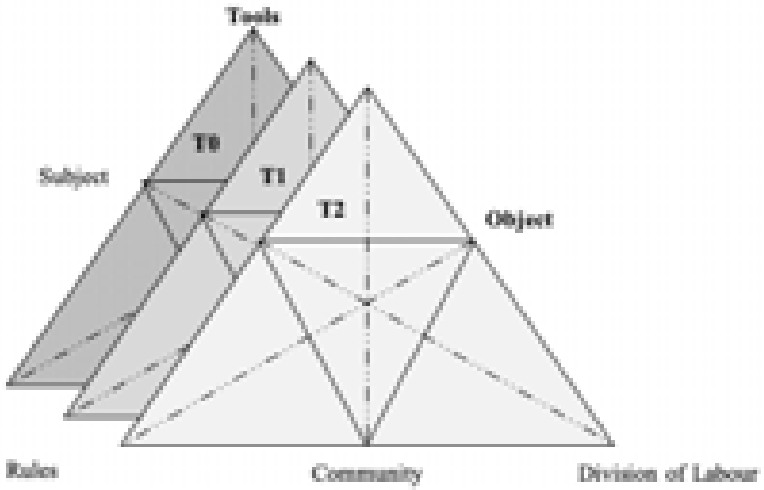


**Figure 2.** Research design – activity theory triangle in three-time spans – general outlook. Source: Own work based on Blin, Munro, 2008.

The activity of academic teaching is performed by a university teacher (subject) and is motivated by the teaching activities design (object). Therefore, the tool is an artefact that facilitates the outcome by the subject: enhanced academic teaching practices due to the changes in the ICT use (tools) and through the changes in the teaching activities design (object) impact the outcome, which is the academic's teaching practices. The AT triangle built for this research is presented in Figure 3.

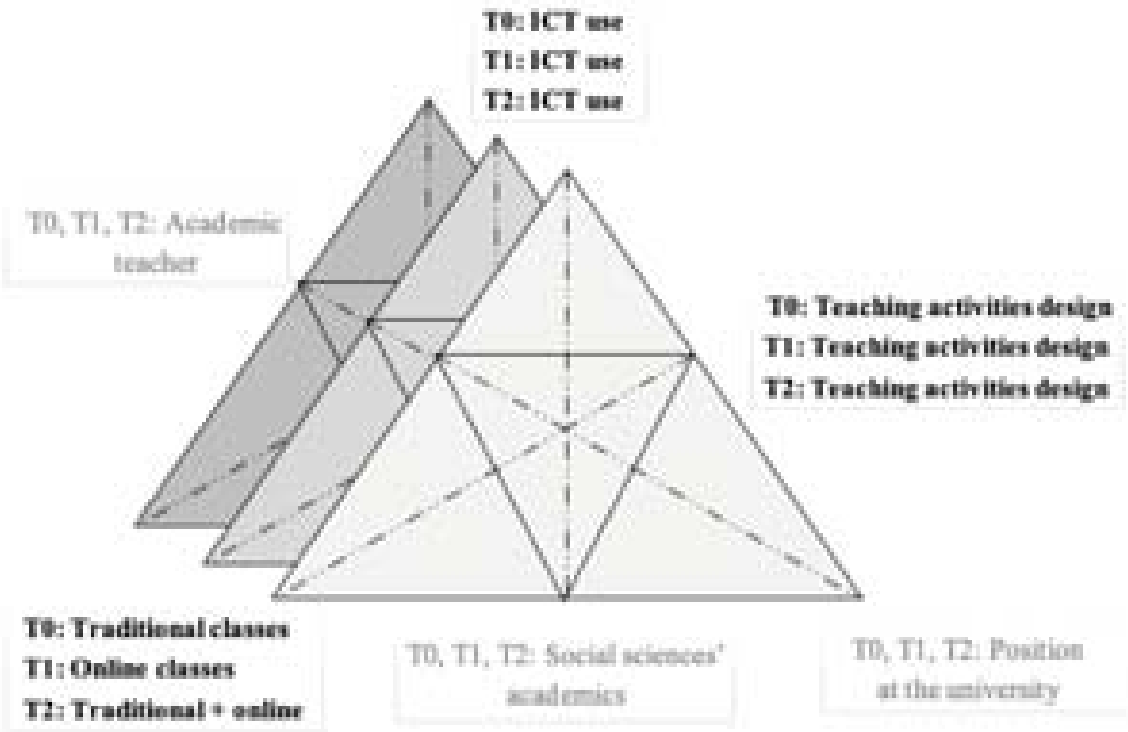


**Figure 3.** Research design – academics' teaching practices before (T0), during (T1), and after (T2) the COVID pandemic. Source: Own work based on Blin, Munro, 2008.

The authors argue that while the teachers were forced to work online and change what tools (ICT) they used for teaching and how they designed their classes (object), they still were under the same community and division of labour. In consequence, these indices of AT triangle – together with the subject – were not investigated in this research. Instead, the subject is the teacher we ask directly in the questionnaire about his/her academic teaching practices (the outcome). Therefore, changes in tools and objects are expected to be observed in three timespans, which we recall later on as (T0-T1) for before and during the COVID pandemic, (T0-T2) for before and after the COVID pandemic as well as (T1-T2) for during and after COVID pandemic.

Based on the research design (Figure 3) and Blin and Munro's (2008) past findings, we hypothesise:

**H1:** There are statistically significant differences in ICT use (tools) in academic teaching practices between the time spans before, during, and prediction after the COVID pandemic.

**H2:** There are statistically significant differences in teaching activities design (object) in academic teaching practices between the time spans before, during, and prediction after the COVID pandemic.

Further, building upon the hypothesised statistically significant differences (i.e. changes) in tools and objects, we assume academic teaching practices may also transform after the COVID pandemic presenting a unique opportunity for permanent and substantial transformation of well-established, regular universities' practices.

## 4. The methodology of our research

The data, results, and conclusions presented in this paper are part of broad research. The main focus of that research was to survey academics from different countries to collect their opinions on the COVID pandemic's impact on research and teaching as well as everyday academics and universities' work. Six academic teachers and researchers elaborated on the survey questionnaire and spread this questionnaire around. First, the questionnaire embraced general questions, such as demographics and professional information. Then, the questions concerned three areas: (1) general questions related to the work at university, (2) questions related to scientific research, and (3) questions related to the teaching process.

In turn, two papers have been already published. The first one focuses on the scientists' opinions and aims to investigate the influence of the COVID pandemic on scientific research exclusively (*the reference will be provided after review*). The second one focuses on the effect of the COVID pandemic on ICT use by academics, recognising the nature, magnitude, and trends of the changes related to bringing ICTs to the forefront of academic work life, both in research and teaching (*the reference will be provided after review*). This research

focuses on AT and recognises whether the COVID pandemic is a disruptive factor that leads to the evolution of academics' teaching practices. Moreover, our data, results, and conclusions are limited to social science and employ the questions on the teaching practices at the universities exclusively. Thus, our study's main assumption was the COVID pandemic is a disruptive factor that significantly contributed to the changes in teaching practices, particularly ICT use and the teaching activities design. For our analyses and deliberations, we chose only these questions related to the teaching process, especially the quality and use of ICT in the timespans presented earlier in Figure 2 – T0, T1, and T2. The respondents' task was to assess their teaching practices, i.e., ICT use, instructional tools, and overall teaching processes in T0, T1 and T2.

### 4.1. Research subject

Stratified sampling was used to obtain a research sample allowing for both the results interpretation and generalising to the social sciences. Efforts were made to invite respondents from social sciences. The appropriate number of women and men participated in the survey representing different age generations. Referring to work at the university, we did our best to invite academics employed in various academic positions. As we intended to collect as many questionnaires as possible, the snowball sampling method was used. Snowball sampling is recognised as a reliable, viable, and widely used method of recruiting study participants who are not easily accessible or known to the researchers (Leighton et al., 2021; Marcus et al., 2017). We started with a small number of academics who fit the research criteria and were invited to become participants in the research. Then we asked that academics recommend our survey to the other people who fit the research criteria and who might also be willing participants. Thus, we used our professional networks to establish links and contacts, which resulted in most of our sample representing social science and coming from Europe.

### 4.2. Data collection process

The ongoing COVID pandemic resulted in social distancing, which had to be taken into account while conducting our research. For this reason, we decided to employ the Computer Assisted Web Interview (CAWI) method and use the Lime Survey software. Importantly, researchers show that the validity and quality of the online gathered data are equivalent to the traditional, i.e., conducted in place, data gathering methods (Shatz, 2017).

We used a 5-point Likert scale. Depending on the question, some of the respondents could choose from: definitely worse / rather worse / neither worse nor better / rather better / definitely better; whereas others could choose from: never / seldom / sometimes / often / very often.

We prepared the preliminary version of the questionnaire in April 2020 and conducted a pilot test to validate the instrument. The questionnaire was in English. The pilot study aimed to test the questionnaire, its validity and methodological scrutinising. At this stage, 15 academics from different countries and universities were asked to fill out the questionnaire and share more profound opinions with experts. We amended some minor changes based on

the respondents' clues, especially related to the formal, technical, and language nature. In addition, we enhanced the layout of the questionnaire.

The primary research process aimed at data collection occurred in 2020, from June 11 to August 18. The questionnaire was anonymous, and the participation was voluntary.

The total sample size covers 982 responses (complete and incomplete). After screening for full responses, 476 responses were isolated. Next, we chose answers from social sciences academics only, resulting in a total of 382 valid responses, which were taken into analysis. The demographics of the respondents are presented in Table 1.

**Table 1.**
*Demographic analysis of the respondents*

| Demographics | Number of respondents | Percentage of respondents |
|---|---|---|
| **Gender** | | |
| Females | 201 | 52.6 |
| Males | 174 | 45.5 |
| Missing data | 7 | 1.8 |
| **Age** | | |
| 20-34 | 72 | 18.8 |
| 35-49 | 187 | 49.0 |
| 50-68 | 113 | 29.6 |
| >69 | 10 | 2.6 |
| **Region** | | |
| Europe | 305 | 79.8 |
| Other continents | 77 | 20.2 |
| **Position** | | |
| PhD. Students | 40 | 10.5 |
| Lecturer | 38 | 9.9 |
| Adjunct | 119 | 31.2 |
| Associate Professor | 103 | 27.0 |
| Full Professor | 68 | 17.8 |
| Other | 14 | 3.7 |

Source: Own work.

### 4.3. Data analysis

The data were stored in MS Excel and uploaded into SPSS to perform the required tests. For the data analysis purposes, the following statistical tests were employed: (1) Cronbach's alpha for instrument reliability, (2) frequency procedures and descriptive statistics for showing the differences and similarities between variables, (3) the Friedman's ANOVA non-parametric

test for repeated samples as it does not assume a normal distribution. We used the Shapiro-Wilk test to check this distribution. The scale applied in the questionnaire was an ordinal one.

## 5. Research findings

### 5.1. The universities' teaching practices and their changes due to the COVID-19 pandemic

Descriptive statistics were employed to partially answer the research question RQ, such as median and mode. The respondents were asked to choose one of the teaching practices out of three suggested, i.e., (1) traditional, (2) traditional and online, and (3) purely online, which is predominant at the university they work for. The results are presented in Table 2.

**Table 2.**
*Teaching model in T0, T1, and T2*

| Time | N | Median | Mode | Traditional (on-site) | Traditional and online | Online |
|---|---|---|---|---|---|---|
| Which of the following teaching models best describes your university? | | | | | | |
| T0 | 382 | 1 | 1 | 328 (85.9%) | 53 (13.9%) | 1 (0.3%) |
| T1 | 382 | 3 | 3 | 4 (1.0%) | 19 (5.0%) | 359 (94.0%) |
| T2 | 382 | 2 | 2 | 35 (9.2%) | 332 (86.9%) | 15 (3.9%) |

Where: 1 – traditional, 2 – traditional and online, 3 – online.

Source: own work.

The results presented in Table 2 show that in T0, the dominant teaching model was a traditional one. Both mode and median values are equal to 1. It means that teaching *before* COVID (T0) was performed on campus – at the universities. However, in T1, a significant shift in the teaching model was noticed. Both mode and median values are 3. It means that the teaching model switched into an online mode. The prediction on the teaching model in T2 indicates that mode and median values are 2. It shows that academics predict the teaching model as traditional and online mixed together. The above results show that there was a change in the universities' teaching practices due to the coronavirus pandemic, and that is predicted that the teaching model after the pandemic (T2) will not go back to the previous state and mixed teaching strategies (traditional and online) will become a standard. The analyses of data presented in Table 2 can bring the big picture on the changes in the academics' teaching models due to the COVID pandemic and therefore supports us in answering the research question.

### 5.2. The changes in tools and objects in T0, T1, and T2

To answer the research question **RQ**, we investigate the possible changes in academics' teaching practices (*activity*) in T0, T1, and T2 timespans of the COVID pandemic using descriptive statistics. Thus, we asked the respondents to express their opinion on the following statements: from #1 to #6 using a 5-point Likert scale (Table 3). For these statements, Cronbach's alpha is 0.736, which indicates a high internal consistency and reliability. What is more, the removal of some items would not improve the internal consistency among items on the scale (it varies from 0.702 to 0.738).

The results presented in Table 3 show that in T0, academics did not use communication apps, e-learning platforms, and social media in their teaching (#1 - #3). The mode values are 1, the median values are 2, and the average values vary from 1.9869 to 2.4110. That means that the responses that academics chose the most frequently answered the questions regarding *tools* were never and seldom. Interestingly, the results show that in T1, communication apps and e-learning platforms were used often or very often (the median and mode values are 5, and the average values are higher than four and oscillate around 4.5). At the same time, social media were still not employed in teaching practices. The median is 2, the mode is 1, and the average value is 2.5262 for social media. The respondents assume that in T2, the use of communication apps and e-learning platforms will be higher than it was in T0. The mode and median values are 4. At the same time, they presume that social media use will be similar compared to T1. Mode, median, and average values for social media for T1-T2 periods are very close.

As to *the objects* (#4 - #6), i.e., the overall teaching process, the quality of teaching, and the instructional tools, the results show that in T1, the mode and median values were most often 2, which means that the situation was somewhat worse in comparison to T0. What is interesting, the respondents assume that in T2, the overall teaching process (#4) will be relatively better (the median and mode values are 4). Nevertheless, they cannot predict what it could be as the quality of teaching (#5) and the instructional tools (#6) because the majority of them chose "3", representing the "it is neither worse, not better" option.

**Table 3.**
*Descriptive statistics of statements referring to tools and objects*

| Time | N | Min | Max | Median | SD | Mode | Average |
|---|---|---|---|---|---|---|---|
| ***Tools*** | | | | | | | |
| #1: How do you assess the frequency of usage of any communication apps in your teaching? (e.g., Skype, WhatsApp, Google Meet) | | | | | | | |
| T0 | 382 | 1 | 5 | 2 | 0.9814 | 1 | 1.9869 |
| T1 | 382 | 1 | 5 | 5 | 0.9467 | 5 | 4.4948 |
| T2 | 382 | 1 | 5 | 4 | 0.9313 | 4 | 3.6152 |
| #2: How do you assess the frequency of usage of any e-learning platforms in your teaching? (e.g., Moodle; Google Classroom; Docebo; Wiz IQ; ATutor) | | | | | | | |
| T0 | 382 | 1 | 5 | 2 | 1.3206 | 1 | 2.411 |
| T1 | 382 | 1 | 5 | 5 | 0.8724 | 5 | 4.563 |
| T2 | 382 | 1 | 5 | 4 | 0.9580 | 4 | 3.861 |

Cont. table 3.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| #3: How do you assess the frequency of usage of any social media in your teaching? (e.g., Facebook, Twitter, LinkedIn, Youtube, Instagram, blog sites) | | | | | | | |
| T0 | 382 | 1 | 5 | 1 | 1.0143 | 1 | 1.838 |
| T1 | 382 | 1 | 5 | 2 | 1.4301 | 1 | 2.526 |
| T2 | 382 | 1 | 5 | 2 | 1.3102 | 1 | 2.437 |
| ***Object*** | | | | | | | |
| #4: In your opinion, how does the overall teaching process look like? | | | | | | | |
| T0 | 382 | 3 | 3 | 3 | 0.0000 | 3 | 3.000 |
| T1 | 382 | 1 | 5 | 2 | 0.9954 | 3 | 2.500 |
| T2 | 382 | 1 | 5 | 4 | 0.8156 | 4 | 3.489 |
| #5: In your opinion, how does the quality of teaching (i.e., knowledge and skills gained by students) look like? | | | | | | | |
| T0 | 382 | 3 | 3 | 3 | 0.0000 | 3 | 3.000 |
| T1 | 382 | 1 | 5 | 2 | 0.9228 | 2 | 2.448 |
| T2 | 382 | 1 | 5 | 3 | 0.7994 | 3 | 3.374 |
| #6: In your opinion, how do the instructional tools (i.e., materials, platforms, teaching, and assessment methods) look like? | | | | | | | |
| T0 | 382 | 3 | 3 | 3 | 0.0000 | 3 | 3.000 |
| T1 | 382 | 1 | 5 | 2 | 1.0700 | 2 | 2.382 |
| T2 | 382 | 1 | 5 | 3 | 1.0486 | 2 | 2.948 |

Source: own work.

To fully answer the main research question **RQ** and test the hypotheses **H1** and **H2**, the non-parametric analysis of variance was conducted, the Friedman's ANOVA test for repeated samples to compare respondents' opinions regarding the T0, T1, and T2 timespans. We tested both hypotheses at a significance level of alpha=0.05. The results in Table 4 show that we statistically confirmed the significant differences in the tools and objects in academic teaching practices in all statements' timespans (T0, T1, and T2).

**Table 4.**
*The Friedman's ANOVA test with repeated measures*

| | **N** | **Average ranks** | **Chi-square** | **df** | **p** |
|---|---|---|---|---|---|
| ***Tools*** | | | | | |
| #1: How do you assess the frequency of usage of any communication apps in your teaching? (e.g., Skype, WhatsApp, Google Meet) | | | | | |
| T0 | 382 | 1.12 | 618.291 | 2 | <005 |
| T1 | 382 | 2.78 | | | |
| T2 | 382 | 2.10 | | | |
| | | | | | |
| #2: How do you assess the frequency of usage of any e-learning platforms in your teaching? (e.g., Moodle; Google Classroom; Docebo; Wiz IQ; ATutor) | | | | | |
| T0 | 382 | 1.22 | 538.191 | 2 | <005 |
| T1 | 382 | 2.67 | | | |
| T2 | 382 | 2.11 | | | |
| | | | | | |
| #3: How do you assess the frequency of usage of any social media in your teaching? (e.g., Facebook, Twitter, LinkedIn, Youtube, Instagram, blog sites) | | | | | |
| T0 | 382 | 1.58 | 249.741 | 2 | <005 |
| T1 | 382 | 2.26 | | | |
| T2 | 382 | 2.16 | | | |
| | | | | | |

Cont. table 4.

| | | | | | |
|---|---|---|---|---|---|
| ***Objects*** | | | | | |
| #4: In your opinion, how does the overall teaching process look like? | | | | | |
| T0 | 382 | 1.97 | 288.308 | 2 | <005 |
| T1 | 382 | 1.49 | | | |
| T2 | 382 | 2.54 | | | |
| | | | | | |
| #5: In your opinion, how does the quality of teaching (i.e., knowledge and skills gained by students) look like? | | | | | |
| T0 | 382 | 2.06 | 270.285 | 2 | <005 |
| T1 | 382 | 1.48 | | | |
| T2 | 382 | 2.46 | | | |
| | | | | | |
| #6: In your opinion, how does the instructional tools (i.e., materials, platforms, teaching and assessment methods) look like? | | | | | |
| T0 | 382 | 2.23 | 122.542 | 2 | <005 |
| T1 | 382 | 1.61 | | | |
| T2 | 382 | 2.16 | | | |
| | | | | | |

Source: own work.

To provide a detailed answer to the main research question and test the hypotheses **H1** and **H2**, we used the post-hoc Wilcoxon test to explore differences in ICT use (*tools*) as well as the teaching activities design (*object*) in academic teaching practices in the particular timespans, i.e., T0-T1, T1-T2, and T0-T2. The results are presented in Table 5. They show that the respondents declared more frequent use of all three types of *tools* (#1, #2, #3) in the T0-T1 and T0-T2 timespans comparison. The above is also valid for all three statements #4, #5, and #6, showing that respondents predict that *objects* will look better after this COVID pandemic despite worse usage of *objects* during the pandemic (timespan T0-T1).

**Table 5.**
*Related samples Wilcoxon signed-rank test for statements #1 - #6*

| **Time** | **N** | **Z** | **Asymp.Sig. (2-tailed)** | **Negative ranks** | **Positive ranks** |
|---|---|---|---|---|---|
| ***Tools*** | | | | | |
| #1: How do you assess the frequency of usage of any communication apps in your teaching? (e.g., Skype, WhatsApp, Google Meet) | | | | | |
| –T0-T1 | 382 | -16.395 | <005 | 2 | 350 |
| –T1-T2 | 382 | -13.349 | <005 | 262 | 14 |
| –T0-T2 | 382 | -15.687 | <005 | 1 | 322 |
| #2: How do you assess the frequency of usage of any e-learning platforms in your teaching? (e.g., Moodle; Google Classroom; Docebo; Wiz IQ; ATutor) | | | | | |
| –T0-T1 | 382 | -15.587 | <005 | 2 | 320 |
| –T1-T2 | 382 | -11.812 | <005 | 216 | 20 |
| –T0-T2 | 382 | -14.761 | <005 | 1 | 282 |
| #3: How do you assess the frequency of usage of any social media in your teaching? (e.g., Facebook, Twitter, LinkedIn, Youtube, Instagram, blog sites) | | | | | |
| –T0-T1 | 382 | -11.243 | <005 | 4 | 172 |
| –T1-T2 | 382 | -2.667 | 0.008 | 63 | 34 |
| –T0-T2 | 382 | -10.736 | <005 | 4 | 156 |

Cont. table 5.

| | | | | | |
|---|---|---|---|---|---|
| ***Objects*** | | | | | |
| #4: In your opinion, how does the overall teaching process look like? | | | | | |
| –T0-T1 | 382 | -8.689 | <005 | 203 | 63 |
| –T1-T2 | 382 | -13.463 | <005 | 18 | 268 |
| –T0-T2 | 382 | -9.916 | <005 | 36 | 198 |
| #5: In your opinion, how does the quality of teaching (i.e., knowledge and skills gained by students) look like? | | | | | |
| –T0-T1 | 382 | -9.866 | <005 | 209 | 46 |
| –T1-T2 | 382 | -12.568 | <005 | 16 | 247 |
| –T0-T2 | 382 | -8.250 | <005 | 45 | 165 |
| #6: In your opinion, how does the instructional tools (i.e., materials, platforms, teaching and assessment methods) look like? | | | | | |
| –T0-T1 | 382 | -9.673 | <005 | 238 | 71 |
| –T1-T2 | 382 | -9.615 | <005 | 22 | 152 |
| –T0-T2 | 382 | -1.025 | <005 | 146 | 136 |

Source: own work.

Based on Friedman's ANOVA and Wilcoxon's signed-rank tests (Table 5), we confirmed statistically significant differences in ICT use (*tools*) in academic teaching practices between the time spans before, during, and prediction after the COVID pandemic. Thus, **H1** regarding *tools* is confirmed. Moreover, it should be noted that the predicted usage of *tools* after this COVID pandemic is expected to be less frequent when compared to the time during this pandemic (T1-T2).

Further, we confirmed statistically significant differences in teaching activities design (*object*) in academic teaching practices between the time spans before, during, and prediction after the COVID-19 pandemic. Thus, **H2** regarding *objects* is confirmed as well.

In addition, we found that the perceived frequency of use of ICT *tools* in the form of social media in T2 depends on the geographical region. For example, respondents located in Europe were more prone to state that social media (statement #3) will be used never or seldom in T2 ($\chi 2$ (4, N = 382) = 41.317, $p < 0.05$). Further, European respondents were more convinced that instructional tools (statement #6) would be relatively worse in T2, while those were declaring locations other than Europe most often indicated that instructional tools would be relatively better in T2 ($\chi 2$ (4, N = 382) = 14.565, $p = 0.006$).

No other significant differences regarding T2 prediction were identified.

## 6. Discussion and conclusion

Activity theory being a theoretical background in this study, provides a broad, conceptual framework for analysing human activity as a system of multiple elements and their relations (Georg et al., 2015). This paper contributes to prior literature by showing that introduction of a new *tool* (ICT) and modified *object* (teaching activity design) resulted in a serious alteration of the *outcome* (teaching practice of social sciences' academics). Thus, we can infer that activity

system has been disrupted in line with Engeström's theory (Engeström, 2001). Our findings did not confirm that this disruption was expansive enough to permanently transform teaching activities of social sciences academics, hence suggesting that obstacles to successful incorporation of ICT use in teaching practices are still present as pointed in prior literature (Liu et al., 2020). We showed that ICT as a *tool* is predicted to be used more frequently rather than before (when it was only utilised as a platform to transfer traditional material) and will not modify the well-established practices referring to instructional tools (*object*). It suggests that the relation between *subject* (teacher) and *object* (teaching activity design) is not mediated by ICT *tools*, which may result in resistance from the *subject* as suggested by Blin and Munro (2008).

### 6.1. Challenges for future enhanced ICT use by social sciences academic teachers

Based on our findings, we argue that this coronavirus pandemic acted as a disruptive factor and has already changed academics' teaching practices which broke two main barriers restraining academic teachers from using ICT. Not only did the pandemic result in forcing academic teachers to use ICT (*tools)* for the time being, but it has also given them time to convince them about their usefulness in academic teaching practices, thus giving a high hope that the use of ICT tools in academic teaching practices will persist after the pandemic. For the future it seems important that the change of the teaching practices activity described by the lens of activity theory in this paper would be applied by academic teachers even after pandemic, which can move teachers to blended learning with enhanced use of ICT. If teachers perceive their professional activities through the lens of relations between *tools* (used by *subjects*) and *objects*, it will enable them to develop teaching practice (*outcome*) overcoming the obstacles described below.

In the past, two main obstacles were presented in the literature due to which academics do not use e-learning platforms broadly. One of them was presented by Guillén-Gámez and Mayorga-Fernández (2020) who highlighted the need to improve the digital competence of academics to meet the demands of the qualified professions in the future and, therefore, prepare students for that. It was also suggested by Blin and Munro (2008). Our results partially support that thesis as social sciences academic teachers were, on the one hand, forced to implement e-learning and other ICT rapidly. However, on the other, most universities facilitate training modules for the academic staff. The second blockbuster presented in the literature was the lack of willingness to use ICT (Blin, Munro, 2008; Kirkwood, 2009; Liu et al., 2020). As the pandemic forced academic teachers to use technologies for an extended amount of time, they noticed which tools were worth using and felt the advantages of using specific e-learning methods. This gives a chance that academic resistance to change their teaching practices broken down during the pandemic, will not reappear after the pandemic, and –with dedicated training and IT competences – social sciences academic teachers will adopt ICT tools more broadly for their teaching tasks.

### 6.2. The teaching activities design – investigated and expected changes

Our research indicates that this coronavirus pandemic acted as a disruptive factor that forced changes in overall teaching practices (*outcome*). As the pandemic's duration exceeded one academic semester, the disruptive factors influenced all three phases of the teaching process: planning (pre-active), conduct and management (active), and follow-up (post-active). Combining this result with the above-described findings regarding *tools*, it may suggest that academic teachers have noticed the prevalence of ICT (*tools*) implemented into the academics' teaching practice and plan to take advantage of them in their overall teaching process even after this coronavirus pandemic ends.

Our results also indicate that the quality of social sciences teaching has worsened during the pandemic and most of the respondents do not predict significant changes in the quality of teaching after the pandemic compared to the quality of teaching before the pandemic. This confirms many reports and the past literature stating that teaching quality requires teacher development support (Darling-Hammond, Berry, 2006; Berry, 2011; Global Partnership for Education, 2019), including certification and accreditation for teachers, ongoing support, coaching from headteachers and other administrative staff. Weak subject content, lack of pedagogical knowledge and classroom skills, inadequate standards, and other quality of teaching challenges that academic teachers may face can probably not be removed with the enhanced ICT use. Changing teachers' practice regarding scripted lesson plans, structured teaching content, or assessment methods also requires institutional teaching improvement programs in the form of training and teachers' guides (Felder, Brent, 1999; Global Partnership for Education, 2019). Our findings also suggest that changes introduced with enhanced ICT use will concern teachers only, with no amendments to teaching content or assessment methods. Thus, it may not lead to a permanent change in instructional tools and further social sciences teaching practices confirming prior studies about teachers and their constraints (Karasavvidis, 2009; Liu et al., 2020).

The decision about the degree of use and the number of tools and ICT may differ depending on the geographical region and other situational factors (Adnan, Anwar, 2020; Mishra et al., 2020; Parolin, Lee, 2021). This finding is in accordance with previous research (Lin et al., 2010; Lawrence, Lentle-Keenan, 2012; Ashrafzadeh, Sayadian, 2015; Kidd et al., 2016; Zdonek, Mularczyk, 2020), acknowledging that academic teachers consider technology as relatively advantageous but also indicating the diversified use of social science academic teaching practices.

## 7. Limitations and further research

Although this paper has contributed to our understanding of academic teachers' practice through the lens of activity theory, it is bounded by several limitations. Eliminating them would enhance the results presented in this paper and is an excellent proposal for future research.

The first limitation is connected to the sample size and internationality of the survey. While we have collected views from different countries, we believe that the number of respondents and the representation of different nationalities could be expanded. Furthermore, the representation concerns non-Europe countries in particular, as our research had only a collection of 77 responses from outside of Europe. It is worth noticing that the problem of limited generalizability of the online surveys during COVID was in detail described by Singh, Sagar (2021).

The second limitation derives from the choice of the way of data analysis. We applied a general approach in our research for ICT (*tools*) analyses. It means that we divided them into three categories, i.e. communication apps, e-learning platforms, and social media. Thus, we did not ask respondents about each particular tool in detail. That detailed approach would be very interesting and would open further research possibilities. Moreover, we have focused on quantitative data. However, to deepen the results presented in this paper, a qualitative approach could be adapted to perform a series of interviews, enhancing insight into social science academics' perspectives.

The third limitation is linked to the fact that the COVID is a phenomenon that evolves continuously. Nevertheless, the above allows further in-depth, pandemic-related research in the scope of ICT use among social sciences and other disciplines' academics.

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## References


1. Adnan, M., Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' perspectives. *Journal of Pedagogical Sociology and Psychology*, *Vol. 2, Iss. 1*, pp. 45-51, doi: 10.33902/JPSP.2020261309.
2. Almarzooq, Z., Lopes, M., Kochar, A. (2020). Virtual learning during the COVID-19 pandemic: A Disruptive Technology in Graduate Medical Education. *Journal of the American College of Cardiology*, *Vol. 75, Iss. 20*, pp. 2635-2638, doi: 10.1016/j.jacc.2020.04.015.
3. Ashrafzadeh, A., Sayadian, S. (2015). University instructors' concerns and perceptions of technology integration. *Computers in Human Behavior*, *Vol. 49*, pp. 62-73, doi: 10.1016/j.chb.2015.01.071.
4. Azhar, K., Iqbal, N. (2018). Effectiveness of Google Classroom. *Teachers' Perceptions*, *Vol. 2*, pp. 52-66. Retrieved from https://www.proquest.com/docview/2363005393?pq-origsite=gscholar&fromopenview=true.
5. Barab, S., Barnett, M., Squire, K. (2002). Developing an empirical account of a community of practice: Characterising the essential tensions. *The Journal of Learning Sciences*, *Vol. 11, Iss. 4,* pp. 489-542, doi: 10.1207/S15327809JLS1104_3.
6. Berry, B. (2011). Teacherpreneurs. A More Powerful Vision for the Teaching Profession. *Phi Delta Kappan*, *Vol. 92, Iss. 6*, pp. 28-33, doi: 10.1177/003172171109200606.
7. Blin, F., Munro, M. (2008). Why hasn't technology disrupted academics' teaching practices? Understanding resistance to change through the lens of activity theory. *Computers and Education*, *Vol. 50*, pp. 475-490, doi: 10.1016/j.compedu.2007.09.017.
8. Bonacini, L., Gallo, G., Scicchitano, S. (2021). Working from home and income inequality: risks of a 'new normal' with COVID-19. *Journal of Population Economics*, *Vol. 34*, pp. 303-360, doi: 10.1007/s00148-020-00800-7.
9. Bond, M., Marín, V. I., Dolch, C., Bedenlier, S., Zawacki-Richter, O. (2018). Digital transformation in German higher education: student and teacher perceptions and usage of digital media. *International Journal of Educational Technology in Higher Education, Vol. 15,* p. 48, doi: 10.1186/s41239-018-0130-1.
10. Brynjolfsson, E., Horton, J.J., Ozimek, A., Rock, D., Sharma, G., Tu Ye, H.-Y. (2020). *COVID-19 and Remote Work: An Early Look at US Data*. NBER, 27344 Working Paper. Retrieved from https://www.nber.org/papers/w27344.pdf, 10.03.2022.
11. Burbules, N., Callister, T. (2000). Universities in transition: The promise and the challenge of new technologies. *Teachers College Record*, *Vol. 102, Iss. 2*, pp. 271-293, doi: 10.1111/0161-4681.00056.
12. Byrnes, K.G., Kiely, P.A., Dunne, C.P., McDermott, K.W., Coffey, J.C. (2020). Communication, collaboration and contagion: "Virtualisation" of anatomy during COVID-19. *Clinical Anatomy*, *Vol. 34*, pp. 82-89, doi: 10.1002/ca.23649.

13. Carnevale, J.B., Hatak, I. (2020). Employee adjustment and well-being in the era of COVID-19: Implications for human resource management. *Journal of Business Research*, *Vol. 116*, pp. 183-187, doi: 10.1016/j.jbusres.2020.05.037.
14. Carpenter, J.P., Morrison, S.A., Craft, M., Lee, M. (2020). How and why are educators using Instagram? *Teaching and Teacher Education*, *Vol. 96*, 103149, doi: 10.1016/j.tate.2020.103149.
15. Chung, Ch.-J., Hwang, G.-J., Lai, Ch-L. (2019) A review of experimental mobile learning research in 2010-2016 based on the activity theory framework. *Computers & Education*, *Vol. 129*, pp. 1-13, doi: 10.1016/j.compedu.2018.10.010.
16. Clemmensen, T., Kaptelinin, V., Nardi, B. (2016). Making HCI theory work: an analysis of the use of activity theory in HCI research. *Behaviour & Information Technology*, *Vol. 35*, pp. 1-20, doi: 10.1080/0144929X.2016.1175507.
17. Conole, G. (2004). E-learning: The hype and the reality. *Journal of Interactive Media in Education*, *Vol. 2004, Iss. 2*, pp. 1-18, doi: 10.5334/2004-12.
18. Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., Magni, P.A., Lam, S. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, *Vol. 3, Iss. 1*, pp. 1-20, doi: 10.37074/jalt.2020.3.1.7.
19. Darling-Hammond, L., Berry, B. (2006). Highly qualified teachers for all. Educational leadership. *Journal of the Department of Supervision and Curriculum Development*, *Vol. 64, Iss. 3*, pp. 14-20. Retrived from https://eric.ed.gov/?id=EJ766231.
20. Desvars-Larrive, A., Dervic, E., Haug, N. (2020). A structured open dataset of government interventions in response to COVID-19. *Scientific Data*, *Vol. 7, Iss. 285*, pp. 1-9, doi: 10.1038/s41597-020-00609-9
21. Engelström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
22. Engelström, Y. (2001). Expansive learning at work: toward an activity theoretical reconceptualisation. *Journal of Education and Work*, *Vol. 14, Iss. 1*, pp. 133-156, doi: 10.1080/13639080020028747.
23. Felder, R. M., Brent, R. (1999). How to improve teaching quality. *Quality Management Journal*, *Vol. 6, Iss. 2,* pp. 9-21, doi: 10.1080/10686967.1999.11919183.
24. Fletcher, L. (2021). Let's chat about CHAT: Illuminating undergraduates' literature discussion with Cultural Historical Activity Theory. *Learning, Culture and Social Interaction*, *Vol. 29*, 100498, doi: 10.1016/j.lcsi.2021.100498.
25. Guillén-Gámez, F.D., Mayorga-Fernández, M.J. (2020). Identification of Variables that Predict Teachers' Attitudes toward ICT in Higher Education for Teaching and Research: A Study with Regression. *Sustainability*, *Vol. 12, Iss. 4*, 1312, doi: 10.3390/su12041312.
26. Haug, N., Geyrhofer, L., Londei, A., Dervic, E., Desvars-Larrive, A., Loreto, V., Pinior, B., Thurner, S., Klimek, P. (2020). Ranking the effectiveness of worldwide COVID-19

government interventions. *Nature Human Behaviour*, *Vol. 4*, pp. 1303-1312, doi: 10.1038/s41562-020-01009-0.

27. Hea, H., Harris, L. (2020). The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. *Journal of Business Research*, *Vol. 116*, pp. 176-182, doi: 10.1016/j.jbusres.2020.05.030.
28. Helle, M. (2000). Disturbances and contradictions as tools for understanding work in the newsroom. *Scandinavian Journal of Information Systems*, *Vol. 12*, pp. 81-114. Retrieved from http://aisel.aisnet.org/sjis/vol12/iss1/7.
29. Holen, J.B., Hung, W., Gourneau, B. (2017). Does One-to-One Technology Really Work: An Evaluation Through the Lens of Activity Theory. *Computers in the Schools*, *Vol. 34, Iss. 1-2*, pp. 24-44, doi: 10.1080/07380569.2017.1281698.
30. Huang, B., Hew, K.F. (2018). Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts. *Computers & Education*, *Vol. 125*, pp. 254-272, doi: 10.1016/ j.compedu.2018.06.018.
31. Global Partnership for Education (2019). Improving Teaching and Learning. *A Knowledge and Innovation Exchange (KIX) Discussion Paper*. Retrieved from https://www.globalpartnership.org/sites/default/files/document/file/2019-07-kix-improving-teaching-and-learning-final.pdf, 10.03.2022.
32. Karasavvidis, I. (2009). Activity Theory as a conceptual framework for understanding teacher approaches to Information and Communication Technologies. *Computers & Education*, *Vol. 53, Iss. 2*, pp. 436-444, doi: 10.1016/j.compedu.2009.03.003.
33. Kellner, D. (2004). Technological transformation, multiple literacies, and the re-visioning of education. *E-learning*, *Vol. 1, Iss. 1*, pp. 9-37, doi: 10.2304/elea.2004.1.1.8.
34. Kidd, T., Davis, T., Larke, P. (2016). Experience, Adoption, and Technology: Exploring the Phenomenological Experiences of Faculty Involved in Online Teaching at One School of Public Health. *International Journal on E-Learning*, *Vol. 15, Iss. 1*, pp. 71-99. Retrieved from https://www.learntechlib.org/primary/p/41516/.
35. Kirby, K., Anwar, M.N. (2020). An application of activity theory to the "problem of e-books". *Heliyon*, *Vol. 6, Iss. 9*, doi: 10.1016/j.heliyon.2020.e04982.
36. Kirkup, G., Kirkwood, A. (2005). Information and communications technologies (ICT) in higher education teaching – a tale of gradualism rather than revolution. *Learning, Media and Technology*, *Vol. 30, Iss. 2*, pp. 185-199, doi: 10.1080/17439880500093810.
37. Kirkwood, A. (2009). E-learning: You don't always get what you hope for. *Technology, Pedagogy and Education*, *Vol. 18, Iss. 2*, pp. 107-121, doi: 10.1080/14759390902992576.
38. Klimkiewicz, K. (2016). Building commitment - using Moodle in developing social skills of students. *E-mentor*, *Vol. 2, Iss. 64*, pp. 4-12, doi: 10.15219/em64.1235.
39. Kumar, J.A., Bervel, B. (2019). Google Classroom for mobile learning in higher education: Modelling the initial perceptions of students. *Education and Information Technologies*, *Vol. 24*, pp. 1793-817, doi: 10.1007/s10639-018-09858-z.

40. Lawrence, B., Lentle-Keenan, S. (2013). Teaching beliefs and practice, institutional context, and the uptake of Web-based technology. *Distance Education*, *Vol. 34, Iss. 1*, pp. 4-20, doi: 10.1080/01587919.2013.770432.
41. Lee, C.B., Hanham, J., Kannangara, K., Qi, J. (2021). Exploring user experience of digital pen and tablet technology for learning chemistry: applying an activity theory lens. *Heliyon*, *Vol. 7, Iss. 1*, doi: 10.1016/j.heliyon.2021.e06020.
42. Lei, J., Hu, G. (2019). Doctoral candidates' dual role as student and expert scholarly writer: An activity theory perspective. *English for Specific Purposes*, *Vol. 54*, pp 62-74, doi: 10.1016/j.esp.2018.12.003.
43. Leighton, K., Kardong-Edgren, S., Schneidereith, T., Foisy-Doll, C. (2021). Using Social Media and Snowball Sampling as an Alternative Recruitment Strategy for Research. *Clinical Simulation in Nursing*, *Vol. 55*, pp. 37-42, doi: 10.1016/J.ECNS.2021.03.006.
44. Lin, C., Singer, R., Ha, L. (2010). Why university members use and resist technology? A structure enactment perspective. *Journal of Computing in Higher Education*, *Vol. 22*, pp. 38-59, doi: 10.1007/s12528-010-9028-1.
45. Liu, Q., Geertshuis, S., Grainger, R. (2020). Understanding academics' adoption of learning technologies: A systematic review. *Computers & Education*, *Vol. 151*, 103857, doi: 10.1016/j.compedu.2020.103857.
46. Lu, Q., Chen, L., Lee, S., Zhao, X. (2018). Activity theory-based analysis of BIM implementation in building O&M and first response. *Automation in Construction*, *Vol. 85*, pp. 317-332, doi: 10.1016/j.autcon.2017.10.017.
47. Marcus, B., Weigelt, O., Hergert, J., Gurt, J., Gelléri, P. (2017). The use of snowball sampling for multi-source organisational research: Some cause for concern. *Personnel Psychology*, *Vol. 70, Iss. 3*, pp. 635-673, doi: 10.1111/PEPS.12169.
48. Marks, A., AL-Ali, M., Atassi, R., Abualkishik A.Z., Rezgu, Y. (2020). Digital Transformation in Higher Education: A Framework for Maturity Assessment. *International Journal of Advanced Computer Science and Applications*, *Vol. 11, Iss. 12*, pp. 504-513, doi: 10.14569/IJACSA.2020.0111261.
49. McAndrew, P., Taylor, J., Clow, D. (2006). *Methods for evaluating learning, collaboration and technology use in distributed virtual environments and mobile environments: Supporting first-aider training*, doi: 10.1.1.556.1629&rep=rep1&type=pdf.
50. Mishra, L., Gupta, T., Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, *Vol. 1*, 100012, doi: 10.1016/J.IJEDRO.2020.100012.
51. MSHE, 2020. *Ministry of Science and Higher Education suspends teaching at universities until March 25 to prevent the spread of COVID-19*. Retrieved from https://www.gov.pl/web/nauka/ministerstwo-nauki-zawiesza-zajecia-dydaktyczne-na-uczelniach-do-25-marca-aby-zapobiec-rozprzestrzenianiu-sie-covid-19, 11.03.2022.

52. Nguyen, S.V., Habók, A. (2021). Vietnamese non-English-major students' motivation to learn English: from activity theory perspective. *Heliyon*, *Vol. 7, Iss. 4*, e06819, doi: 10.1016/j.heliyon.2021.e06819.
53. OECD (2021). How socio-economics plays into students learning on their own: clues to COVID-19 learning losses. *PISA in Focus 2021/114* (September). Retrieved from https://www.oecd-ilibrary.org/docserver/2417eaa1-en.pdf?expires=1648809729&id=id&accname=guest&checksum=548A1AA77BFE1B7C3FE00423F91D13DB, 15.12.2021.
54. Parolin, Z., Lee, E.K. (2021). Large socio-economic, geographic and demographic disparities exist in exposure to school closures. *Nature Human Behaviour*, *Vol. 5*, pp. 522-528, doi: 10.1038/s41562-021-01087-8.
55. Peña-Ayala, A., Sossa, H., Méndez, I. (2014). Activity theory as a framework for building adaptive e-learning systems: A case to provide empirical evidence. *Computers in Human Behavior*, *Vol. 30*, pp. 131-145, doi: 10.1016/j.chb.2013.07.057.
56. Pisz, I. (2021). Impact COVID-19 pandemic on implementation of industry 4.0 in enterprises and supply chain. *Scientific Papers of Silesian University of Technology*, *Vol. 150,* pp. 183-198. Retrieved from https://managementpapers.polsl.pl/wp-content/uploads/2021/02/ZN150Pisz.pdf.
57. Ramkissoon, P., Belle, L.J., Bhurosy, T. (2020). Perceptions and experiences of students on the use of interactive online learning technologies in Mauritius. *International Journal of Evaluation and Research in Education, Vol. 9, Iss.* 4, pp. 833-839, doi: 10.11591/ijere.v9i4.20692.
58. Reid, A.M., Ledger, A., Kilminster, S., Fuller, R. (2015). Can the tools of activity theory help us in advancing understanding and organisational change in undergraduate medical education? *Advances in Health Sciences Education*, *Vol. 20*, pp. 655-668, doi: 10.1007/s10459.
59. Rizun, M., Strzelecki, A. (2020). Students' Acceptance of the COVID-19 Impact on Shifting Higher Education to Distance Learning in Poland. *International Journal of Environmental Research and Public Health*, *Vol. 17, Iss. 18*, pp. 64-68, doi: 10.3390/ijerph17186468.
60. Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, A., Mohammadi, M., Rasoulpoor, S., Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Global Health*, *Vol. 16, Iss. 1*, p. 57, doi: 10.1186/s12992-020-00589-w.
61. Sangster, A., Stoner, G., Flood, B. (2020). Insights into accounting education in a COVID-19 world. *Accounting Education*, *Vol. 29, Iss. 5*, pp. 431-562, doi: 10.1080/09639284.2020.1808487.
62. Selwyn, N. (2007). The use of computer technology in university teaching and learning: A critical perspective. *Journal of Computer Assisted Learning*, *Vol. 21*, pp. 430-439, doi: 10.1111/j.1365-2729.2006.00204.x.

63. Shatz, I. (2017). Fast, free and targeted: Reddit as a source for recruiting participants online. *Social Science Computer Review*, *Vol. 35, Iss. 4*, pp. 537-549, doi: 10.1177/0894439316650163.
64. Singh, S., Sagar, R. (2021). A critical look at online survey or questionnaire-based research studies during COVID-19. *Asian Journal of Psychiatry*, *Vol. 65*, 102850, doi: 10.1016/J.AJP.2021.102850.
65. Tearle, P. (2003). ICT implementation: What makes the difference? *British Journal of Educational Technology*, *Vol. 34, Iss. 5*, pp. 567-583, doi: 10.1046/j.0007-1013.2003.00351.x
66. Tee, M.L., Tee, C.A., Anlacan, J.P., Aligam, K.J.G., Reyes, P.C., Kuruchittham, V., Ho, R.C. (2020). Psychological impact of COVID-19 pandemic in the Philippines. *Journal of Affective Disorders*, *Vol. 277*, pp. 379-391, doi: 10.1016/j.jad.2020.08.043.
67. Thompson, M. (2004). Some Proposals for Strengthening Organisational Activity Theory. *Organisation*, *Vol. 11*, pp. 579-602, doi: 10.1177/1350508404044062.
68. Weill, J.A., Stiglerb, M., Deschenesc, O., Springbor, M.R. (2020). Social distancing responses to COVID-19 emergency declarations strongly differentiated by income. *Proceedings of the National Academy of Sciences of the United States of America*, *Vol. 117, Iss. 33*, pp. 19658-19660, doi: 10.1073/pnas.2009412117.
69. World Health Organization (2020a). *Naming the coronavirus disease (COVID-19) and the virus that causes it.* Retrieved from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it, 19.12.2021.
70. World Health Organization (2020b). *Novel Coronavirus – China*. World Health Organization. https://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en/, 20.01.2022.
71. Wu, Z. (2020). *How a top Chinese university is responding to coronavirus*. Retrieved from https://www.weforum.org/agenda/2020/03/coronavirus-china-the-challenges-of-online-learning-for-universities/, 20.01.2022.
72. Zdonek, I., Mularczyk, A. (2020). Factors motivating academic teachers to improve their teaching skills – pilot studies. *Scientific Papers of Silesian University of Technology*, *Vol. 148*, pp. 825-843. Rertived from https://managementpapers.polsl.pl/wp-content/uploads/2020/10/148_Zdonek-Mularczyk.pdf.
73. Zraick, K., Garcia, S. (2020). Canceled Because Of Coronavirus: A Brief List. *NY Times*. Retrieved from https://www.nytimes.com/article/cancelled-events-coronavirus.html.

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# THE CONCEPT OF COMPULSORY GOVERNANCE STRUCTURE

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**Purpose:** identification of the original concept of compulsory governance structure.
**Design/methodology/approach**: institutions that legally compel owners to entrust the governance of the firm to an independent outsider were sought. Their features were subjected to a cluster analysis in a form of Czekanowski's diagram. Based on Coase theorem, a definition is proposed.
**Findings:** the compulsory governance structure is a regulatory mechanism aimed at neutralizing the social cost for stakeholders caused by ineffective firm. It introduces an external manager to the firm, who under special powers aims to remove the causes of inefficiency. During compulsory governance structure collateral transaction costs are internalized by the firm and transformed into additional coordination costs. The second finding is an observation that firm's ineffectiveness might be measured by the level of stakeholders transaction costs.
**Research limitations/implications**: relying solely on manifestations of compulsory governance structure in Poland.
**Originality/value:** identification of a new research unit called compulsory governance structure and noting the relationship between firm ineffectiveness and stakeholders transaction costs.

**Keywords:** corporate governance, compulsory governance structure, new institutional economics, transaction costs.

**Category of the paper:** Research paper.

## 1. Introduction

One of the rare and counter-intuitive events in enterprises are cases when an outsider is brought into the firm with the purpose of managing it, usually against current owner's will. These instances, which influence coordination and transaction costs, are manifestations of economic institutions (Williamson, 1985). Therefore, this article will be placed in the new institutional economics, in particular in the scientific research of the Nobel laureate R.H. Coase (Coase theorem). It will be placed in the basic (theoretical) research based on qualitative

analysis (Nowosielski, 2016). Its purpose is to identify the original concept of compulsory governance structure.

For this purpose, the article requires identification of the cases that will fall under the scope of the compulsory governance structure concept. Due to research limitations, they will be limited to the legal regime of the Republic of Poland. It should also be noted that only general institutions related to the broad market were selected, while specialized (qualified) forms related specifically to associations, education or banking were omitted. Listing and briefly presenting the examined institutions:

1. Three variants of civil compulsory administration. In the event of a firm's debt, an external administrator may be introduced into the firm. Firstly, to protect the firm's assets against loss during a debt lawsuit, secondly to collect the debt from the firm's income, thirdly to collect the debt by selling the firm.
2. Bankruptcy of an insolvent firm. A situation where a trustee is brought into the firm in order to liquidate its assets and settle debts (also separate institution for securing the firm during preliminary bankruptcy proceedings).
3. Liquidation of a solvent firm. A situation where a liquidator is introduced into the firm in order to liquidate its assets and settle debts.
4. Two types of curator. A situation where the firm's statutory bodies remain vacant or when the firm has no representative during the court proceedings.
5. Inheritance administration. A situation when the owner-manager dies and external administrator is placed to manage the firm until the inheritance proceedings are resolved.
6. Penal compulsory administration. In the course of criminal proceedings, an administrator is placed in the suspect's firm to monitor whether it is not used to commit further crimes or to conceal evidence and benefits obtained from crime.
7. Three variants of supervision in four types of restructuring proceedings. In simple terms, in firms threatened with insolvency, an external supervisor negotiates an agreement with creditors for the survival of the firm.

Secondly, it is necessary to identify the research gap which lies between the two tiers of scientific publications relating to subject and scope of research gap. The most significant subject publications are restructuring publications on the theoretical (Lachiewicz et al., 2005) and managerial levels (Lubián, 2014) in the aspects of economy (Borowiecki and Wysłocka, 2012; Podczarski, 2016), law (Zaremba, 2021), actors and stakeholders (Gilejko, 2006; Janda, 2011) or history (Mączyńska, 2001; Kamosiński, 2015). Followed by publications on bankruptcies (Antonowicz, 2015) and liquidations (Missala and Wolbach, 2013; Witosz, 2014). Other institutions are described mainly in legal publications based on jurisprudence in the field of civil (Machnikowski, 2022), criminal (Skorupka, 2021), corporate (Jara, 2022), procedural law (Zieliński and Flaga-Gieruszyńska, 2022), bankruptcy and restructuring (Zimmerman, 2022). In terms of scope of research gap, it is recognized that the mainstream theory of the firm started

with two fundamental works: “The Nature of the Firm” (Coase, 1937) and earlier “Risk, Uncertainty and Profit” (Knight, 1921). While many authors consider the latter to be more acute and despite many criticisms (Kennedy, 1981; Schmitz, 2001; Fox, 2007) it was the Coase's article that became the starting point for analysis of the firm and more broadly theory of economic organization (Walker, 2021). The works of Coase are designated by some as the Coase theorem, despite many disputes as to the correct way of interpreting it (McCloskey, 1998), since the paradigm is considered still in the making (Rudolf, 2005). Nevertheless during his life, Coase did not make any significant revisions to his claims (Aslanbeigui and Oakes, 2015). Coase's works have a second essential stage (Press release. NobelPrize.org., 1991), in which he depict the problem of social costs of *externalities* (market failures) and judges decisions (Coase, 1960). The author himself claimed that this work had more impact on legal scholarship, than economics (Coase, 1991) which may be due to the fact that costs and benefits balancing in a market is ordinarily carried out by economic exchange (Campbell, 2016). Leaving the parties freedom to choose, they will find an effective solution regardless of the legal system of liability for damages (Frank, 2007). It is broadly pointed out that Coase theorem is unrealistic in the sense that it assumes an efficiency of solutions due to absence of transaction costs, nevertheless transaction costs undoubtedly do exists (Zerbe, 2000). On the other hand this is a logical consequence of Adam Smith's assumptions that economic system depends on division of labor, but is only achievable when division of labor is provided with at the lowest possible cost of exchange (lowest possible transaction costs) (Coase, 1998). As a whole, institutions mostly have the status of an economic growth factor (Szplit, 2016) but not all authors share this opinion (Glaeser et al., 2004). In addition, institutions create a number of measurement problems (Voigt, 2013). In summary, the subject of the research gap for compulsory governance structure concept lie in common denominator for institutions from various fields of law. The scope of research gap is framed by assessing them as a tools to deal with *externalities* (market failures) which usually should be internalised by price mechanism rather than by institutions. So far, it has not been discussed in the literature, therefore it constitutes an original concept and proposal for new research unit.

Since *ECONOMIC theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgment in choosing between rival sets of assumptions* (Coase, 1937, p. 386). Therefore, in order to correctly identify the concept of compulsory governance structure, it is necessary to identify the underlying assumptions of this concept in advance. They will constitute a starting point for theoretical considerations. As Coase theorem does not provide undisputed summary, the choice fell on two summary statements derived from two major publications (Coase, 1937, 1960). They are not in themselves the best depiction of Coase

theorem that we can find in scholarly literature (Zerbe, 2000), however they provide the best reference for compulsory governance structure. Selected:

1. *(...) the operation of a market costs something and by forming an organization and allowing some authority (an "entrepreneur") to direct the resources, certain marketing costs are saved. The entrepreneur has to carry out his function at less cost, taking into account the fact that he may get factors of production at a lower price than the market transactions which he supersedes, because it is always possible to revert to the open market if he fails to do this* (Coase, 1937, p. 392).
2. *The problem which we face in dealing with actions which have harmful effects is not simply one of restraining those responsible for them. What has to be decided is whether the gain from preventing the harm is greater than the loss which would be suffered elsewhere as a result of stopping the action which produces the harm. In a world in which there are costs of rearranging the rights established by the legal system, the courts, in cases relating to nuisance, are, in effect, making a decision on the economic problem and determining how resources are to be employed. It was argued that the courts are conscious of this and that they often make, although not always in a very explicit fashion, a comparison between what would be gained and what lost by preventing actions which have harmful effects. But the delimitation of rights is also the result of statutory enactments. Here we also find evidence of an appreciation of the reciprocal nature of the problem. While statutory enactments add to the list of nuisances, action is also taken to legalize what would otherwise be nuisances under the common law. The kind of situation which economists are prone to consider as requiring corrective Government action is, in fact, often the result of Government action. Such action is not necessarily unwise. But there is a real danger that extensive Government intervention in the economic system may lead to the protection of those responsible for harmful effects being carried too far* (Coase, 1960, pp. 27-28).

At this point, the individual institutions covered by the study were described and a research gap was identified. The underlying assumptions that will be the basis for further theoretical considerations have been also determined. This completes the stage where the subject and theoretical background for the research is presented. The next stage, as described in research methodology, will aim to create a definition based on steps taken so far.

## 2. Methods

The premise of this article is to identify the original concept of compulsory governance structure. This goal will be achieved by formulating a definition of this phenomenon. The compulsory governance structure will be *definiendum*. What is sought is the element of the definition marked as *definiens*. It is a statement in a given language, containing an appropriate degree of generalization, characterizing a certain phenomenon or presenting the meaning of a certain word (Ziembiński, 2002). When there is an existing definition, the cognitive process of understanding the phenomenon requires familiarization with the written definition which in turn provide the reader with a generalized picture of the phenomenon. Understanding the general form, the reader independently assesses whether individual manifestations fall within the general definition. Such process goes from general aspects to individual display. However, to create previously non-existent definition, this cognitive process need be reverse engineered. It requires heuristic, diagnostic examination aimed at determining the features and principles of a specific manifestations of phenomenon. Only on their basis, the researcher will undertake generalizing examination aimed at discovering and justifying general regularities (Apanowicz, 2000).

The research will start with qualitative revision of legal provisions. The result will be shown in the table with weights assigned to individual records, for the purpose of cluster analysis in the form of Czekanowski's diagram (Jaskulski and Sołtysiak, 2004). Developed with the help of the tool MaCzek version 3.3.44[1]. The following scale of weights will be adopted: in 'Established by' category a weight [1] will be assigned to the court office with affiliates while weight [2] will be assigned to owners. In 'Scale of court supervision' will be assigned: [1] high, [2] medium, [3] small. In 'Range' will be assigned: [1] entire firm, [2] all or part of the firm. In 'End method' will be assigned: [1] termination or loss of the firm [2] survival of economic activity in hands of the owner. In 'Impact on owner authority' assigned: [1] taking all power from the owner [2] cooperation with the owner [3] acting on behalf of the owner. In 'Administrator' will be assigned: [1] licensed entity [2] any person meeting minimum requirements. In 'Type of salary' will be assigned: [1] the amount of salary is legally imposed [2] the amount of salary depends on the owner. In 'Source of salary' will be assigned: [1] costs borne by the owner or the liable third party [2] costs principally covered by the firm. In the case of the strategic and operational goals, they were not included in the Czekanowski's diagram, due to incomparable end goals for cluster analysis. The weights were allocated on the assumption that the scale starts with the solutions most distant from the typical governance structure.

[1] Freeware MaCzek version 3.3.441 is available to download on the website of the University of Warsaw: http://www.antropologia.uw.edu.pl/MaCzek/maczek.html.

At this stage, the study will identify individual manifestations and features of the phenomenon being defined. While formulating the *definiens*, it is necessary to grasp the 'essence of the phenomenon' while deciding which features are important and which are irrelevant. Often, the inadequacy of the definition come not from the definition itself, but from the researcher's perception of the phenomenon. There are many definition errors, such as defining the unknown by the unknown *ignotum per ignotum*, the same by the same *idem per idem*, too broad and too narrow a range or categorical shifts related to ontological categories (Ziembiński, 2002). At this point, the importance of correctly identifying the underlying assumptions is emphasized. Therefore, adopting and relying on the Coase theorem allows the *definiens* to be placed in a specific conceptual scheme. Two underlying assumptions will be selected from Coase's most important works, representing two separate stages of his research. This presumption permits to go beyond the reporting legal definition (describing the meaning of a word in a language) and create a design economic definition placed in semantic stylization of a regulatory nature (determining the meaning of a word for the future, in the designed way of speaking) (Ziembiński, 2002).

## 3. Results

A simple criterion was adopted for sought institutions, where an outsider is introduced to the firm and entrusted with its management (excluding everyday employment). Therefore, thirteen institutions have been identified in total.

**Table 1.**
*Civil compulsory administration 1 (zarząd przymusowy w trybie art. 747 pkt 6 k.p.c.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 752(4) § 1(1) k.p.c. |
| **Scale of court supervision** | high [1] | Art. 752(4) k.p.c. |
| **Range** | all or part of the enterprise [2] | Art. 752(4) § 1 k.p.c. |
| **End method** | as a rule, 2 months after the end of the court case [2] | Art. 754(1) § 1 k.p.c. |
| **Impact on owner authority** | deprives the debtor's rights [1] | Art. 752(5) k.p.c. |
| **Strategic goal** | securing pecuniary claims | art. 747 pkt 6 k.p.c. |
| **Operational goal** | activities needed to run proper management | Art. 752(4) § 1 w zw. z at. 935 § 1 k.p.c. |
| **Administrator** | everyone except the obligated person [2] | Art. 752(4) § 1(1) k.p.c. |
| **Type of salary** | dependent on workload and profitability of company [1] | Art. 752(4) § 1 w zw. z art. 939 § 1 k.p.c. |
| **Source of salary** | in principle, from the company's income [2] | Art. 752(4) § 1 w zw. z art. 940 pkt. 1 k.p.c. |

Source: based on: (Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (t.j. Dz. U. z 2021 r. poz. 1805 z póź. zm.), 2022).

**Table 2.**
*Civil compulsory administration 2 (zarząd przymusowy w trybie art. 1064(1)-1064(13) k.p.c.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 1064(3) § 3 k.p.c. |
| **Scale of court supervision** | high [1] | Art. 1064(1)-1064(13) kpc |
| **Range** | all or part of the enterprise [2] | Art. 1064(5) k.p.c. |
| **End method** | 6 months or earlier debt recovery [2] | Art. 1064(6) § 1 k.p.c. |
| **Impact on owner authority** | deprives the debtor's rights [1] | Art. 1064(9) k.p.c. |
| **Strategic goal** | debt enforcement | Art. 1064(1) § 1 k.p.c. |
| **Operational goal** | debt enforcement from the company's income | Art. 1064(1) § 1 k.p.c. |
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 1064(10) § 1 k.p.c. |
| **Type of salary** | dependent on workload and profitability of company [1] | Art. 1064(1) § 2 w zw. z art. 939 § 1 k.p.c. |
| **Source of salary** | in principle, from the company's income [2] | Art. 1064(11) § 1 w zw. z art. 940 pkt. 1 k.p.c. |

Source: based on: (Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (t.j. Dz. U. z 2021 r. poz. 1805 z póź. zm.), 2022).

**Table 3.**
*Civil compulsory administration 3 (zarząd przymusowy w trybie art. 1064(14)-1064(23) k.p.c.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 1064(14) § 1 k.p.c. |
| **Scale of court supervision** | high [1] | Art. 1064(14)-1064(23) kpc |
| **Range** | entire enterprise [1] | Art. 1064(14) § 1 k.p.c. |
| **End method** | pending sale [1] | Art. 1064(14) § 1 k.p.c. |
| **Impact on owner authority** | deprives the debtor's rights [1] | Art. 1064(15) § 1 w zw. z art. 1064(9) k.p.c. |
| **Strategic goal** | debt enforcement | Art. 1064(14) § 1 k.p.c. |
| **Operational goal** | sale of the company | Art. 1064(14) § 1 k.p.c. |
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 1064(15) § 1 w zw. z art. 1064(10) § 1 k.p.c. |
| **Type of salary** | dependent on workload and profitability of company [1] | Art. 1064(14) § 2 w zw. z art. 939 § 1 k.p.c. |
| **Source of salary** | in principle, from the company's income [2] | Art. 1064(15) § 1 w zw. z art. 1064(11) § 1 i art. 940 pkt. 1 k.p.c. |

Source: based on: (Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (t.j. Dz. U. z 2021 r. poz. 1805 z póź. zm.), 2022).

**Table 4.**
*Penal compulsory administration (zarząd przymusowy w trybie art. 292a k.p.k.)*

| | | |
|---|---|---|
| **Established by** | court (prosecutor in preparatory proceedings - then approved by the court) [1] | Art. 292a. § 1-6 k.p.k. |
| **Scale of court supervision** | medium [2] | Art. 292a. § 1-6 k.p.k. |
| **Range** | all or part of the enterprise [2] | Art. 292a § 1 k.p.k. |
| **End method** | pending the sentence in a criminal case [2] | Art. 294. § 1 k.p.k. |
| **Impact on owner authority** | management next to the debtor [2] | SN 17.10.19 r. III PZ 15/19 |
| **Strategic goal** | monitoring and management of the company | Art. 292a § 8 k.p.k. |
| **Operational goal** | the administrator ensures the continuity of the work of the secured enterprise and provides the court or the prosecutor with the information that is relevant to the criminal proceedings. | Art. 292a § 8 k.p.k. |
| **Administrator** | person with a restructuring advisor license [1] | Art. 292a § 1 k.p.k. |
| **Type of salary** | dependent on workload and profitability of company [1] | Art. 292 § 1 k.p.k. w zw. z art. 939 § 1 k.p.c. |
| **Source of salary** | State Treasury expenditure included in the court costs borne by the convicted person [1] | Art. 616 § 2 ust. 2 w zw. z art. 618 § 1 ust. 9b k.p.k. |

Source: based on: (Postanowienie Sądu Najwyższego z dnia 17 października 2019 r. sygn. akt: III PZ 15/19, 2019; Ustawa z dnia z dnia 6 czerwca 1997 r. Kodeks postępowania karnego (t.j. Dz. U. z 2021 r. poz. 534 z póź. zm.), 2022).

**Table 5.**
*Inheritance administration (zarząd sukcesyjny)*

| | | |
|---|---|---|
| **Established by** | entrepreneur *mortis causa* , heir [2] | Art. 9 i art. 12 z.s. |
| **Scale of court supervision** | small [3] | Art. 60 z.s. |
| **Range** | entire enterprise [1] | Art. 17 ust. 1 z.s. |
| **End method** | pending the sentence in a inheritance case [2] | Art. 51-60 z.s. |
| **Impact on owner authority** | the owner's representative according to the provisions of the civil contract [3] | Art. 26 z.s. |
| **Strategic goal** | temporary management of the enterprise after the death of the entrepreneur | Art. 1 ust. 1 z.s. |
| **Operational goal** | performs the rights and obligations of the deceased entrepreneur resulting from his economic activity and the rights and obligations resulting from running an enterprise in the estate. Seeks to preserve property | Art. 13 ust. 1 i art. 29 z.s. |
| **Administrator** | person without issued bans to conduct business [2] | Art. 8 z.s. |
| **Type of salary** | owners according to the provisions on civil contracts [2] | Art. 26 z.s. |
| **Source of salary** | owners according to the provisions on civil contracts [1] | Art. 26 w zw. z art. 1 z.s. |

Source: based on: (Ustawa z dnia 5 lipca 2018 r. o zarządzie sukcesyjnym przedsiębiorstwem osoby fizycznej (t.j. Dz. U. 2021 poz. 170), 2022).

**Table 6.**
*Curator 1 (kuratela w trybie art. 42 k.c.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 42 § 1 k.c. |
| **Scale of court supervision** | high [1] | Art. 42 k.c. |
| **Range** | entire enterprise [1] | Art. 42 § 2 k.c. |
| **End method** | a period not exceeding one year, or an earlier filling of vacancies in the authority [2] | Art. 42(1) § 1 k.c. |
| **Impact on owner authority** | represents an enterprise incapable of independent representation [1] | Art. 42 § 2 k.c. |
| **Strategic goal** | management of an enterprise incapable of independent representation | Art. 42 § 1 k.c. |
| **Operational goal** | appointment or supplementation of the management body | Art. 42 § 2 k.c. |
| **Administrator** | court curator [1] | Ustawa k.s. |
| **Type of salary** | as a rule, not exceeding 40% of the minimum fees for lawyers [1] | § 1 ust. 1 rozp. o wynagrdz. |
| **Source of salary** | in principle, enterprise for which curator was appointed [2] | Art. 603(4) § 4 k.p.c. |

Souce: based on: (Rozporządzenie Ministra Sprawiedliwości z dnia 9 marca 2018 r. w sprawie określenia wysokości wynagrodzenia i zwrotu wydatków poniesionych przez kuratorów ustanowionych dla strony w sprawie cywilnej (Dz.U. 2018 poz. 536), 2022; Ustawa z dnia 23 kwietnia 1964 r. - Kodeks cywilny (t.j. Dz. U. z 2020 r. poz. 1740 z póź. zm), 2022; Ustawa z dnia 27 lipca 2001 r. o kuratorach sądowych (t.j. Dz. U. z 2020 r. poz. 167), 2022).

**Table 7.**
*Curator 2 (kuratela w trybie art. 69 k.c.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 69 § 1 k.p.c. |
| **Scale of court supervision** | high [1] | Art. 69 k.p.c. |
| **Range** | entire enterprise [1] | Art. 69 k.p.c. |
| **End method** | pending the sentence in a court case or appointing a probation officer under Art. 42 § 1 k.c. [2] | Art. 69 § 1 i 4 k.p.c. |
| **Impact on owner authority** | represents an enterprise incapable of independent representation [1] | Art. 69 k.p.c. |
| **Strategic goal** | conducting a court case of an enterprise incapable of independent representation | Art. 69 § 1 k.p.c. |
| **Operational goal** | termination of the court case | Art. 69 § 3 k.p.c. |
| **Administrator** | court curator [1] | Ustawa k.s. |
| **Type of salary** | as a rule, not exceeding 40% of the minimum fees for lawyers [1] | § 1 ust. 1 rozp. o wynagrdz. |
| **Source of salary** | in principle,enterprise for which curator was appointed [2] | Art. 603(4) § 4 k.p.c. |

Source: based on: (Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (t.j. Dz. U. z 2021 r. poz. 1805 z póź. zm.), 2022; Ustawa z dnia 27 lipca 2001 r. o kuratorach sądowych (t.j. Dz. U. z 2020 r. poz. 167), 2022; Rozporządzenie Ministra Sprawiedliwości z dnia 9 marca 2018 r. w sprawie określenia wysokości wynagrodzenia i zwrotu wydatków poniesionych przez kuratorów ustanowionych dla strony w sprawie cywilnej (Dz.U. 2018 poz. 536), 2022).

**Table 8.**
*Liquidatior (likwidacja w trybie k.s.h.)*

| | | |
|---|---|---|
| **Established by** | partners/owners [2] | Art. 58, art. 98, art. 148, art. 270, art. 459 k.s.h. |
| **Scale of court supervision** | small [3] | Art. 71 § 1, art. 271 k.s.h. |
| **Range** | entire enterprise [1] | Art. 58, art. 98, art. 148, art. 270, art. 459 k.s.h. |
| **End method** | until the liquidation activities are completed; at Sp. z o.o. not faster than 6 months, and with S.A. not earlier than one year from the activities commencing liquidation. [1] | Art. 286 § 1, art. 474 § 1 k.s.h. |
| **Impact on owner authority** | In the absence of other dispositions - the usual rules of representation and management [3] | Art. 68, art. 280, art. 466 k.s.h. |
| **Strategic goal** | liquidation of the enterprise | Art. 58, art. 98, art. 148, art. 270, art. 459 k.s.h. |
| **Operational goal** | ending the company's current interests, collecting debts, fulfilling obligations and liquidating the company's assets. | Art. 77 § 1, art. 282 § 1, art. 468 § 1 k.s.h. |
| **Administrator** | liquidator [2] | Art. 70 § 1, art. 286 § 1, art. 463 § 1 k.s.h. |
| **Type of salary** | set by the owner [2] | Art. 68, art. 275 § 1, art. 462 § 1 w zw. z art. 203(1) k.s.h. |
| **Source of salary** | in principle, enterprise for which liquidator was appointed based on civil contract [2] | Art. 203(1) w zw. z art. 280, art. 378 w zw. z art. 466 k.s.h. |

Source: based on: (Ustawa z dnia 15 września 2000 r. Kodeks spółek handlowych (tj. Dz. U. z 2020 r. poz. 1526 z póź. zm.), 2022).

**Table 9.**
*Preliminary bankruptcy trustee (tymczasowy nadzór sądowy w trybie art. 38-43 p.u.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 38 § 1 p.u. |
| **Scale of court supervision** | medium [2] | Art. 38 § 3 p.u., Art. 56aa p.u. |
| **Range** | entire enterprise [1] | Art. 38a p.u. |
| **End method** | ends on the day of the declaration or refusal to declare bankruptcy [2] | Art. 43 p.u. |
| **Impact on owner authority** | debtor entitled to ordinary management activities. For activities exceeding the scope of day-to-day management, the consent trustee is required, otherwise null and void [2] | Art 38a p.u. |
| **Strategic goal** | securing the debtor's assets at the stage of examining the bankruptcy petition | Art. 38 § 1 p.u. |
| **Operational goal** | control of the debtor's management activities and expenses | Art. 39 § 2, art. 38a p.u. |
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 157 § 1-2a w zw. z art 38 § 1 p.u. |

Cont. table 9.

| | | |
|---|---|---|
| **Type of salary** | dependent on the amount of work, the scope of activities undertaken in the proceedings, the degree of their difficulty, and the time of performing the function [1] | Art. 38 § 1b, 1c, 1d p.u. |
| **Source of salary** | in principle, an indebted enterprise [2] | Art. 38 § 2 w zw. z art. 32 p.u. |

Source: based on: (Ustawa z dnia 28 lutego 2003 r. Prawo upadłościowe (t.j. Dz. U. z 2020 r. poz. 1228 z póź. zm), 2022).

**Table 10.**
*Bankruptcy trustee (syndyk w trybie p.u.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art 157(1) § 1 p.u. |
| **Scale of court supervision** | high [1] | Art. 168, art. 165 p.u. |
| **Range** | entire enterprise [1] | Art. 173 p.u. |
| **End method** | until the bankruptcy (liquidation) activities are completed [1] | Art. 364 w zw. z art. 361 p.u. |
| **Impact on owner authority** | all rights of the bankrupt related to participation in companies or cooperatives are exercised by the trustee [1] | Art. 186 p.u. |
| **Strategic goal** | liquidation of the enterprise | Art. 173 p.u. |
| **Operational goal** | manages the debtor's property, secures it against destruction, damage or removal by third parties | Art. 173 p.u. |
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 157 § 1-2a p.u. |
| **Type of salary** | depending on the amount paid to creditors, the number of employees in the liquidated enterprise, the number of creditors, duration, degree of difficulty [1] | Art. 162 p.u. |
| **Source of salary** | in principle, an indebted enterprise [2] | Art. 164 w zw. z art. 32 p.u. |

Source: based on: (Ustawa z dnia 28 lutego 2003 r. Prawo upadłościowe (t.j. Dz. U. z 2020 r. poz. 1228 z póź. zm), 2022).

**Table 11.**
*Restructuring supervisor 1 (nadzorca układu w trybie art. 35-37 p.r.)*

| | | |
|---|---|---|
| **Established by** | debtor [2] | Art. 35 § 1 p.r. |
| **Scale of court supervision** | small [3] | Art. 31 p.r. |
| **Range** | entire enterprise [1] | Art. 3 § 1 p.r. |
| **End method** | until the restructuring activities are completed [2] | Art. 27 § 1 p.r. |
| **Impact on owner authority** | does not limit the debtor in the management of his property [3] | Art. 36 § 1 p.r. |
| **Strategic goal** | conclusion of an arrangement by the debtor with creditors without the participation of the court, as a result of self-collection of creditors' votes | Art. 3 § 2 ust. 1 p.r. |
| **Operational goal** | controls the activities of the debtor with regard to his property and the debtor's business and whether the property is sufficiently protected against damage or loss | Art. 37 § 1 p.r. |

Cont. table 11.

| | | |
|---|---|---|
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 24 § 1 p.r. |
| **Type of salary** | depending on the degree of repayment to creditors [1] | Art. 35 § 2a, 2b p.r. |
| **Source of salary** | in principle, an indebted enterprise [2] | Art. 35 § 1, 2 p.r. |

Source: based on: (Ustawa z dnia 15 maja 2015 r. - Prawo restrukturyzacyjne (t.j. Dz. U. z 2021 r. poz. 1588 z póź. zm.), 2022).

**Table 12.**
*Restructuring supervisor 2 (nadzorca sadowy w trybie art. 38-50 p.r.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 38 § 1 p.r. |
| **Scale of court supervision** | high [1] | Art. 31 p.r. |
| **Range** | entire enterprise [1] | Art. 3 § 1 p.r. |
| **End method** | until the restructuring activities are completed [2] | Art. 27 § 1 p.r. |
| **Impact on owner authority** | the debtor may perform ordinary management activities. The consent of the court supervisor is required to perform activities exceeding the scope of day-to-day management, unless the law provides for the consent of the board of creditors [2] | Art. 39 § 1 p.r. |
| **Strategic goal** | conclusion of an arrangement by the debtor, with creditors with the participation of the court | Art. 3 § 3 ust. 1, art. 3 § 4 ust. 1 w zw. z art. 38 § 1 p.r. |
| **Operational goal** | controls the activities of the debtor with regard to his property and the debtor's business and whether the property is sufficiently protected against damage or loss | Art. 39 § 2 w zw. z art. 37 § 1 p.r. |
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 24 § 1 p.r. |
| **Type of salary** | depending on the number of creditors, total receivables, type of proceedings, duration [1] | Art. 42 p.r. |
| **Source of salary** | in principle, an indebted enterprise [2] | Art. 45 § 5, art. 207, art. 208 § 1 p.r. |

Source: based on: (Ustawa z dnia 15 maja 2015 r. - Prawo restrukturyzacyjne (t.j. Dz. U. z 2021 r. poz. 1588 z póź. zm.), 2022).

**Table 13.**
*Restructuring supervisor 3 (zarządca w trybie art. 51-64 p.r.)*

| | | |
|---|---|---|
| **Established by** | court [1] | Art. 51 § 1 p.r. |
| **Scale of court supervision** | high [1] | Art. 31 i 32 p.r. |
| **Range** | entire enterprise [1] | Art. 3 § 1 p.r. |
| **End method** | until the restructuring activities are completed [2] | Art. 27 § 1 p.r. |
| **Impact on owner authority** | takes over the management of the restructuring mass [1] | Art. 51 § 2 p.r. |
| **Strategic goal** | carrying out extensive restructuring and repair of the enterprise | Art. 3 § 5 w zw. z art. 51 § 1 p.r. |
| **Operational goal** | legal and factual actions aimed at improving the economic situation of the debtor and restoring the debtor's ability to fulfill obligations, while protecting against debt enforcement | Art. 3 § 6 p.r. |

Cont. table 13.

| | | |
|---|---|---|
| **Administrator** | person or enterprise with a restructuring advisor license [1] | Art. 24 § 1 p.r. |
| **Type of salary** | dependent on the number of creditors, total receivables, average monthly turnover, administrator's workload, duration [1] | Art. 55 p.r. |
| **Source of salary** | in principle, an indebted enterprise [2] | Art. 59 § 10, art. 207, art. 208 § 1 p.r. |

Source: based on: (Ustawa z dnia 15 maja 2015 r. - Prawo restrukturyzacyjne (t.j. Dz. U. z 2021 r. poz. 1588 z póź. zm.), 2022).

Further look at clustering (Table 14 and Figure 1) led to the conclusion that selected institutions should be excluded ('Inheritance administrator', 'Liquidator' and 'Restructuring supervisor 1'). This conclusion was also justified by the fact that these three cases were incompatible with the other institutions. They were not 'compulsory' in their nature. To a certain extent all institutions are subject to legal constraint, however excluded institutions left owner (shareholders) more freedoms such as choosing whether to use this institution, who to nominate as an administrator, and how to pay for it. Since certain issues are decided by the owner, it is redundant for the court to check whether his rights are not harmed by his own decisions. It effectively leads to noticeably less judicial supervision, while strong judicial review is an important feature of other institutions.

**Table 14.**
*Clustering matrix*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CCA1** | 0.00 | 1.00 | 1.73 | 2.00 | 3.46 | 1.41 | 1.41 | 3.46 | 2.00 | 1.73 | 3.32 | 1.73 | 1.41 |
| **CCA2** | 1.00 | 0.00 | 1.41 | 1.73 | 3.61 | 1.00 | 1.00 | 3.61 | 1.73 | 1.41 | 3.16 | 1.41 | 1.00 |
| **CCA3** | 1.73 | 1.41 | 0.00 | 2.24 | 3.61 | 1.00 | 1.00 | 3.32 | 1.73 | 0.00 | 3.16 | 1.41 | 1.00 |
| **PCA** | 2.00 | 1.73 | 2.24 | 0.00 | 2.45 | 2.00 | 2.00 | 2.83 | 1.41 | 2.24 | 2.24 | 1.73 | 2.00 |
| **IA** | 3.46 | 3.61 | 3.61 | 2.45 | 0.00 | 3.46 | 3.46 | 1.41 | 2.45 | 3.61 | 1.73 | 3.00 | 3.46 |
| **C1** | 1.41 | 1.00 | 1.00 | 2.00 | 3.46 | 0.00 | 0.00 | 3.46 | 1.41 | 1.00 | 3.00 | 1.00 | 0.00 |
| **C2** | 1.41 | 1.00 | 1.00 | 2.00 | 3.46 | 0.00 | 0.00 | 3.46 | 1.41 | 1.00 | 3.00 | 1.00 | 0.00 |
| **L** | 3.46 | 3.61 | 3.32 | 2.83 | 1.41 | 3.46 | 3.46 | 0.00 | 2.45 | 3.32 | 1.73 | 3.00 | 3.46 |
| **PBT** | 2.00 | 1.73 | 1.73 | 1.41 | 2.45 | 1.41 | 1.41 | 2.45 | 0.00 | 1.73 | 1.73 | 1.00 | 1.41 |
| **BT** | 1.73 | 1.41 | 0.00 | 2.24 | 3.61 | 1.00 | 1.00 | 3.32 | 1.73 | 0.00 | 3.16 | 1.41 | 1.00 |
| **RS1** | 3.32 | 3.16 | 3.16 | 2.24 | 1.73 | 3.00 | 3.00 | 1.73 | 1.73 | 3.16 | 0.00 | 2.45 | 3.00 |
| **RS2** | 1.73 | 1.41 | 1.41 | 1.73 | 3.00 | 1.00 | 1.00 | 3.00 | 1.00 | 1.41 | 2.45 | 0.00 | 1.00 |
| **RS3** | 1.41 | 1.00 | 1.00 | 2.00 | 3.46 | 0.00 | 0.00 | 3.46 | 1.41 | 1.00 | 3.00 | 1.00 | 0.00 |

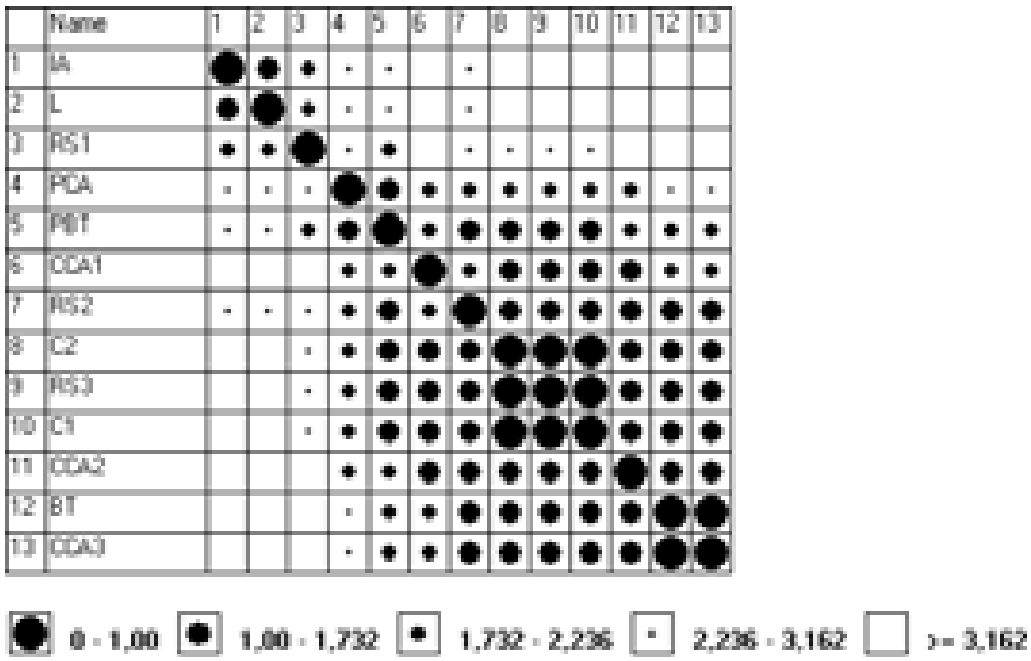


**Figure 1.** Czekanowski's diagram. Source: MaCzek version 3.3.44.

Final economic definition reads as follows:

*The compulsory governance structure is a regulatory mechanism aimed at neutralizing the social cost for stakeholders caused by ineffective firm. It introduces an external manager to the firm, who under special powers aims to remove the causes of inefficiency. During compulsory governance structure collateral transaction costs are internalized by the firm and transformed into additional coordination costs.*

## 4. Discussion

The purpose of this chapter is to present the thought process that underlies the definition in a repeatable manner. The issues will be presented step by step, leading to new issues for consideration. The entire process will end with the definition.

The first underlying assumption can be simplified as such: a firm operating in the market, functions in a certain quasi-balance, which necessitate that, coordination costs within the firm need to be lower than the transactions costs on the market (assumption 1). If this quasi-balance is sufficiently upset by increasing coordination costs, it would be preferable to buy in the market without a firm (implication 1). Therefore, replacing typical governance with a compulsory governance structure in this logical framework has its consequences. The effect of this substitution is an appearance of new coordination costs for the owner – shareholder (corollary 1). This is the cost of external administrator, long-term court supervision, formalized procedures, restrictions on business activity and inhibition of decision-making. According to

the Coase theorem, substituted compulsory governance structure should limit scope of the firm, or even force it to cease activities. This supposition is confirmed in the effects of individual institutions, that end with the cessation of business activity, (e.g. bankruptcy) or its limitation. This line of thought raises two questions. Beyond its legal goals, what is the economic purpose of a compulsory governance structure (question A)? Is there a mutual relationship between coordination costs and transaction costs in compulsory governance structure (question B)?

The second underlying assumption is derived from Coase's reflections on the social cost of business operations. In his original work, he analyzed courtroom examples of neighbor disputes concerning noise, vibration, smoke nuisance, bleaching fumes etc. He notes that judges hearing these cases often seek free market solutions. Judges try to recreate the behavior of the disputed parties, as if they were still in agreement (assumption 2). Therefore it leads to simple observation. If judges are looking for market solutions, then this search will inextricably evaluate the transaction costs of the opposing parties. The judges will want to neutralize unnecessary transaction costs (implication 2). Replacing typical governance with a compulsory governance structure in this logical framework also has its consequences. Although specific powers of judges may vary, the conclusion is that a compulsory governance structure also strives to restore the market mechanisms (corollary 2, answer A). This supposition is confirmed in the objectives of individual institutions that aims to restore the previous state. However, this logic seems to be counter intuitive. It leads to the question, why would judges restrict the free market to protect the free market (question C)?

At this point, the relationship between coordination costs and transaction costs should be considered. The compulsory governance structure used in a single entity might affect entire free market (assumption 3). Through the prism of a cause-and-effect relationship, it will suggest that the internal problems of an individual firm (micro aspect) might have at least some impact on free market transaction costs (macro aspect). The firm is a part of the market, so it has some influence on it (implication 3.1). The strength of this influence although, will depend on where the firm is placed between monopoly and perfect competition (implication 3.2). Since monopolies are irregularities and Coase theorem assumes perfect competition, therefore this impact should be statistically negligible in the scale of developed market. However, if from the broad market (macro aspect) we separate market participants related to the firm, i.e. stakeholders (micro aspect), it turns out that this impact on transaction costs is of a grand importance. This means that the relationship between coordination costs and transaction costs in compulsory governance structure exists, but only for stakeholders (corollary 3, answer B).

Summarizing the logical reasoning so far. A firm operating in the market, functions in a certain quasi-balance. Simplified, coordination costs within the firm must be lower than the market transactions costs. Compulsory governance structure affects both sides of this balance, by increasing coordination cost and lowering stakeholders transactions cost. Notwithstanding, this finding is incomplete, since these traits do not occur simultaneously. There is a certain

sequence of events to consider. In order to present the timeline, it is necessary to introduce a division between ‘before’ and ‘during’ compulsory governance structure (assumption 4).

Pre-establishment, the firm operates in the normal governance structure. As consequence of certain events it looses financial liquidity or decision making ability. Such ineffectiveness is a fundamental problem for its stakeholders. It is not uncommon for the firm well into crisis to prioritize its own survival over the interests of business partners and stakeholders. It may refuse to pay obligations and delay deadlines. This causes both, financial harm and necessity to find replacement solutions. This search for substitution generate collateral transaction costs (implication 4.1).

Post-establishment, the firm is facing an external administrator, long-term court supervision, formalized procedures, restrictions on business activity and inhibition of decision-making. They provide predictable, repeatable legal environment for stakeholders thus, neutralizing collateral transaction costs. This does not mean that stakeholders will no longer incur financial costs related to the ineffectiveness of the firm. However, the stakeholders collateral transaction costs are transformed into additional coordination costs for the firm (implication 4.2).

The above observations allow us to conclude that among many types of social costs, there is a specific social cost resulting from the ineffectiveness of the firm. Compulsory governance structure is a regulatory mechanism that aims to neutralize this social cost by shifting the burden from stakeholders to the firm. In a way, it functions much like a directional tax levied on the culprits of extensive noise, vibration, smoke nuisance, bleaching fumes etc. introducing certain restrictions to protect the free market (corollary 4, answer C).

Nevertheless, the mechanism of linking the increase in firm inefficiency with the increase in transaction costs of stakeholders leads to the unintended observation that firm’s ineffectiveness can be measured by an increase in collateral transaction costs for stakeholders. However, as this was not the purpose of this article, it remains a topic for further research.

In Assessment of the above considerations, certain limitations should be addressed. Undoubtedly, the analysis suffers from the fact that it is based on the legal regime in Poland. Nevertheless, it can be assumed that the vast majority of these institutions would be mirrored in other countries with common roots in Roman law (the case of the Anglo-Saxon legal system remains to be explored). This limitation and even further divergences or detailed provisions remain mostly irrelevant since the analysis is placed in the in economic theories. Since compulsory governance structure is based on the Coase theorem, it shares some of its burdens. Following (Zerbe, 2000) the unrealistic nature of this theory is that it assumes an efficiency of solutions due to absence of transaction costs, notwithstanding transaction costs undoubtedly do exists. Compulsory governance structure does not solve this. Admittedly it aims to keep transaction costs as low as possible, however it does so by transmitting them into coordination costs. This is a mechanism for removing *externalities* (market failures), but not by means of increasing overall (total) efficiency. Positive or negative changes in overall efficiency cannot

be ruled out as they were not analyzed (overall efficiency understood as the sum of transaction costs and coordination costs), nevertheless compulsory governance structure only focuses on one side of the equation reducing transaction costs. Thus, it does not achieve the 'ambition of efficiency', but also does not become 'unrealistic' which is associated with the Coase theorem. Notwithstanding so-called Coesian paradox point to intrinsically unobjectionable cost-benefit analysis of Coase theorem (Aslanbeigui and Oakes, 2015). In a broader sense, the institutions of the new institutional economy are accused of not being precise, objective and not prerequisite for economic growth (Voigt, 2013). Such allegations should not be made against compulsory governance structure concept which is relatively precise and objective. On the other hand, the question of whether it supports economic growth or impact overall efficiency remains a topic for further research.

## 5. Conclusions

As a result of the research, it was concluded:

1. in the Polish legal system there are a number of legal provisions where an outsider is introduced to the firm and entrusted with its management, often against current owner's will;
2. the cases in question are to be considered as institutions under the new institutional economy;
3. excluding three atypical cases with outlier characteristics, ten institutions have common features that allow them to be grouped and collectively designated as compulsory governance structure;
4. the compulsory governance structure is a regulatory mechanism aimed at neutralizing the social cost for stakeholders caused by ineffective firm. It introduces an external manager to the firm, who under special powers aims to remove the causes of inefficiency;
5. during compulsory governance structure collateral transaction costs are internalized by the firm and transformed into additional coordination costs;
6. the compulsory governance structure despite its coercion characteristic should be considered a mechanism for preserving the free market by removing *externalities* (market failures);
7. an observation was made that firm's ineffectiveness can be measured by an increase in collateral transaction costs for stakeholders.

The proposed definition presented in this article creates a new research unit called compulsory governance structure. It provides a deeper understanding of the internal mechanisms governing firm at the time these rare and specific institutions.

## References


1. Antonowicz, P. (2015). *Bankructwa i upadlosci przedsiebiorstw: teoria, praktyka gospodarcza, studia regionalne*. Gdansk: Wydawnictwo Uniwersytetu Gdanskiego.
2. Apanowicz, J. (2000). *Metodologiczne elementy procesu poznania naukowego w teorii organizacji i zarządzania*. Gdynia: Wydawnictwo Diecezji Pelplińskiej „Bernardinum".
3. Aslanbeigui, N., Oakes, G. (2015). On Coaseana: Critique of a Political Economy. *Œconomia. History, Methodology, Philosophy*, *5-3,* pp. 271-293. Available at: https://doi.org/10.4000/oeconomia.2085.
4. Borowiecki, R., Wysłocka, E. (2012). *Analiza ekonomiczna i ocena ekspercka w procesie restrukturyzacji przedsiębiorstw*. Difin S.A.
5. Campbell, D. (2016). Ronald Coase's "the problem of social cost". *The University of Queensland Law Journal*, *35(1),* pp. 75-98. Available at: https://doi.org/10.3316/informit.524721547827767.
6. Coase, R.H. (1937). The Nature of the Firm. *Economica*, *4(16),* pp. 386-405. Available at: https://doi.org/10.1111/j.1468-0335.1937.tb00002.x.
7. Coase, R.H. (1960). The Problem of Social Cost. *The Journal of Law and Economics*, p. 44.
8. Coase, R.H. (1991). *The Institutional Structure of Production*. Nobel Prize in Economics documents, 1991-1. Nobel Prize Committee.
9. Coase, R.H. (1998). The New Institutional Economics. *The American Economic Review*, *88(2),* pp. 72-74.
10. Fox, G. (2007). The Real Coase Theorems. *CATO Journal*, *27*.
11. Frank, R. (2007). *Mikroekonomia jakiej jeszcze nie było*. Gdańskie Wydawnictwo Psychologiczne.
12. Gilejko, L. (ed.) (2006). *Aktorzy restrukturyzacji – trudne role i wybory.* Szkoła Główna Handlowa w Warszawie – Oficyna Wydawnicza.
13. Glaeser, E.L. et al. (2004). Do Institutions Cause Growth? *Journal of Economic Growth*, *9(3),* pp. 271-303. Available at: https://doi.org/10.1023/B:JOEG.0000038933.16398.ed.
14. Janda, P. (2011). *Ochrona osób trzecich w postępowaniu upadłościowym obejmującym likwidację majątku upadłego przedsiębiorcy*. Wolters Kluwer Polska Sp. z o.o.
15. Jara, Z. (ed.) (2022). *Kodeks spółek handlowych. Komentarz*. C.H. Beck.
16. Jaskulski, P., Sołtysiak, A. (2004). Diagram Czekanowskiego: pomysł, historia, zastosowania. *Prace Naukowe Akademii Ekonomicznej we Wrocławiu. Taksonomia*, *(nr 1022, Klasyfikacja i analiza danych – teoria i zastosowania),* pp. 374-383.
17. Kamosiński, S. (2015). *Przedsiębiorstwa w przebudowie. Prywatyzacja i restrukturyzacja przedsiębiorstw kujawsko-pomorskich w latach 1990-2004*. Wydawnictwo Uniwersytetu Kazimierza Wielkiego.
18. Kennedy, D. (1981). Cost-Benefit Analysis of Entitlement Problems: A Critique. *Stanford Law Review, 33(3),* 387-445 [Preprint]. Available at: https://doi.org/10.2307/1228354.

19. Knight, F.H. (1921). *Risk, Uncertainty and Profit*. Houghton Mifflin.
20. Lachiewicz, S. et al. (2005). *Restrukturyzacja organizacji i zasobów kadrowych przedsiębiorstwa*. Oficyna Ekonomiczna.
21. Lubián, F.J.L.L. (2014). *The Executive Guide to Corporate Restructuring*. Basingstoke, Hampshire, New York, NY: Palgrave Macmillan IE Business Publishing.
22. Machnikowski, P. (ed.) (2022). *Zobowiązania. Przepisy ogólne i powiązane przepisy Księgi I KC. Tom I. Komentarz*. C.H. Beck.
23. Mączyńska, E. (ed.) (2001). *Restrukturyzacja przedsiębiorstw w procesie transformacji gospodarki polskiej, TOM I i II*. Wyd. DiG.
24. McCloskey, D. (1998). The So-Called Coase Theorem. *Eastern Economic Journal*, *24(3),* pp. 367-371.
25. Missala, W., Wolbach, Ł. (2013). *Likwidacja spółki kapitałowej*. Wolters Kluwer Polska Sp. z o.o.
26. Nowosielski, S. (2016). Goals in scientific research management. Methodological aspects [in Polish]. Available at: https://doi.org/DOI: 10.15611/pn.2016.421.37.
27. Podczarski, S. (2016). *Efektywność ekonomiczna procesów restrukturyzacji przedsiębiorstw przemysłowych*. PWN.
28. *Postanowienie Sądu Najwyższego z dnia 17 października 2019 r. sygn. akt: III PZ 15/19* (2019).
29. Press release. NobelPrize.org (1991). *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1991, Nobel Prize Outreach AB 2022.*, *NobelPrize.org*. Available at: https://www.nobelprize.org/prizes/economic-sciences/1991/press-release/, 2.04.2022.
30. *Rozporządzenie Ministra Sprawiedliwości z dnia 9 marca 2018 r. w sprawie określenia wysokości wynagrodzenia i zwrotu wydatków poniesionych przez kuratorów ustanowionych dla strony w sprawie cywilnej (Dz.U. 2018 poz. 536)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20180000536, 21.05.2022.
31. Rudolf, S. (ed.) (2005). *Nowa Ekonomia Instytucjonalna. Aspekty Teoretyczne i Praktyczne*. Wydawnictwo Wyższej Szkoły Ekonomii i Administracji im. prof. Edwarda Lipińskiego w Kielcach.
32. Schmitz, P. (2001). The Coase Theorem, Private Information, and the Benefits of Not Assigning Property Rights. *European Journal of Law and Economics*, *11*, pp. 23-28. Available at: https://doi.org/10.1023/A:1008709628107.
33. Skorupka, J. (ed.) (2021). *Kodeks postępowania karnego. Komentarz*. C.H. Beck.
34. Szplit, A. (2016). *Nowa ekonomia instytucjonalna a nauki o zarządzaniu.* S. Rudolf (ed.). CeDeWu. Available at: https://docplayer.pl/59484616-Nowa-ekonomia-instytucjonalna-a-nauki-o-zarzadzaniu.html, 18.08.2022.
35. *Ustawa z dnia 15 maja 2015 r. - Prawo restrukturyzacyjne (t.j. Dz. U. z 2021 r. poz. 1588 z póź. zm.)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id= wdu20150000978, 2.04.2022.

36. *Ustawa z dnia 15 września 2000 r. Kodeks spółek handlowych (tj. Dz. U. z 2020 r. poz. 1526 z póź. zm.)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=wdu20000941037, 2.04.2022.
37. *Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (t.j. Dz. U. z 2021 r. poz. 1805 z póź. zm.)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU19640430296, 2.04.2022.
38. *Ustawa z dnia 23 kwietnia 1964 r. - Kodeks cywilny (t.j. Dz. U. z 2020 r. poz. 1740 z póź. zm)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU19640160093, 2.04.2022.
39. *Ustawa z dnia 27 lipca 2001 r. o kuratorach sądowych (t.j. Dz. U. z 2020 r. poz. 167)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20010981071, 21.05.2022.
40. *Ustawa z dnia 28 lutego 2003 r. Prawo upadłościowe (t.j. Dz. U. z 2020 r. poz. 1228 z póź. zm)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=wdu20030600535, 2.04.2022.
41. *Ustawa z dnia 5 lipca 2018 r. o zarządzie sukcesyjnym przedsiębiorstwem osoby fizycznej (t.j. Dz. U. 2021 poz. 170)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20180001629, 2.04.2022.
42. *Ustawa z dnia z dnia 6 czerwca 1997 r. Kodeks postępowania karnego (t.j. Dz. U. z 2021 r. poz. 534 z póź. zm.)* (2022). Available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU19690130096, 2.04.2022.
43. Voigt, S. (2013). How (Not) to measure institutions. *Journal of Institutional Economics* [Preprint].
44. Walker, P. (2021). *The Theory of the Firm An Overview of the Economic Mainstream Revised Edition*. Routledge.
45. Williamson, O.E. (1985). *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. Free Press.
46. Witosz, A. (2014). *Rozwiązanie i likwidacja spółek handlowych*. LexisNexis.
47. Zaremba, U. (2021). *Restrukturyzacja sądowa a upadłość przedsiębiorstw*. Wyższa Szkoła Informatyki i Zarządzania.
48. Zerbe, R.O., Medema, S. (2000). The Coase Theorem. In: Bouckaert, DeGeest (eds.), *The Encyclopedia of Law and Economics, vol. 1,* (pp. 836-892). Aldershot: Edward Elgar Publishing, Inc.
49. Zieliński, A., Flaga-Gieruszyńska, K. (2022). *Kodeks postępowania cywilnego. Komentarz*. C.H. Beck.
50. Ziembiński, Z. (2002). *Logika praktyczna*. Warszawa: PWN.
51. Zimmerman, P. (2022). *Prawo upadłościowe. Prawo restrukturyzacyjne. Komentarz*. C.H. Beck.

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# CHINESE GOLDSMITHING – LUXURY CRAFT OR LUXURY PRODUCTS?

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**Purpose:** The text presents the crafts related to precious metals in terms of the importance of gold in China's economic culture; the development of jewelry manufacturing techniques and their makers, the jewelry market divided into the geographical location (within the PRC); the needs and preferences of the demand side, as well as the gender and age group of the final consumers. The aim of the article is to answer the question whether Chinese goldsmithing is associated with luxury or associated mainly with the production of luxury products.
**Design/methodology/approach**: The research method used was *desk research* – an analysis of the literature and articles written by Chinese journalists based on interviews with goldsmiths.
**Findings:** The article points out that the contemporary group of Chinese goldsmiths is very diverse. Although gold is associated with luxury and a good financial situation, the profession of a craftsman is not as closely associated with this social consciousness.
**Originality/value:** The article presents the topic of goldsmithing, which is relatively rarely represented in the literature of economic sciences.

**Keywords:** crafts, Chinese crafts, China, goldsmiths, jewelry market, economic culture.

**Category of the paper:** research paper.

## 1. Introduction

To In ancient times, the Chinese symbol for gold [金] was closer in meaning to metal than to the chemical element with the symbol Au – the soft and the most ductile metal (Knobloch, 1977, p. 68). This is indicated, among others, by two dots – equivalents of metal lumps, which in the earlier version of the record were located next to the arrowheads and the ax ( [金]), i.e., objects that were made of metal. Due to its properties, gold was not a good material for the production of weapons. Moreover, for a long time this metal was not considered the most

valuable in China, silver had a much greater value (Künstler, 2007, p. 308), and later on, they were equally valued (Prodan, 1975, pp. 177-178). Both these metals, however, were not as precious as copper and tin alloys – bronze. Bronze products were symbols of the right to exercise political power for rulers by Heaven, they symbolized not only the held power, but also the status associated with it. Apart from bronze, jade was also perceived as a valued artistic material (Zhang et al., 2015).

On the other hand, the reason for the lower price of gold than silver most likely was associated with the availability of both ores in China. Gold occurs in veins as well as in alluvial and crumb deposits, while silver only in deposits, anyway, acquisition of them requires mining. Therefore, the metals obtained from them were rare and not often used by craftsmen (Scarpari, 2008, pp. 58-61).

Under the Song Dynasty [960-1279], gold mines would be explored by the community, but later on, public mining was forbidden until 1033. During the Yuan Dynasty [1279-1368] miners were perceived as the lowest class of the population, which was not favorable for gold mining and gold popularity (Zhang et al., 2015). Nowadays, Chinese gold is obtained from three provinces: Anhui - Shaxi Copper Mine, Shandong - Jiaojia Gold Mine, Dayingezhuang Gold Mine, Sanshandao Gold Mine, and Gansu - Zaozigou Gold Mine (five of the largest gold mines in China in 2020, 2021). In 2020, China was the largest producer of this metal in the world, generating 368.3 tons - 11% of total world production (Global mine production, 2021). As the export of domestic goldmine production is prohibited in China, all production remains in the country of origin (Frisby, 2022).

From the very beginning, crafts related to precious metals in China were associated with the creation of luxury goods. They were initially intended for the imperial court and temples, and, later on, were available for those in power and wealthy people. Luxury goods are defined as having an income elasticity of demand greater than one (Begg, Fischer & Dornbusch, 2007, p. 589). They are also characterized by the fact that they have unique features that satisfy specific consumption needs, excluding basic needs. Nowadays, precious metal products are still luxurious, but they are becoming available to a growing group of Chinese recipients. Jewelry, as one of the types of luxury goods, is perceived as a carrier of historical and cultural values, quality and artistry of craftsmanship which means durability and, moreover, exclusivity (Armano, 2019/2020).

Although China's leading position in the global gold production, as well as the common knowledge about the economic power of gold related to, among others, its widespread recognition as securing the real value of paper money and strengthening the country's financial credibility (The Ministry of Finance explains the role of gold in Poland's currency reserves, 2021), there are very few texts on the issues of goldsmithery and economic sciences in the literature on the subject. For example, in the Web of Science database, after entering the phrase Chinese goldsmithing (and other derivatives of these words), not a single item appears. Due to the above, the article focuses on the topic of Chinese goldsmithing and the craftsmen involved

in it, in relation to the perception of the value of gold in Chinese culture, the main techniques of jewelry making and the gold luxury market in China. The aim of the article, apart from presenting the professional situation of contemporary craftsmen – a very diverse group of goldsmiths and traditional jewelers, is also to answer the question whether Chinese goldsmithing is associated with luxury or associated mainly with the production of luxury products. The article uses the method of existing data analysis.

## 2. Materials and Methods

The research was conducted in two stages. The first was related to the literature analysis of the subject in Polish, English and Chinese. During the research, it was noticed, that Chinese goldsmithing is not a popular subject which is rarely selected for research by the scientific community. Due to the above, the research was continued, looking for journalists' articles, based on interviews with Chinese goldsmiths, which were available only in English and Chinese. The selection was made by entering various combinations of words in the search engine: *goldsmith, gold*, and even *silver, jeweler, jewelry, China, crafts, market*, and after obtaining more detailed data, e.g., names of craftsmen, articles/ interviews dedicated to them were also searched for.

## 3. Chinese jewelry market

The jewelry market could be analyzed from the perspective of clients' preferences, i.e., those interested in renting jewelry (currently under development) or those interested in purchasing jewelry. Precious goods can be bought for their own needs/use or to meet the needs of other people. Therefore, in China we can distinguish: the wedding market (accounting for about 50% of consumer sales in China) and the "celebration" market (including the celebration of spring [春节], anniversaries, birthdays and Valentine's Day) (HKTDC, 2021). The Chinese jewelry market can also be divided into sub-markets according to the sex of the recipients or their birth year – belonging to a specific generation. In this way, we can talk about the women's jewelry market (the dominant buyers in China) and the men's jewelry market. In addition, we can distinguish client markets to which various craft products are directed – markets:

- children (a market more static than the adult market, with large growth forecasts, among others due to the withdrawal of the one-child policy in the PRC (HKTDC, 2021)),
- youth,
- young adults (including the Millennial generation),

- mature adults,
- seniors (including jewelry less resistant to inflation, with sentimental value (HKTDC, 2021)).

The jewelry market can also be divided due to its geographical location related to the places of processing and distribution of raw materials, semi-finished products and finished products. Plants specializing in the production of jewelry are located mainly in the provinces of Guangdong, Shandong, Fujian, Zhejiang and the separate city of Shanghai (HKTDC, 2021). For example, the following markets could be pointed out (THL, 2021):

- gold and silver (e.g., Shenzhen Luohu [深圳罗湖]),
- jade (Xiuyan in province Liaoning [辽宁岫岩]; Ruili, Yunnan [云南瑞丽]; Tengchong, Yunnan [云南腾冲]; Sihui, Guangdong [广东四会]; Pingzhou, Guangdong [广东坪洲]; Putian, Fujian [福建莆田]; Zhenping, Henan [河南镇平]),
- turquoise (Zhushan, Hubei [湖北竹山], Longling,Yunnan [云南龙陵]),
- pearls (Zhuji, Zhejiang [浙江诸暨]; Suzhou Xiangcheng [苏州相城]),
- sapphire (Shandong Changle [山东昌乐]),
- Shoushan stone [寿山石] (Jin'an, Fuzhou [福州晋安]),
- agate (Fuxin, Liaoning [辽宁阜新]),
- artificial gems (Wuzhou, Guangxi [广西梧州]),
- etc.

As well as the so-called jewelry production bases, incl. Chengyang, Qingdao [青岛城阳]; Shunde Lunjiao, Guangdong [广东伦教]; Panyu, Guangzhou [广东番禺], and Guangzhou Huadu [广东花都].

The Chinese jewelry market is of characteristic worth that began with ancient crafts and the most exquisite works made by the hands of those craftsmen. Mainly due to the fact that, although contemporary research is being conducted in the field of shaping goldsmith products and the uniqueness of the materials used in this craft (See: Zhou et al., 2021; Lu et al., 2021; Lu et al., 2015), nevertheless, "(...) in the field of processing precious metals, antiquity has already done everything that could be done, and later times could at most certainly add to it some technical improvements that would shorten the path to the goal a bit" (Gradowski, 1980, p. 15).

At the beginning of the Zhou Dynasty period [1046 BC - 256 BCE], precious metals had appeared in Chinese crafts. At that time, gold was mainly used for inlaying bronzes (Prodan, 1975, pp. 177-179; Künstler, 2007, p. 308). Inlays, using the technique called “damaskinage” were performed in two stages: first, colored metal wire was clapped into previously made patterns on the surface of the object, and then the surface was smoothed with a grinding stone so that it did not protrude and became smooth and shiny (5000 years…, 2014, pp. 39-69). Besides, small adornments were often made of gold or decorated with gold small ornaments

e.g., buttons, earrings and beads (Demandt, 2016) – found in the tombs of emperors and their families.

During the reign of subsequent dynasties, not only did the shape and preferences regarding the golden decoration of objects change, but also the techniques used in working with precious metals. The first Chinese gold coin was molded during the Warring States period [480 BC - 221 BC] (Zhang et al., 2015). Initially, only the molding method was used, later on (late period of the Zhou Dynasty and the Han Dynasty [206 BC - 220 AD]), forging was also implemented. The final shape and decoration was achieved by tapping and carving with a chisel (Tang Dynasty [618-907]) (Prodan, 1975, pp. 177-179). The value of gold began to be appreciated during the reign of the Han and Tang dynasties. Especially between the 7th and 10th centuries, the imperial family and the aristocracy started to value gold products. The golden vessels were given to officials to appropriate their work and the aristocracy often paid tribute to the ruler in the same way. Under the Tang dynasty, the Imperial Workshop was established for the production of gold and silver utensils (Zhang et al., 2015). At that time, however, gold was mainly used for the production of jewelry (Scarpari, 2008, pp. 58-61). Jewelry was a part of costume to emphasis the rank of the position held by the person (China Fetching). Only after the reign of the Song dynasty were art works of goldsmiths' hands delivered to recipients outside the imperial court. At that time, goldsmithing techniques such as: repoussé (boning), punching and chiseling, plating and gilding achieved a high level (5000 years…, 2014, pp. 233-279).

During the reign of the Ming Dynasty [1368-1644], the price of gold increased, so it was mainly used to make coins and jewelry (Prodan, 1975, pp. 177-179). In this period, the method of encrusting lacquerware products with gold and silver was developed (Kajdański, 2005, p. 94). About 1400 C.E., China began trading with South Asia and India, which resulted in access to new jewelry materials e.g., turquoise. Towards the end of the Ming Dynasty, trade with Europe and North Africa grew rapidly, which meant that Western techniques and materials were adopted and refined by Chinese jewelers. This is how the Chinese cloisonné technique was created, combining works with bronze, porcelain and painting (Invaluable, 2017). Brass, bronze or copper surfaces were first decorated with metal wire (as lines of ornament), then in between a multicolored paste was applied, then the item was heated, sanded, polished, and finally, metal elements were gilded (5000 years…, 2014, pp. 334-365). Another original method invented by Chinese craftsmen was tian-tsui/dian cui [点 翠] – sticking fragments of kingfisher feathers on the metal (mainly silver) surface. In this way, very delicate hair ornaments and cyan-azure coloured brooches were created (Yun Boutique, 2017).

In ancient China, gold was also used to make dishes (spoons, goblets, cups, bowls, bowls), storage boxes, seals, harness ornaments, masks, clothes hooks and headgear ornaments (tiaras, cufflinks and pins) (J.J. Lally & Co. Oriental Art, 2012).

Gems like jade, pearl, coral, amber, agate and lapis lazuli were also used by Chinese manufactures to attract jewelry (including hairpins and necklaces). Closer to our times, activities related to the manufacturing of goldsmithing work are as follows (Gradowski, 1980):

preparing a workplace (mostly independently (Knobloch, 1977, p. 276)); project preparation; basic works (e.g., forging, spinning off, repoussé, die-cutting and embossing, molding); surface treatment (e.g., grinding, texturing, polishing, chiseling, engraving, etching, granulation, gilding, coloration, inlaying and applying, plating); special works (e.g., filigree, niello, enamel, jewelry stone decoration, jewelry making, chryselephantine) and assembly works, incl. soldering and other hot and cold bonding methods. Gold, on the other hand, continues to hold a high position in China (at this time much higher than silver and bronze), and its reserves are increasing. At the end of 2020, China's national reserve amounted to almost 14.73 thousand tons (CIS, 2021). During the Covid-19 pandemic, despite a drop in gold consumption by 18.1%, the level of retail jewelry sales decreased by only 4.7%. Chinese consumers purchased 490.6 tons of gold jewelry in 2020, which was influenced, among others, by an increase in the price of ore (HKTDC, 2021). The Chinese generally like gold. In the past this color (like yellow) was dedicated only for one recipient - the emperor, and to this day, it symbolizes prestige and is extremely positively correlated. This is also evidenced by the changing urban landscape, where jewelry stands and shops with gold products appear in all shopping malls. However, the demand for gold is not only in the jewelry market, it also applies to the group of private investors, buyers of bars/coins and the high technology industry (Kaliński, 2014).

It is forecasted that in the longer term, the demand for jewelry, including gold jewelry, will continue to increase in China. This is affected by three factors: rising incomes and therefore, the expansion of the middle class; the persistent high level of savings and the specificity of Chinese culture – its tradition, incl. the popularizing of jewelry as a gift, especially during weddings and celebrations (WGC, 2014). Furthermore, other precious metals, like platinum is obtained by China mainly from import, the decrease of which in 2020 was 17.1%.

Moreover, China is the world's second largest consumer of diamonds (including imported diamonds), with demand rising despite the pandemic, reaching RMB 70.7 billion [approximately US $ 11.1 billion] last year (HKTDC, 2021). In the first decade of the 21st century, China was also the world's largest producer of silver jewelry and fully one third of Chinese silver production was targeted for the domestic market. Silver jewelry along with silver-plated jewelry (covered with a more noble metal), due to its lower price lower in respect to gold and platinum, finds its customers among the lower-ranked group of Chinese society, including people from rural areas (Hsu et al., 2014).

## 4. Chinese goldsmiths and traditional jewelers

A goldsmith is defined as a person who produces or sells gold items (Goldsmith), and in a broader sense, one who also sells decorative objects and jewelry containing other precious metals (The goldsmith). Commonly, this term is also used as a synonym for a jeweler,

i.e., a person who deals with jewelry, precious stones, watches, silver and porcelain (Jeweler). In Chinese, the word goldsmith [金匠] is presented with symbols of gold [金] and craft [匠]. A Jeweler [珠宝商人] is a person [人] engaged in business [商] related to jewelry [珠宝], a derivative of pearls [珠] and treasures [宝]. This article discusses artisans who identify themselves either as goldsmiths and jewelers (who run traditional shops where hand-made jewelry is made), or as technicians and designers.

In China's Imperial Period, goldsmiths specialised in the production of jewelry, designed products intended mainly for the imperial court. Their works could not be sold on the private market. However, over time private companies known as silver buildings [银楼] not only produced and sold precious metals but also granted loans against valuable items. These companies were represented by guilds (Hsu et al., 2014). The development of products manufactured from precious metals was hampered by the Cultural Revolution. At that time, jewelry was considered as a symbol of the rejected capitalism. However, at the end of the 20th century, the jewelry industry flourished again. Although initially the quality of jewelry was relatively low, over time it improved to the point when it became a competitive advantage. The following materials are mainly used to produce jewelry: metals (precious: gold, silver, platinum as well as alloys and base metals – mainly copper and aluminum), stones (diamonds and other colored precious stones, including jade and pearls) and other raw materials (including clay, wood, string, leather and ivory) (HKTDC, 2021). Similarly to other professions, Chinese goldsmiths are not a homogeneous group. While some of them are faithful to a specific precious metal, others adjust to market changes and change or combine the materials they work with. While some goldsmiths predominantly use traditional Chinese motifs (images of dragons and phoenixes, decorative motifs of bamboo, peony, lotus, floating fish, philanthropic and Chinese zodiac signs, and famous characters from literature), others follow Western design patterns. The third group combines both of the above. For example, Wang Naiyan [王乃炎] is a craftsman who combines eastern and western trends. He believes that modern handicraft can combine old production technology and modern design (KKNews, 2017a). Likewise, Zhou Jingzhao [周镜钊] represents the artisanal spirit of "inheriting innovation without forgetting the past" ["传承不守旧,创新不]. This also shows that the spirit of craftsmanship is fostered by dedication, self-improvement and seriousness – and is gaining social recognition and respect (Deng, 2017).

Another aspect refers to recognition at a wider than just local scale. Jingyi Bai [白静宜] a Beijing craftswoman and artist-designer, who mastered the art of filigree inlay and specialises in filigree and marquetry (a fine gold decorative technique that has been listed as China's intangible cultural heritage in 2008) may serve as an example. She has developed a unique artistic style. In 2009, she was named the Representative Inheritor of filigree inlay art [花丝镶嵌]" (Yuncunzhai, 2016). In 2010, she was also awarded the honorary title of Master of Chinese Jewelry Design [中国珠宝首饰设计大师] (Lu, 2019). Another example is Yue-Yo

Wang [王月要] – a jewelry designer from Taiwan, who combines the arts of knotting and marquetry. According to Yo Wang, nowadays, it is very important to create products for several different markets (Lucas et al., 2015). Another aspect is income. It would seem that in the era of luxury goods, every goldsmith is "doomed" to wealth. However, according to Master Luo [罗] two aspects need to be considered. Firstly, in the past, the Chinese visited a goldsmith in search for a dowry, wedding gifts (e.g., dragon and phoenix bracelets or mandarin duck rings) or welcoming gifts for a new family member. Nowadays, they first visit jewelry shops (not necessarily traditional), and not every goldsmith owns such a store. Secondly, most often the Chinese visit goldsmiths not to buy something new but to repair or process the jewelry they already have. Therefore, the change in preferences has become evident (KKNews, 2016). The goldsmith industry has also been affected by the first stages of the COVID-19 pandemic. Some of the companies went bankrupt, others have been functioning, but they have been forced to sell jewelry below its market value (Yidu, 2020). Brand development can also affect the level of income. Goldsmiths and jewelers know that nowadays the price of a product also depends on the brand under which a given product is sold. Creating a brand is much more economically profitable than the production of jewelry itself. For example, the price of diamond jewelry with a label of a well-known brand may be as high as 300% of the same product offered without a brand (Xiang, 2021). Another aspect refers to those, who are actively working in the profession – creating or making repairs, developing new products and focusing on teaching and spreading cultural heritage – and those who work in the industry, but mainly as managers, and people who have retrained.

Wang Bisheng from Nanjing specialises in the production of thin gold leaves. The handmade leaves made with a hammer are softer and more sophisticated compared to machine production. They are used for gilding other surfaces. Master Wang, in collaboration with the Nanjing Gold Thread and Gold Leaf Factory, trains a new generation of craftsmen (Chinadaily, 2020).

Zhang Zhengang, a craftsman from Hangzhou, is a goldsmith who specializes in hand hammering and carving in gold and silver. Due to the precise and time-consuming nature of all necessary individual activities, the designing and forging of one item takes about three months. Zhengang also holds classes at the Hangzhou Intangible Culture Protection Center. In ancient times, the northern province of Zhejiang was full of goldsmiths. Due to fierce competition, they achieved advanced craftsmanship. However, once popular gold and silver craftsmanship declined over time and the demand for gold handicrafts decreased significantly. According to the craftsman Zhang, government support has no longer been enough as the craft requires greater public interest and more importantly – continuation. To make a living, Zhang designs factory molds for mass production (Shanghai Municipal People's Government, 2020). According to another goldsmith, Chung Chunzhong [鍾春忠], changes in the handicraft market have become evident as goldsmiths have been gradually abandoning manual production and

now sell gold jewelry made automatically with casting molds instead (Lin, 2018). According to Master Xiong [熊] although working conditions have significantly improved over time, as a parent, he would not want his child to become a goldsmith in the future. It is a physical and tiring work that requires many years of training job and repeating the same activities, which is often reflected in the condition of the hands, eyesight and the pace of work. For example, it used to take him two hours to make a chain and now it takes him at least four hours. However, Master Xiong hopes his craftsmanship will not disappear in the same way cameras are still available despite the mobile revolution. He believes goldsmithing also will not disappear, but adapt to a specific customer market. He sees opportunities in education (jewelry design courses at universities) and the importance of transferring knowledge in textbooks written by current craft masters (KKNews, 2018). The craftswoman He [何] also believes that goldsmithing requires not only patience (sitting in one position for several hours) but also good eyesight. When working with blowtorches, burns and roughness of hands are quite common (Ma, 2013). Prior to 2000, traditional jewelry stores most often redesigned jewelry from older pieces provided by customers. At that time, products made of gold were most popular and not only jewelry shops were selling it. Subsequently, the change in consumer preferences and numerous reports of gold 'stolen' during its cleaning contributed to lowered trust towards this professional group. Furthermore, learning this craft is difficult and time-consuming. Entering the industry requires an apprenticeship followed by working in a craft shop and doing all kinds of activities. Then, a master gradually teaches the craft for several years (KKNews, 2017b). However, even those who complete their education, do not always work creatively as goldsmiths but quite often engage in business outside China, or set up their own jewelry companies (KKNews, 2017a).

## 5. Conclusions

As a final product, gold jewelry is a combination of materials (including the selected metal and additives used), as well as the creativity and skills of its creator – a craftsman. Chinese artisans use their talent and skills to develop pioneering techniques that have had a lasting global impact on designed items, including jewelry.

The main conclusions of the conducted research are as follows:

- In Chinese culture, the value of gold was initially lower than the value of silver and bronze, however, it has increased over time and is now worth far more than silver or bronze. This affects the dynamic development of the gold jewelry market, and many new sub-markets within it, for example, addressed to children;

- Both in scientific articles and opinion columns, the issues of the raw materials, techniques or final products are discussed more often than the profiles of craftsmen, the position of this professional group and the data on handmade gold jewelry. Moreover, studies and articles have shown, there is a considerable imbalance between the number of texts devoted to ancient and contemporary goldsmith masters. Works of contemporary jewelry manufacturers and designers, including those containing precious stones, are more popular. This is directly linked to the position of gold in Chinese culture, its acquisition and its popularity, which has increased over time.
- The group of Chinese goldsmiths/traditional jewelers is not homogeneous, although in China gold jewelry craftsmanship is mainly associated with repair services. Despite the fact that gold is associated with luxury and wealth, the profession of a goldsmith is not perceived as such neither by the overall Chinese society nor the craftsmen themselves.
- As in case of other traditional Chinese crafts, measures are needed to prevent goldsmithing from disappearing, and being completely replaced by large concerns and fully automated production.

Due to the difficulties in accessing scientific literature discussing the economic aspects of Chinese goldsmithing, as well as the lack of data on hand-made gold jewelry, this study has been limited. The online interviews (mainly in Chinese) certainly make a significant contribution to this topic; however, they are mainly conducted among individual jewelry makers, with various specialisations and working in different places (geographic location), therefore, it is not certain whether the results of this research are valid for all contemporary Chinese goldsmiths/traditional jewelers. Due to the above, it is recommended to continue this research and conduct in person interviews and surveys with Chinese artisans.

## References

1. Armano, G. (2019/2020). *Luxury Jewellery in the Chinese Digital Age. Online strategies for selling high-end jewellery in the Chinese Market* (Master's Degree Programme in Languages, Economics and Institutions of Asia and North Africa). Venezia: Universita Ca'Foscari.
2. Begg, D., Fischer, S., Dornbusch, R. (2007). *Microeconomics* [*Mikroekonomia*]. Warszawa: PWE.
3. Chinadaily (2020). *Craftsman promotes gold leaf hammering skills in Nanjing*. Retrieved from http://en.chinaculture.org/2020-07/17/content_1482276.htm, 03.03.2022.
4. China Fetching. *Chinese Jewelry- History, Tradition, Culture and Artifact*. Retrieved from https://www.chinafetching.com/chinese-jewelry, 21.02.2022.

5. Demandt, M.H.S. (2016). Early Gold Ornaments of Southeast Asia: Production, Trade, and Consumption *Asian Perspectives*, *Vol. 54, No. 2,* pp. 305-330.
6. Deng, Y.F. (2017). *Don't be conservative in the inheritance of folk craftsmanship, and don't forget the origin of innovation* [邓毅富，民间工艺传承不要守旧，创新不要忘本]. Retrieved from https://kknews.cc/culture/rz5xn2x.html, 28.01.2022.
7. *Five largest gold mines in China in 2020* (2021). Mining Technology. Retrieved from https://www.mining-technology.com/marketdata/five-largest-gold-mines-china-2020/, 22.04.2022.
8. Frisby D. (2022). *China almost certainly owns more gold than the US – here's why that matters*. Retrieved from https://moneyweek.com/investments/commodities/gold/603131/how-much-gold-does-china-own, 25.04.2022.
9. *Global mine production* (2021). World Gold Council. Retrieved from https://www.gold.org/goldhub/data/gold-production-by-country, 25.04.2022.
10. Goldsmith. In: *Marriam-Webster Dictionary*. Retrieved from https://www.merriam-webster.com/dictionary/goldsmith, 27.01.2022.
11. Gradowski, M. (1980). *Ancient goldsmithing. Technique and terminology* [*Dawne złotnictwo. Technika i terminologia*]. Warszawa: PWN.
12. HKTDC (2021). *China's Jewellery Market*. Retrieved from https://research.hktdc.com/n/article/MzEwMzg3MzA0 , 29.01.2022.
13. Hsu, T., Lucas, A., Qiu, Z.L., Li, M., Yu, Q.Y. (2014). Exploring the Chinese Gem and Jewelry Industry. *Gems and Gemology*, *Vol. 50, No. 1*, pp. 2-29.
14. Invaluable (2017). *Why Antique Chinese Jewelry still Soars*. Retrieved https://www.invaluable.com/blog/antique-chinese-jewelry/, 13.03.2022.
15. J.J. Lally & Co. Oriental Art. (2012). *Silver and Gold in Ancient China*. New York: J.J. Lally & Co. Oriental Art.
16. Jeweler. In: *Marriam-Webster Dictionary*. Retrieved from https://www.merriam-webster.com/dictionary/jeweler, 27.01.2022.
17. Kajdański, E. (2005). *China. Lexicon* [*Chiny. Leksykon*]. Warszawa: Książka i Wiedza.
18. Kaliński, A. (2014). *Why does China need so much gold?* [*Po co Chinom tyle złota?*]. Retrieved from https://www.obserwatorfinansowy.pl/bez-kategorii/rotator/po-co-chinom-tyle-zlota/, 28.01.2022.
19. KKNews (2017a). *Accompanying with gold and silver all their lives* [一生与金银为伴 徒弟纷纷转行下海　古稀老人却依然坚守]. Retrieved from https://kknews.cc/culture/px98q98.html, 29.01.2022.
20. KKNews (2017b). *From the golden day to the lack of traffic in front of the door, what should traditional goldsmiths do to save themselves?* [从日进斗金到门前冷落车马稀，传统打金店该拿什么拯救自己？]. Retrieved from https://kknews.cc/news/pqayqv2.html, 30.01.2022.

21. KKNews (2016). *Goldsmiths: not only to practice handicraft skills, but also to practice breathing* [打金匠：不止要練手工技藝，還要練嘴上吹氣]. Retrieved from https://kknews.cc/other/2jkajz.html, 29.01.2022.
22. KKNews (2018). *The gold shop master teaches how to avoid being "eating by gold"* [打金铺老师傅教你如何避免被“吃金”]. Retrieved from https://kknews.cc/news/4onk3vq.html, 29.01.2022.
23. Knobloch, M. (1977). *Goldsmithing* [*Złotnictwo*]. Warszawa: WNT.
24. Künstler, M.J. (2007). *The history of Chinese culture* [*Dzieje kultury chińskiej*]. Warszawa: PWN.
25. Lin, G.L. (2018). *Three generations of metalworking! "The Craftsman's Soul" Goldsmiths record the temperature of the goldsmith's handwork* [林冠伶, 金工傳承三代！《匠人魂》打金篇紀錄金匠手作溫度]. Retrieved from https://www.upmedia.mg/news_info.php?SerialNo=45779, 29.01.2022.
26. Lu, Q., Gong, H., Guo, Q., Huang, X., Cai, J. (2021). Gemological Characteristic Difference between Colorless CVD Synthetic Diamonds and Natural Diamonds *Materials, Vol. 14, 6225*, doi: 10.3390/ma14206225.
27. Lu, T.J., Zhang, J., Lan, Y., Ma, Y., Chen, H., Ke, J., Wu, Z.L., Tang, M.M. (2015). Characterization of Tarnish Spots in Chinese High-Purity Gold Jewelry. *Gems and Gemology, Vol. 51, No. 4,* pp. 410-417.
28. Lu, X.Y. (2019). *Designing Jewelry with a Story – Interview with Wang Yueyao, Artistic Director of Wang Yueyao International Jewelry Co., Ltd.* [卢小云,设计有故事的珠宝——访王月要国际珠宝有限公司艺术总监王月要]. Retrieved from https://zhuanlan.zhihu.com/p/86298456, 20.01.2022.
29. Lucas, A., Chapin, M., Lin, M.Q., & Jia, X.D. (2015). The Chinese Soul in Contemporary Jewelry Design *Gems & Gemology*, *Vol. 51, No. 1*, pp. 18-30.
30. Ma, J.J. (2013). *40-year-old Mrs. He in Longdejing Community, Putian, famous for her gold-making craftsmanship* [马俊杰, 莆田龙德井社区 40岁何大姐打金工艺闻名街巷]. Retrieved from https://kknews.cc/other/899ej94.html, 28.01.2022.
31. Prodan, M. (1975). *Chinese art* [*Sztuka chińska*]. Warszawa: PWN.
32. Scarpari, M. (2008). *Ancient China. Art treasures* [*Starożytne Chiny. Skarby sztuki*]. Barcelona: Ediciones Folio S.A.
33. Shanghai Municipal People's Government (2020). *Hangzhou artisan still hammering away at ancient metal trade*. Retrieved from http://service.shanghai.gov.cn/sheninfo/featuredetail.aspx?Id=05d4159b-6cff-4313-a17b-c4d57fdbd0df, 21.03.2022.
34. The goldsmith [*Złotnik*]. In: PWN Polish Dictionary [*Słownik języka polskiego PWN*]. Retrieved from https://sjp.pwn.pl/szukaj/z%C5%82otnictwo.html, 27.01.2022.
35. *The Ministry of Finance explains the role of gold in Poland's currency reserves* [*Ministerstwo Finansów wyjaśnia rolę złota w rezerwach walutowych Polski*] (2021).

Retrieved from https://www.bankier.pl/wiadomosc/Ministerstwo-Finansow-wyjasnia-role-zlota-8050687.html, 21.04.2022.

36. THL (Tencent Holding Limited) (2021). *Encyclopedia of China's Jewelry and Jade Jewelry Featured Industrial Bases* [中国珠宝玉石首饰特色产业基地大全]. Retrieved from https://new.qq.com/omn/20210126/20210126A03SJP00.html, 29.01.2022.
37. WGC (2014). *China's gold market: progress and prospects*. World Gold Council.
38. WNP (2021). *The Chinese have record gold reserves* [Chińczycy mają rekordowe zapasy złota]. Retrieved from https://www.wnp.pl/hutnictwo/chinczycy-maja-rekordowe-zapasy-zlota,488460.html, 28.01.2022.
39. Xiang, Y. (2021). *Why are all Chinese jewelry stores surnamed Zhou?* [向远,中国珠宝店为什么都姓周]. Retrieved from https://www.pingwest.com/a/232225, 30.01.2022.
40. Yidu (2020). *Chinese jewelers under the epidemic did not follow the same path as Japanese businessmen* [疫情下的中國珠寶商，沒有走上當年日本商人的老路]. Retrieved from https://read01.com/OAjnAx4.html#.YfVE5erMI2w, 30.01.2022.
41. Yun Boutique (2017). *The Kingfisher Feather Jewelry of Ancient China*. Retrieved from https://www.yunboutique.com/blogs/divine-land-gemstone-compendium/112805125-the-kingfisher-feather-jewelry-of-ancient-china, 13.03.2022.
42. Yuncunzhai (2016). *Bai Jingyi – master of filigree inlay work* [白静宜——花丝镶嵌工美大师]. Retrieved from http://www.yuncunzhai.com/book/215114.jhtml, 30.01.2022.
43. Zhang, R., Pian, H.Y., Santosh, M., Zhang, S.T. (2015). The history and economics of gold mining in China. *Ore Geology Reviews, Vol. 65,* pp. 718-727, doi: 10.1016/ j.oregeorev.2014.03.004.
44. Zhou, D., Lu, T., Dai, H., Lv, J., Chen, S., Song, Z., Zhang, J. (2021). Study on the Microstructure and Spectra of Regrown Quartz Crystals from Chinese Jewelry Market. *Crystals, Vol. 11, 1145*, doi: 10.3390/cryst11091145.
45. *5000 lat sztuki chińskiej* (2014). Warszawa: Wydawnictwo Arkady Sp. z o.o.
46. 金. In: *Handian – Chinese Dictionary* [汉典]. Retrieved from https://www.zdic.net/zd/zx/jw/%E9%87%91, 27.01.2022.

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# PROBLEMS IN DECISION-MAKING BY YOUNG PEOPLE TO PARTICIPATE IN ENTREPRENEURIAL EDUCATION PROGRAMS

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**Purpose:** The main purpose of this work is to analyze the attitudes, intentions and actions of young people in relation to educational programs on entrepreneurship.
**Design/methodology/approach**: The survey of respondents was conducted through popular social networks in the region by filling out a questionnaire on the Internet. The sample group consisted of 179 people aged 17-35 years.
**Findings:** Young people who refused to take part in an educational program on entrepreneurship, as a rule, have no ideas or projects for business and are characterized by zero entrepreneurial activity. Respondents from this group, in comparison with others, have a poor understanding of the goals and objectives of startups, and are also less likely than others to choose an intensive training program. All this may indicate that the real reason for the refusal of young people to participate in paid training programs may be a lack of motivation and a clear understanding by respondents of their vision of themselves as an entrepreneur.
**Research limitations/implications**: The limitations of this study are related to the fact that the survey was of a regional nature for the target group of 17-35 years. In this regard, its results cannot be generalized. The results we have obtained provide a reasonable basis for further research on barriers to youth entrepreneurship.
**Practical implications:** The research results are qualitatively, analyzed feedback from young people on the problems of low entrepreneurial activity which can be used to develop government measures to stimulate the private sector. In addition, the results provide a reasonable basis for further research on the role and relationship of financial and educational barriers to youth entrepreneurship.
**Social implications:** The results of the research allow us to revise the measures of youth policy aimed at increasing entrepreneurial activity through the formation of sustainable behavioral entrepreneurial intentions.
**Originality/value:** This study is an independent and comprehensive analysis of the low activity of young people in educational programs in the field of entrepreneurship.

**Keywords:** Entrepreneurial education, youth entrepreneurship, start-up.

**Category of the paper:** Research paper.

## 1. Introduction

Due to the changing market environment nowadays, enterprises are forced to intensify the competition. Universities, which constantly have to adapt to the changing conditions on the educational services market, are in the same situation. Maintaining and improving the quality of education or even a competitive position on the market of higher education and, above all, gaining cooperation between universities and enterprises is a desirable feature for mutual benefit. The requirements of the modern market pose many new challenges for all its participants. One of such challenges is a thorough understanding of the needs and expectations of current and future entrepreneurs as consumers of educational services.

Young people play a unique role in the development of entrepreneurship, because they are characterized by high tolerance to entrepreneurial risk, they easily make the decision to open their own company, they quickly shape entrepreneurial intentions in the implementation of innovative projects. The constant development of technology, lifestyle changes, migrations and crises (social, economic, financial ones) mean that young entrepreneurs need new strategies and business models. Understanding the motives, expectations and attitudes of modern youth towards business will allow for the development of effective approaches to the implementation of entrepreneurial education as a sought-after service on the market.

One of the important elements of testing educational services in the marketplace and identifying consumer needs are free or contract free youth business education programs (e.g. Founders ConnectED, Modern Business Management, Open Company, MetLife LifeChanger etc.). Practical and theoretical knowledge gained during participation in such projects is useful in taking up various types of challenges, including those related to running your own business. Participation of young people in entrepreneurial education programs allows for obtaining such benefits as: readiness to take and risk assessment, adaptation to changing environmental conditions, ability to work in a team, perceiving opportunities and the ability to use them, drawing correct conclusions by associating facts, searching for and introducing innovative solutions, analysis of the situation.

The analysis of young people's attitudes and intentions towards entrepreneurship, as well as understanding the main barriers to starting their own business, allows to develop an effective strategy of involving young people in the entrepreneurial environment. One of the most important issues in this field is the question of how young people decide to participate in entrepreneurship education programs. The lack of a conceptual solution to this problem inhibits the effective creation of an entrepreneurial ecosystem, and consequently leads to low entrepreneurial activity among young people.

## 2. Literature background

Potential entrepreneurs often do not know the conditions that must be met to start a business. They also don't know what entrepreneurship is and what knowledge they need to be successful in business.

Entrepreneurship is an interdisciplinary issue, which in the literature on the subject is defined in various ways depending on the field of science. The multitude and variety of definitions, the lack of precisely defined research principles and theoretical concepts mean that it does not meet the criteria qualifying it to be a separate science. Nevertheless, entrepreneurship as a discipline uses the achievements of many sciences, such as economics, mathematics, management and sociology. As emphasized by A. Kurczewska, in the literature on the subject, there are three directions of defining entrepreneurship: the first is focused on the effects, the next one indicates entrepreneurial situations and processes, and the last one describes entrepreneurial skills (Kurczewska, 2013). Each of the faculties includes activities in which there are competences and skills allowing for the introduction of new solutions. Entrepreneurship can be defined as effective thinking, but also as independent decision making, which is often associated with risk.

The European Commission in 2006 (Recommendation..., 2006) and 2018 (Recommendation..., 2018) identified entrepreneurship as one of the eight key competences in the lifelong learning process. According to the recommendations of the Council of the European Union of 22 May 2018, competences in the field of entrepreneurship include the ability to use opportunities and ideas and transform them into value for other people. Entrepreneurship is based on creativity, critical thinking and problem-solving, taking initiative, persistence and the ability to act together to plan and manage projects of cultural, social or financial value (Recommendation..., 2018).

In 2016, at the request of the European Commission, the project "EntreComp: The Entrepreneurship Competence Framework" was implemented, which establishes a set of entrepreneurial competences for the needs of the education system (Bacigalupo et al., 2016). Within the EntreComp, entrepreneurship is defined as a transversal core competence and as "the ability to act upon opportunities and ideas and transform them into financial, cultural or social values for others".

According to EU documents, knowledge and understanding of project planning and management approaches, which embrace both processes and resources, are essential to mastering entrepreneurial competences. (Recommendation..., 2018)

The authors of the Polish literature on the subject indicate that the preparation, implementation and control of specific projects mean the use of development opportunities and the creation of innovative initiatives (Klimek, Klimek, 2010; Nowak, Musiał, 2005; Sobiecki, 2003). K. Kacuga interprets in his work from the point of view of management "a project is a planned scope of activities within a specified period of time to achieve the set goal (...)

a project is a problem for which a solution has been planned" (Kacuga, 2008, p. 13). The most important issue, however, is to plan its beginning and end, assuming an appropriate distribution of all planned activities in time, in order to create a unique result or product or service (Kowalik, Tsimayeu, 2022, p. 279).

Project is one of the leading components of entrepreneurship and effective project planning and management is one of the main skills that a successful entrepreneur must possess. Therefore, entrepreneurship education programs very often focus on transferring knowledge in the field of project management.

A well-designed entrepreneurial training is needed to advance the development of the youth in this regard. Many researchers emphasize that there is a need to provide aspiring entrepreneurs the necessary knowledge and skills for development of business start-up (Giacomin et al., 2010). Lee et al. (2005) state that starting a business without the necessary knowledge involves high risk, even when one has strong entrepreneurial intentions. Also, Rudawska (2019) confirms that education is one of the factors which is crucial for shaping future entrepreneur.

According to Linan (2007) the role of entrepreneurship education may be very relevant throughout the whole entrepreneurial process which leads to start-up. It acts upon different elements of that process. It helps to develop intention and its antecedents, to develop creativity and opportunity recognition skills, specific local knowledge, network contacts.

It has also been recognized that there are different kinds of entrepreneurship education seeking separate objectives. Linan (2007) classifies them into four categories depending on objectives: entrepreneurial awareness, start-up and continuing education and education for entrepreneurial dynamism. The purpose of the first category would be to increase the number of people having enough knowledge about small enterprises, self-employment and entrepreneurship, so that they consider that alternative as a rational and viable option. The second type would be focused on preparation to be the owner of small business, the third on improvement of existing entrepreneur's abilities. Education for entrepreneurial dynamism would try to promote dynamic entrepreneurial behaviours after the start-up phase.

The most common is «education for start-up», which is usually based on the elaboration of a business plan. Most courses and programmes concentrate on the business plan and could then be considered as «education for start-up». This category helps those individuals already having a high level of intention, and having identified a viable business opportunity, to take the specific steps to start their venture. However, there is a majority of people who have not even considered becoming entrepreneurs. This is especially true in some areas where entrepreneurial activity is lower and entrepreneurship is not a socially valued career option.

Many researchers emphasize the importance and necessity of entrepreneurial education (Valerio et al., 2014; Kew et al., 2009; Miller et al., 2009), pointing out that young people with entrepreneurial skills and competencies are more motivated and more successful at opening new business.

## 3. Methodology

The research was based on the results of a survey conducted in the form of a questionnaire among people aged 17 to 35 years. The research was nonexperimental and was conducted in 2019 as part of the preparatory activities of the business education program "Gorki Startup Jump". In 2019, 10751 people of this age group lived in the place of the survey (Gorki district, Mogilev region), which was 23.53% of the total population of the region (NSC, 2020). The survey sample of the study was 204 people (0.45% of the total population of the region), which was a sufficient size for a regional study (Kramer, 1994).

The aim of the research was to the evaluate respondents' attitude, intentions and barriers to become an entrepreneur in the future. A special role in the research was assigned to the problems of entrepreneurial activity among young people. A questionnaire containing 19 questions, including 15 closed and 4 open questions, was used as the main tool for collecting information. The questionnaire had 14 main questions related to various aspects of business activity and 5 questions related to the demographic profile of the respondents. The main 14 questions of the questionnaire can be divided into three parts: (1) Entrepreneurship: "attitude-intention-entrepreneurial activity", (2) Barriers to entrepreneurship, (3) Business education program. The results presented in the article relate to the third part of the questionnaire. The first and second parts were investigated earlier (Bilewicz, Tsimayeu, 2021). At the same time, in these studies we also present the results of the analysis of the relationships between all parts of the questionnaire. This allowed us to get more information about possible problems of entrepreneurial activity of young people.

The survey of respondents was conducted through popular social networks in the region (Vkontakte, Instagram, Facebook) by filling out a questionnaire on the Internet. The research was anonymous in order to guarantee the sincerity of the answers. The actual survey sample of 204 respondents was formed from representatives of the target group aged 17-35 years who accepted the invitation to participate in the survey. Only 179 out of 204 questionnaires were selected for the research (response rate – 87.74%). The remaining 25 questionnaires were excluded due to incomplete or incorrect completion of the questionnaires.

Statistical processing and analysis of the information received from the respondents was carried out in SPSS Statistics. To measure the level of reliability and internal consistency of the survey questionnaire, the Cronbach's alpha coefficient was used, which is 0.66. This is a satisfactory value of Cronbach's alpha when evaluating the psychometric properties of surveys related to the measurement of respondents ' motives, attitudes, and intentions in the future ($\alpha > 0.60$).

## 4. Empirical Results

The analysis of the demographic profile of the respondents showed that the majority of them were women – 66.5% (Table 1). Our study sample was divided into three age groups (between 17-24, between 25-30 and between 31-35 years old). The age composition was distributed with a preponderance towards the youngest group of 17-24 years old – 86.6%.

**Table 1.**
*Demographics (N = 179)*

| Indicators | Structure, % | |
|---|---|---|
| Gender | Male | 33.5 |
| | Female | 66.5 |
| Age | 17-24 | 86.6 |
| | 25-30 | 11.2 |
| | 31-35 | 2.2 |

Note. Own study.

The analysis of the results of the youth survey showed that the main barrier to their development as entrepreneurs is the lack of financial resources. At the same time, 62.1% of respondents noted a lack of entrepreneurial knowledge (analysis of potential consumers and markets, evaluation of the effectiveness of business projects) (Bilewicz, Tsimayeu, 2021). This may indicate that the foundation of the barrier associated with a lack of finance may partly lie in the area of entrepreneurial literacy and business education, which could provide young people with knowledge about preparing high-quality business projects for investors or banks.

An analysis of the answers to the question about readiness to take part in an educational project to develop your business idea under the guidance of an experienced expert showed that most of the respondents (114 people, 63.6%) want to participate and undergo such training. Almost a third of respondents were undecided with the answer (29.1%). This may indicate that these respondents have never thought about the possibility of their participation in such programs before. The number of respondents who refused to participate in the educational project was 7.3% (Table 2).

A distinctive feature of the research is that in the questionnaire, young people were asked not only to confirm their desire to participate in a business education program, but also to indicate their intentions to invest their time and money in such an education format. An analysis of the responses received shows that the most intensive training program (3 times a week for 1.5 hours) was supported by only 15.6% of respondents who would like to be trained.

To assess the respondents' intentions to invest their money in the development of their own business, young people were asked about their willingness to pay for education. The results of the responses show that only 36.8% of respondents who want to take part in an educational program are ready to pay for it. The remaining answers indicate that the majority of young people (43.9%) have doubts about making a decision. At the same time, 19.3% of respondents categorically refused to pay for participation in business education programs.

**Table 2.**
*Business education program*

| Questions | Structure, % | |
|---|---|---|
| Would you like to take part in an educational program to develop your business idea under the guidance of an expert? (N = 179) | Yes | 63.6 |
| | No | 7.3 |
| | Doubt | 29.1 |
| How much time are you willing to devote to studying under the program? (N = 114) | 3 or more times a week for 1.5 hours | 15.6 |
| | 2 times a week for 1.5 hours | 31.8 |
| | 1 time a week for 3 hours | 14.5 |
| | No answer | 1.7 |
| Are you willing to pay for entrepreneurial training? (N = 114) | Yes | 36.8 |
| | No | 19.3 |
| | Doubt | 43.9 |

Note. Own study.

It should be noted that the issue with the payment of the educational program was of the nature of a hypothetical event and did not have a specific amount. In this regard, the respondents' unwillingness to pay or doubts about this issue may be due not only to the respondents' lack of money, but also to the lack of motivation for young people to study and not willingness to invest even an insignificant amount for themselves.

For a more detailed study of the characteristics of groups of young people who have different attitudes to payment, we conducted an additional analysis of them (Table 3).

**Ready to pay for training (36.8%)**. Among the people who have confirmed their willingness to invest in their education, most often you can meet women aged 25-30 years who already have their own idea or project for business and have received special training related to entrepreneurship. As the main barrier to starting a business in a group, the most common answer is lack of knowledge. Representatives of this group more often than other groups choose the most intensive training program (4.5 hours per week).

**Not ready to pay for training (19.3%).** In the group of respondents who categorically refused to pay for participation in the educational program, most often you can meet men aged 25-30 years who do not have their own ideas or projects for business and have not yet done anything to become an entrepreneur. As the main barrier to starting a business in a group, the most common answer is lack of knowledge. This group contains the smallest number of supporters of the most intensive training program (4.5 hours per week) and the smallest number of respondents who correctly answered the question "What is a startup?".

**Could not give an exact answer (43.9%).** The largest group were respondents who could not give an unambiguous answer and doubt the readiness of paid participation in the business education program (43.9%). In this group, representatives of the oldest (31-35 years old) and youngest (17-24 years old) age groups can be found more often than others. With the highest probability in this group we will meet people who have already tried themselves as an entrepreneur. This is the only group in which you can meet respondents who have no barriers to starting a business. At the same time, in this group it is equally possible to meet young people who, as the main barrier to starting a business, indicated all the reasons at the same time (lack

of knowledge, finances and time). This group contains the largest number of respondents who correctly answered the question "What is a startup?".

**Table 3.**
*Respondents' willingness to pay for training and their entrepreneurial activity (N = 114)*

| Questions and Indicators | Answer options | Structure, % | | | |
|---|---|---|---|---|---|
| | | Are you willing to pay for entrepreneurial training? | | | Total |
| | | Yes | No | Doubt | |
| Gender | Male | 33.33 | 25.64 | 41.03 | 100 |
| | Female | 38.67 | 16.00 | 45.33 | 100 |
| Age | 17-24 | 36.73 | 18.37 | 44.90 | 100 |
| | 25-30 | 42.86 | 28.57 | 28.57 | 100 |
| | 31-35 | – | – | 100.0 | 100 |
| Do you have any ideas or projects that you would like to implement in business? | I do not have | 21.62 | 27.03 | 51.35 | 100 |
| | I have | 26.32 | 15.79 | 57.89 | 100 |
| | In development | 50.00 | 15.52 | 34.48 | 100 |
| What actions did you take to become an entrepreneur and grow your business? | Not undertaken | 30.51 | 22.03 | 47.46 | 100 |
| | Taken | 40.00 | – | 60.00 | 100 |
| | Training undertaken | 43.75 | 18.75 | 37.5 | 100 |
| What are the reasons that prevent you from developing your business idea and building your business? | Lack of knowledge | 38.98 | 20.34 | 40.68 | 100 |
| | No finances | 34.09 | 19.32 | 46.59 | 100 |
| | No time | 37.78 | 22.22 | 40.0 | 100 |
| | No barriers | – | – | 100.0 | 100 |
| What is a startup? | Correct answer | 33.33 | 21.33 | 45.33 | 100 |
| How much time are you willing to devote to learning in an educational program? | Most intensive program (4.5 h/week) | 46.43 | 25.00 | 28.57 | 100 |

Note. Own study.

## 5. Discussion and Conclusions

As a result of our research, we found that the group of respondents who refused to pay for training is characterized by a lack of ideas or projects for business and zero entrepreneurial activity. Respondents in this group, compared with others, have a poor understanding of the goals and objectives of startups, and also less often than others choose an intensive training program (4.5 hours per week) as part of a business education program. All this may indicate that the real reason for refusing to pay may be the lack of motivation and a clear understanding of the respondents' vision of themselves as an entrepreneur.

The results obtained by us confirm the existing studies of other authors who claim that entrepreneurial intentions do not always turn into actions (Ozaralli and Rivenburgh, 2016; Veciana et al., 2005; Franco et al., 2010; Zwan et al., 2010; Shirokova et al., 2015).

This reflects the presence of barriers that could not be overcome (Lalit Sharma, 2018) (Krueger, 2008). Research tends to indicate that barriers explain a significant percentage of the variance in behaviour (Lien et al., 2002). Strength of perceived barriers is known to negatively

impact the entrepreneurial intentions of students (Pruett et al., 2009). Researches have also found that perceived barriers negatively influence the entrepreneurial attitude and entrepreneurial intentions of students (Malebana, 2015; Kebaili et al., 2017).

According to Linan (2007) the entrepreneurial process could be considered as made up of three essential elements: individuals having the intention to become an entrepreneur; the environment in which they are embedded; and the opportunity upon which the venture will be based. Only an adequate combination of these three elements may lead to a potentially successful business-creation attempt.

The results obtained by us correlate with the results obtained by the Global Entrepreneurship Monitor – 2021 (GEM, 2022). Data analysis shows that the high prestige of an entrepreneurial career of 54.7% (Entrepreneurship as a Good Career Choice Rate) in Poland is accompanied by the presence of a population with a sufficiently high level of knowledge and opportunities to organize their business 60.13% (Perceived Capabilities Rate) and 72.54% (Perceived Opportunities Rate). At the same time, only 2.85% (Entrepreneurial Intentions Rate) of respondents in Poland aged 18-64 years intend to open their own business within the next 3 years.

In addition to the lack of motivation, the reason why people do not plan to become entrepreneurs is the fear of failure, which is 43.48% in Poland (Fear of Failure Rate) (GEM, 2022). In our study, this may apply to 43.9% of respondents who do not have an unambiguous answer related to participation in a paid educational program. In addition, the fear of failure is highly likely to affect 60% of respondents who have already tried themselves as an entrepreneur, but could not confirm their participation in a paid educational program.

The results obtained cannot completely exclude the influence of a financial barrier in making a decision to participate in a paid educational program. At the same time, previous studies conducted among these respondents (Bilewicz, Tsimayeu, 2021), as well as the results obtained by us (27.03% of respondents who have no ideas and 22.03% who have not done anything before to become entrepreneurs refused to take part in a paid training program), suggest that young entrepreneurs often overestimate the lack of finance as a serious limitation and underestimate other factors, such as personal business skills and training. At the same time, the experience of young people who have realized themselves as entrepreneurs shows that they were able to achieve a modest start with the help of their own savings and the help of their loved ones. External financing was crucial for them only when it came to growing and maintaining their business (Kew et al., 2013).

The obtained results create prerequisites for further research, which provide for a deep factor analysis of the main barriers to youth entrepreneurship through the prism of education. As for the recommendations and policy implications, it can be stated that in order to increase the level of entrepreneurial activity among young people, the most effective will be the implementation of measures aimed not only at obtaining new knowledge in the field of business education, but also at the formation of sustainable behavioral entrepreneurial intentions.

The limitations of this study are related to the fact that the survey is of a regional nature and was conducted among a group of 17-35 years old. Therefore, its results cannot be generalized to other territories and age groups. Despite the regional nature of the studies conducted, as well as the existing limitations, their results can be used to continue similar studies in order to identify patterns and trends of entrepreneurial activity.

## References


1. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50(2),* 179-211.
2. Bacigalupo, M., Kampylis, P., Punie, Y., Van Den Brande, L. (2016). *EntreComp: The Entrepre-neurship Competence Framework.* EUR 27939 EN. Luxembourg (Luxembourg): Publications Office of the European Union.
3. Bilewicz, E., Tsimayeu, A. (2021). Intentions and Barriers of Youth Entrepreneurship in Belarus, *European Research Studies Journal, Vol. XXIV, Iss. 2B,* 956-966.
4. Franco, M., Haase, H., Lautenschlager, A. (2010). Students' entrepreneurial intentions: an inter-regional comparison. *Education and Training*, *52(4),* 260-275.
5. GEM (Global Entrepreneurship Monitor) (2022). *Global Entrepreneurship Monitor 2021/2022 Global Report: Opportunity Amid Disruption*. London: GEM.
6. Giacomin, O., Janssen, F., Pruett, M., Shinnar, R., Llopis, F., Toney, B. (2011). Entrepreneurial Intentions, Motivations and Barriers: Differences Among American, Asian and European Students. *International Entrepreneurship and Management Journal, 7.* 219-238.
7. Kacuga, K. (2008). *Projekt – od pomysłu do realizacji*. Warszawa: Fundacja Edukacja dla Demokracji, p. 13.
8. Kew, J., Herrington, M., Litovsky, Y., Gale, H. (2013) *Generation Entrepreneur? The State of Global Youth Entrepreneurship*. Global Entrepreneurship Monitor (GEM), Youth Business International (YBI).
9. Klimek, J., Klimek, S. (2010). *Przedsiębiorczość bez tajemnic*. Toruń: Wydawnictwo Adam Marszałek.
10. Kowalik, J., Tsimayeu, A. (2022). The role of educational projects in building an ecosystem of University startups. *Scientific papers of Silesian University of Technology, Organization and Management series, no. 156,* p. 279.
11. Kramer, J. (Ed.) (1994). *Badania Rynkowe i Marketingowe* (Market and Marketing Research). Warszawa: PWE.
12. Krueger, N.F. (2008). *Entrepreneurial Resilience: Real & Perceived Barriers to Implementing Entrepreneurial Intentions*. https://ssrn.com/abstract=1155269, 28.08.2022.

13. Kurczewska, A. (2013). *Przedsiębiorczość*. Warszawa: PWE.
14. Lee, S.M., Chang, D., Lim, S.B. (2005). Impact of entrepreneurship education: A comparative study of the U.S. and Korea. *International Entrepreneurship and Management Journal*, *1(1),* 27-43.
15. Linan, F. (2007). The Role of Entrepreneurship Education in the Entrepreneurial Process. Chapters. In: A. Fayolle (ed.), *Handbook of Research in Entrepreneurship Education*, *Vol. 1, chapter 13.* Edward Elgar Publishing.
16. Miller, B., Bell, J., Palmer, M., Gonzalez, A. (2009). Predictors of entrepreneurial intentions: a quasi-experiment comparing students enrolled in introductory management and entrepreneurship classes. *Journal of Business and Entrepreneurship*, *Vol. 21, No. 2,* pp. 39- 62.
17. National Statistical Committee of the Republic of Belarus (2020). Gender and age structure of the average annual population in the Republic of Belarus 2019. *Statistical Bulletin, 26.* Minsk.
18. Nowak, M., Musiał, H. (2005). Rola i znaczenie przedsiębiorczości w rozwoju przedsięwzięć gospodarczych. In: D. Kopycińska (ed.), *Teoretyczne aspekty gospodarowania*. Szczecin: Katedra Mikroekonomii US.
19. Ozaralli, N., Rivenburgh, N.K. (2016). Entrepreneurial Intention: Antecedents to Entrepreneurial Behaviour in the USA and Turkey. *Journal of Global Entrepreneurship Research*, *6(3).*
20. Recommendation (2006). *Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning* (2006/962/EC).
21. Recommendation (2018). *Council Recommendation of 22 May 2018 on key competences for lifelong learning* (Text with EEA relevance) (2018/C 189/01).
22. Rudawska (2020). What Drives Youth to Become Entrepreneurs? An Empirical Examination. *European Research Studies Journal, Vol. XXIII, Special Iss. 1,* 614-627.
23. Sharma, L. (2018). Entrepreneurial intentions and perceived barriers to entrepreneurship among youth in Uttarakhand state of India A cross-cultural investigation across genders. *International Journal of Gender and Entrepreneurship, Vol. 10, No. 3.* Emerald Publishing Limited.
24. Shirokova, Osiyevskyy, Bogatyreva (2016). Exploring the intention–behavior link in student entrepreneurship: Moderating effects of individual and environmental characteristics. *European Management Journal*, *vol 34, iss. 4, August*.
25. Sobiecki, R. (ed.) (2003). *Podstawy przedsiębiorczości w pytaniach i odpowiedziach*. Warszawa: Difin.
26. Valerio, A., Parton, B., Robb, A. (2014). *Entrepreneurship Education and Training Programs around the World.* Washington DC: The World Bank.

27. Van der Zwan, P., Thurik, R., Grilo, I. (2010). The entrepreneurial ladder and its determinants. *Applied Economics*, *42(17),* 2183-2191.
28. Veciana, J., Aponte, M., Urbano, D. (2005). University Students' Attitudes Towards Entrepreneurship: A Two Countries Comparison. *International Entrepreneurship and Management Journal*, *1,* 165-182.

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# CONFLICT MANAGEMENT AND LEADERSHIP STYLES. COMPARATIVE CASE STUDY WITH FUTURE LEADERS

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**Purpose:** The purpose of this study is to examine the relationship between the leadership styles and how economics and manager students vote to manage conflicts within their relationships and with other entities.
**Design/methodology/approach**: an exhaustive review of the literature on leadership decision-making and conflict management has been carried out, focusing on trust, conflict management theories, models that have distinct influence in conflict management. In addition, a study of conflict management has been carried out in Óbuda University and in Pontifical University of Salamanca.
**Findings:** In the course of work of the study was found the identified comparison of the most striking conflict management styles, that explain how students manage conflicts.
**Originality/value:** The questions answered by future leaders provides that the paper is able to mediate new mark. The value of the paper that it reflects the direct answers of future leaders in 2022 and it is addressed to university students, teachers, leaders, for employers and employees, both in the private sector and in the public sector.

**Keywords:** conflict, conflict management, leadership styles, alternative dispute resolution, litigation.

**Category of the paper:** Research paper.

## 1. Introduction

Human beings are above all social beings that relate to each other, forming different types of groups to carry out multiple activities. Business organizations are not exempt from this type of relationship; moreover, it is usual for individuals in this type of entity to organize themselves hierarchically in such a way that some interrelate with others through leadership mechanisms, therefore, it is important that leaders develop an adequate role in the resolution of conflicts that are generated in organizations (Khanaki-Hassenzade, 2010).

Furthermore, globalization has made decision-making and conflict resolution increasingly complex as new causes and types of conflicts have emerged (Jehn, 2000; Matthew, 2009; Kahai, 2004). The role of leadership, in order to resolve conflicts should have a series of mechanisms that help establish what type of relationship exists between the leader and the subordinates (Saeed et al., 2014). In most cases, in companies these leadership mechanisms are usually established precisely by leaders in the way they relate to their subordinates.

## 2. Literature review. Hypothesis of the paper

### 2.1. Leadership style as basis of conflict management

Many business executives often find themselves in need of conflict resolution within their own organizations and between organizations, and they must use all their leadership skills to do so.

We can define leadership as the process of influencing and motivating a group of people towards a common goal (Galinsky et al., 2008). I also understand that the first responsibility of the leader is to define reality and the last is to thank his subordinates for the tasks carried out. Between these two stages the leader has to play a double role of serving and demanding (DePree, 2004).

In any organization, the presence of emotional tensions and conflicts of all kinds is common, and it is here that they can help them release tensions, harmonize misunderstandings and deal with disruptive behaviors (Fisher, 2000).

However, the style with which conflicts are managed has been and continues to be measured using different classifications. One of the first conceptual outlines to classify conflict management started from the idea that conflicts must be identified and managed fairly and sensibly, for this, those who have to find solutions to conflicts must enjoy skills such as Communication, being oriented to problem solving and negotiation skills, is therefore a simple dichotomy of cooperation-competition (Deutsch, 1949).

For many scholars this dichotomy is too simplistic to reflect the complexity of individual perceptions of conflict behavior (Ruble, 1976; Smith, 1987) and this led to the development of a more applied style classification (Blake, 1964).

Although many researchers have proposed numerous classifications, for example, it has been argued that individuals select between three or four conflict styles (Pruitt, 1983; Putnam et al., 1982); the most accepted one has been the conceptualization of (Rahim, 1979). These authors differentiate the styles of interpersonal conflict resolution in two basic dimensions: caring a lot about themselves and caring about others. We can say that while the first dimension explains the degree to which a person tries to solve his own problems,

the second dimension tells us to what extent the individual also tries to solve the problems of others.

As a result of the combination of these two dimensions, five specific styles of conflict management emerge: 1) The integrating style in conflict resolution is characterized because the individual focuses his leadership in solving the problems of oneself and others, 2) the leadership style in avoiding conflict resolution corresponds to that individual who shows a low concern for solving the problems of himself and others, 3) the obliging style implies a low involvement on the part of the leader in solving his problems, but nevertheless with a high concern for the problems of others, 4) the dominating conflict resolution leadership style is characterized by a high concern for the problems of himself and a low concern for the problems of others, and 5) the leadership style compromising in the conflicts are associated with an intermediate involvement. both in solving his own problems and those of others.

As this is the classification accepted as suitable by the academic community, it is the one we have used in the conduct of our study.

Many studies have focused on analyzing the factors that determine the leadership style adopted. In this sense (Rahim, 1983; Rubin, 1985), suggest that women have a more cooperative orientation towards conflict management than men, other studies show that women are more competitive (Bedell, 1973; Bem, 1974) while some authors consider that the difference in conflict management is not so much in the sex of the individual as in the role of gender played (Bem, 1974; Bem et al., 1976; Spence et al, 1978), of In this way, they maintain that the differences in conflict management do not affect the behavior of men and women by their sex in itself, but by learned behavior patterns with masculine and feminine characteristics (Cook, 1985).

Psychological studies show us that men and women tend to carry out conflict management strategies according to their gender role (Wachter, 1999).

Furthermore, many academics maintain from their studies that men tend to be more conflictive (Rosenthal et al., 1988), aggressive (Kilmann-Thomas, 1977) and competitive (Rubin-Brown, 1975), while women seek consensus (Greeff et al., 2000). Although, on the other hand, other research suggests that men avoid conflict mediation more than women (Greeff, 2000) and when a woman avoids them it has more to do with power differences than with her gender (Korabik et al., 1993; Randel, 2002; Watson, 1996). The reason may be that many men experience anxiety in social settings, and this may explain why men are more likely to avoid conflict intervention than women (Heavey et al., 1993).

So it can be said that in general there is a consistent agreement in the literature on gender differences in the style of managing conflicts, we can cite in this sense to other major works regarding whether women prefer compromising styles (Holt et al., 2005), easy-going or avoidant (Cardona, 1995).

The question that arises next is whether there are other demographic variables that influence the way conflict is managed, and in this sense we can affirm that if based on, for example, the research that was carried out to determine if demographic characteristics affect organizational conflict where 5 questions were asked to collect information on the sex, marital status, income, education and work experience of the participants (Korkmaz et al., 2015).

The importance of the age of leaders in taking into account the leadership style and the conflict resolution model is highlighted in the research (Uzonwanne, 2016), which shows how leadership patterns are changing, even existing intergenerational collisions.

### 2.2. Conflicts

Conflict and conflict management is a key element in leadership analysis. The concept of conflict from a management point of view does not have a unique meaning (Coser, 1956; Dahrendorf, 1959; Pondy 1963; Fink, 1968), however Rahim (1983) considers conflict as an interactive process that becomes manifested in the incompatibility, disagreement or dissonance that occurs within or between social entities or individuals, deepening the disagreement (Marquis et al., 1996) that establish that the conflict arises from the difference of ideas, values or feelings between two or more people.

The conflict can also be considered as a collapse in the usual decision-making mechanisms, which causes the individual or group to have the need to look for new ways of looking for solutions (Rahim, 2010).

Logically, every organization is going to try that the conflict does not occur and in the event that it arises, it will solve it due to the negative consequences that it will have, therefore it will be sought that in any organization that there is stability and harmony between the individuals that they form it (Nadler et al., 1999).

But unfortunately conflict is a widespread phenomenon in all social spheres, thus (Landau et al., 2001) states that conflict has always existed in human relationships and that it will probably always exist, in fact, people who never experience conflict in their lives are because they live in fiction or confined or isolated from the rest of the world.

Once the existence of conflict in any human relationship is confirmed, it is important to know the inconveniences that it generates in organizations (Seval, 2006): It causes delays in decision-making, divergences in the objectives of the organizations, high staff turnover, reduces worker motivation, excessive energy consumption that limits the ability to achieve goals and reduces the efficiency of the organization.

In the search for a solution to a conflict, companies can resort to judicial procedures, but this has clear disadvantages for them, since in judicial litigation the parties lose control of the process that comes to be in the hands of the lawyers and the judiciary Furthermore, this conflict resolution procedure can take years.

Therefore, alternative dispute resolution methods have become increasingly used instruments for conflict resolution and can be classified as mediation, conciliation, negotiation and arbitration (Lieberman, 1986).

While in judicial cases the court has absolute jurisdiction to resolve the conflict and enforce the decision in compliance with those strictly established by law, in alternative dispute resolution methods the parties may take into account many other aspects such as their interests commercials (Bercovitch et al., 2001).

### 2.3. Leadership style and conflict resolution

Leaders in organizations must manage human resources and conflicts (Smith et al, 2003), their role is very important since employees are often attentive to the leadership style used in conflict management (Ekvall, 1996).

The Integrating style in management conflicts seeks the exchange of information and examines the differences to arrive at an effective solution acceptable to both parties. When leaders use an integrative style, they care as much about themselves as about others and solve problems (Rahim, 2010). Leaders who use an integrative style ensure that there are fewer disputes and that conflicts are short-lived in organizations. (Rahim et al., 1990).

The obliging style seeks to minimize differences and maximize commonalities to satisfy the concerns of the other party. It is a very suitable system when it is very difficult to find meeting points, but still the leader must make a decision. Like the integration style, it is a cooperative style, but it differs from this in that it is indirect and passive (Blake et al., 1964).

The dominating style is characterized in that leaders are more concerned with their own interests than the interests of the other party, it is very uncooperative. Managers who adopt this style tend to be ineffective in achieving their objective and tend to treat their subordinates inappropriately, which often leads to conflicts and is unlikely to comply with management directives (Rahim et al., 1990).

The style of avoiding is associated with situations of withdrawal or evasion, leaders who adopt this style for conflict management are not usually concerned with themselves or with others, it is a non-cooperative and indirect style. This style has also been called non-confrontation, inaction, or withdrawal, and is often inappropriate and ineffective. The compromising style is based on what you have to give to receive, which is why it starts from the principle that in all conflict situations both parties have to give in something to reach a solution acceptable to all. Available research on this style of conflict management tells us that it is a style that is perceived by organizations as moderately appropriate and effective (Gross et al., 2000).

### 2.4. Hyphotesis formulation

In this paper qunatitative methods will be used during testing hypotheses. The empirical study gave an opportunity to find the answer for the hypothesis.

The hypothesis is:

H0: There is no relationship between the conflict management style and choice of alternative dispute resolution.

H1: There is a relationship between the conflict management style and choice of alternative dispute resolution.

## 3. Data collection and methodology

On trust, McKnight (1996) and Rousseau et al., (1998) stated that it can support conflict management and provide a picture of the general state of society and can influence individuals — individuals, legal entities, communities, states, countries, nations — including. Mediation, mediation, and alternative dispute resolution (ADR) as one of the options for resolving and resolving conflict also serve to restore trust that has typically broken down in a conflict situation.

The topic of trust has been an issue for many since the global financial crisis erupted, and the level of trust in organizations and companies remains low. Having trust in an organization brings significant benefits and advantages to both the organization and the employees. Studies show both direct and indirect benefits, such as better performance, reduced costs, and increased social behavior. There is a direct link between trust and the efficiency and performance of organizations. Many believe that trust indirectly improves an organization's performance by fostering desirable workplace behavior and creating a more conducive atmosphere to improve collaborative organizational performance. In addition, trust contributes to increased knowledge sharing and innovation, discretionary behavior, and greater motivation and a positive attitude. Research shows that employees with a high level of organizational trust put more effort into their work as well as collaborate with others. In contrast, those with low levels of organizational trust are less effective or leave the company. Thus, trust can be linked to positive workplace behavior that supports the achievement of the organization's goals. This is clearly related to the central idea of human resource management, which emphasizes the facilitation of positive and desirable behavior for the organization, which contributes to the achievement of corporate goals, results in employee engagement and better performance. Today, organizations where lack of trust can be detected cannot remain competitive in the marketplace (Csókás, 2019).

The responses of 135 persons show that more people choose to settle amicably than to settle litigation. 57 answers were collected in Óbuda University Budapest and 78 answers were collected in Salamanca University from students during alternative dispute resolution lecture. According to the Thomas-Kilmann conflict model (1974) Figure 1 presents the dispersion of the collected answers. For the avoiding type (A), the answer "I always choose out-of-court settlement" is nine times the answer "Decide the court". Four and a half time of the answers „I always choose the out of court settlement" in case of accomodating (Ac) persons versus „go to court" answers, and more than four times as many of the problem-solving (P) persons would settle their conflict out of court as they would through litigation. The compromising (C) would sue 5 of the 18 main respondents and 13 would not, and more than 3 and a half times more of the competitive (Co) would settle a dispute out of court than they would sue. In total, 109 main respondents would be out of court, while 26 main respondents would settle their conflict in court in 2022.

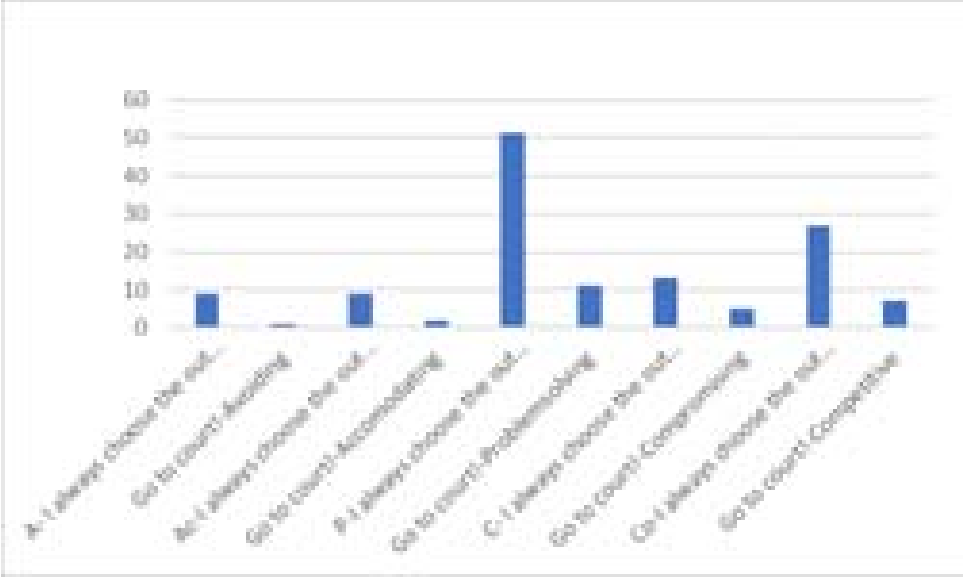


**Figure 1.** Conflict resolution decisions based on the Thomas-Kilmann model - Question: In a conflict, in a disputed situation: a.) I always choose out-of-court settlement, b.) Decide the court - own editing, 2022.

As shown in Figures 2 and 3, after responding from the types of conflict management according to the Thomas-Kilmann model, it can be demonstrated that most respondents belong to the problem-solving type and have the second highest rate of out-of-court alternative dispute resolution. Avoidance-type conflict resolution has the highest rate of out-of-court alternative dispute resolution. Considering only the answers of Hungarian students, most of the respondents belong to the problem-solving type of conflict management and the possibility of out-of-court alternative dispute resolution has the highest rate. Internationally, problem-solving conflict management is also in a leading position. Hypothesis H1 can be confirmed by the empirical part of my paper: there is a relationship between the conflict management style and choice of alternative dispute resolution.

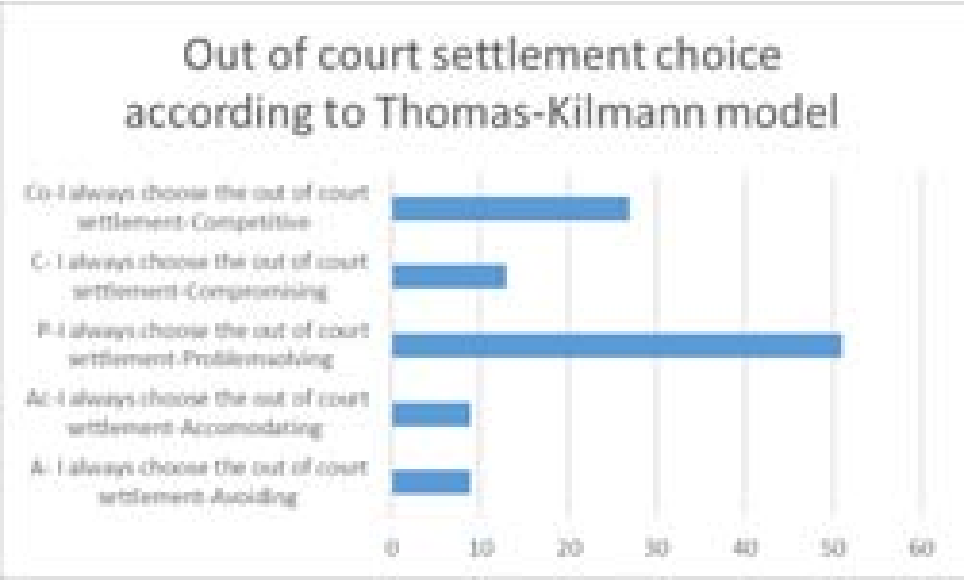


**Figure 2.** Conflict resolution decisions based on the Thomas-Kilmann model - Question: In a conflict, in a disputed situation: a.) I always choose out-of-court settlement, own editing, 2022.


**Figure 3:** Conflict resolution decisions based on the Thomas-Kilmann model - Question: In a conflict, in a disputed situation: a.) I always choose out-of-court settlement - own editing, 2022.

## 4. Results

Both internal and external measurable trust affects an organization's financial performance. By internal trust, I mean the level of trust that employees have in each other and in the leaders of the organization. External trust is the trust that customers, partners, vendors, and investors have in a brand. Trust is made up of several factors.

The first component is competence; the belief that an organization is capable of delivering what it says. It is able to sustain itself and compete in the market. The second component is integrity; belief that the organization is fair and equitable. The third component is reliability; the belief that the organization keeps its promise and acts consistently. Trust is a dynamic process, so your measurements need to be done consistently, and not just through simple processes. It affects everything from cognitive and emotional perceptions to the intellectual level (Csókás, 2019).

The mediation process is preceded by one or more conflicts. In the conflict, in addition to the conflict of interests, trust between individuals has been lost, without which it is difficult to reach an agreement. Trust is needed to sign a contract. The goal and slogan "to trust the other party to perform the contract, to follow it voluntarily" often sounds unusual, surprising, unexpected at first for people in conflict who are just starting the mediation process. And this is one of the essential elements of the process - the mediation procedure seeks to build up the lost trust or to strengthen and transform it by concluding an agreement. Figure 4 summarizes this process. It is emphasized that conflicts of interest often stem from their inappropriate expression, and one party does not understand what the other party's needs or interests really are.

## 5. Conclusion

Where trust characterizes the organizational system, individuals perform better in that organization. Internal trust builds, strengthens, trust works back and forth, as does the opposite of trust, with distrust — of course, the opposite consequences. In a conflict situation, the organization and its leader can decide which path to take. Alternative dispute resolution, settlement, a realistic option for the existence or restorability of trust in the event of a conflict between persons. The number of legal disputes and lawsuits may decrease if trust is present in the organizational system and dispute-based dispute resolution is in place.

## References

1. Akerlof, G., Kranton R.E. (2000). Economics and Identity. *The Quarterly Journal of Economics, Vol. 115, Iss. 3,* 715.
2. Balázs L. (2013). Konfliktuskezelés és szervezeti magatartás az iskolában. In: L.-H. Balázs, G. Varga (eds.), *A hatékony kommunikáció. A kommunikáció oktatása 5*. Hungarovox Kiadó, Budapest.

3. Bedell, J, Sistrunk, F. (1973). Power, opportunity costs, and sex in a mixed-motive game. *Journal of Personality and Social Psychology, 25(2),* 219-226. https://doi.org/10.1037/h0033947.
4. Bem, D. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42,* 155-162.
5. Bem, S.L., Lenney, E. (1976). Sex-typing and the avoidance of psychological androgyny. *Journal of Personality and Social Psychology, 31,* 634-643.
6. Bercovitch, J., Jackson, R. (2001). Negotiation or Mediation? An Exploration of Factors Affecting the Choice of Conflict Management in International Conflict. *Negotiation Journal, 17(1),* 59-77.
7. Blake, R.R., Mouton, J.S. (1964). *The Managerial Grid*. Houston: Gulf.
8. Bloom, N., Sadun, R., Reenen, J. (2012). The Organization of Firms Across Countries. *The Quarterly Journal of Economics, Vol. 127, Iss. 4,* 1663.
9. Boies, K., Fiset, J., Gill, J. (2015). Communication and trust are key: Unlocking the relationship between leadership and team performance and creativity. *The Leadership Quarterly, 26,* 1080-1094.
10. Cardona, F. (1995). A comparative study of the styles of handling interpersonal conflict among students, faculty, and administrators. PhD dissertation. East Lansing, MI: Michigan State University.
11. Cook, E.P. (1985). *Psychological androgyny*. New York: Pergamon Press.
12. Coser, L.A. (1956). *The functions of social conflict*. New York: Free Press.
13. Csókás, L. (2019). A HR szerepe a szervezeti bizalom építésében, a Selye János Egyetem.
14. Dahrendorf, R. (1959). *Class and Class Conflict in Industrial Society*. Stanford: Stanford University Press.
15. DePree, M. (2004). *Leadership is an Art*. New York: Doubleday.
16. Deutsch, M. (1949). A theory of cooperation and competition. *Human Relations, 2,* 129-151.
17. Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology, 5(1),* 105-123.
18. Fink, C.F. (1968). Some conceptual difficulties in the theory of social conflict. *Journal of Conflict Resolution, 12(4),* 412-460.
19. Fisher, R.J. (2000). Intergroup conflict. In: M. Deutsch, P.T. Coleman (Eds.), *The Handbook of Conflict Resolution* (pp. 166-185). San-Francisco, CA: Jossey-Bass Publishers.
20. Galinsky, A.D., Jordan, J., Sivanathan, N. (2008). Harnessing power to capture leadership. In: C.L. Hoyt, G.R. Goethals, D.R. Forsyth (Eds.), *Leadership at the crossroads: Psychology and leadership* (pp. 283-299). Westport, CT: Praeger.
21. Greeff, A., de Bruyne, T. (2000). Conflict management style and marital satisfaction. *Journal of Sex and Marital Therapy, 26(4),* 321-334.

22. Gross, M.A., Guerrero, L.K. (2000). Managing conflict appropriately and effectively: an application of the competence model to Rahim's organizational conflict styles. *International Journal of Conflict Management, 11(3),* 200-227.
23. Heavey, C., Layne, C., Christensen, A. (1993). Gender and conflict structure in marital interaction: a replication and extension. *Journal of Consulting and Clinical Psychology, 61(1),* 16-27.
24. Holt, J., DeVore, C. (2005). Culture, gender, organizational role, and styles of conflict resolution: a meta-analysis. *International Journal of Intercultural Relations, 29(2),* 165-96.
25. Sample, J. (2008). *Thomas-Kilmann conflict mode.* TKI Profile and Interpretive Report.
26. Jehn, K.A. (2000). Benefits and detriments of workplace conflict. *Public Manager, 29(2),* 24-26.
27. Kahai, S.S., Sosik, J.J., Avolio, B.J. (2004). Effects of participative and directive leadership in electronic groups. *Group & Organization Management, 29(1),* 67-105.
28. Khanaki, H., Hassanzade, N. (2010). Conflict Management Styles: The Iranian General Preference Compared to the Swedish. *International Journal of Innovation. Management and Technology, 1(4),* 419-426.
29. Kilmann, R.H., Thomas, K.W. (1977). Developing a forced-choice measure of conflict-handling behavior: The "MODE" instrument. *Educational and Psychological Measurement, 37(2),* 309-325. https://doi.org/10.1177/001316447703700204.
30. Korabik, K., Baril, G., Watson, C. (1993). Managers conflict management style and leadership effectiveness: the moderating effects of gender. *Sex Roles, 29(5/6),* 405-422.
31. Korkmaz, O., Aydemir, S. (2015). A Research for the Determination of the Relationship between Organizational Conflict Management and Organizational Alienation. *International Review of Management and Marketing, 5(4),* 230-241.
32. Landau, S., Landau, B., Landau, D. (2001). *From Conflict to Creativity: How Resolving Workplace Disagreements Can Inspire Innovation and Productivity*. San Francisco: Jossey-Bass.
33. Lieberman, A. (Ed.) (1986). *Rethinking school improvement: Research, craft and concept*. New York: Teachers College.
34. Marquis, B.K., Huston, C.J. (1996). *Leadership Roles and Managers Function in Nursing*. Philadelphia: Lippincott.
35. Matthew, L. (2009). Conflict Management: A Gap in Business Education Curricula. *Journal of Education for Business, 84(4),* 240-245. DOI: 10.3200/JOEB.84.4.240-245.
36. McKnight, D.H., Chervany, N.L. (1996): *The Meanings of Trust*. Citesser.
37. Nadler, D.A., Tushman, M.L. (1999). The organization of the future: strategic imperative and core competencies for the 21st century. *Organizational Dynamics, 28(1),* 16-45.
38. Pondy, L.R. (1967). Organizational conflict: concepts and models. *Administrative Science Quarterly, 12,* 296-320.

39. Pruitt, D.G. (1983). Strategic choice in negotiation. *American Behavioral Scientist, 27(2),* 167-194. https://doi.org/10.1177/000276483027002005.
40. Putnam, L., Wilson, C. (1982). Communication Strategies in Organizational Conflict: Reliability and Validity of a Measurement. In: M. Burgoon (Ed.), *Communication Yearbook* (pp. 629-652). Beverly Hills. CA: Sage.
41. Rahim, M.A., Bonoma, T.V. (1979). Managing organizational conflict: a model for diagnosis and intervention. *Psychological Reports, 44,* 1323-1344.
42. Rahim, M.A., Buntzman, G.F. (1990). Supervisory power bases, styles of handling conflict with subordinates, and subordinate compliance and satisfaction. *Journal of Psychology, 123,* 195-210.
43. Rahim, M.A. (1983). A measure of style of handling interpersonal conflict. *Academy of Management Journal, 26(2),* 368-376.
44. Rahim, M.A. (2010). *Managing Conflict in Organizations*. Westport: Quorum Books.
45. Rahim, M.A. (1983). *Rahim organizational conflict inventories: Professional manual*. Palo Alto: Consulting Psychologists Press.
46. Randel, A. (2002). Identity salience: a moderation of the relationship between group sender composition and work group conflict. *Journal of Organizational Behavior, 23(6),* 749-766.
47. Rosenthal, D., Hautaluoma, J. (1988). Effects of importance of issues, gender and power contenders on conflict management style. *Journal of Social Psychology, 128(5),* 699-701.
48. Rousseau, D.M., Sitkin, B.S., Burt, R.S., Camerer, C. (1998): Not So Different After All: A Cross-Discipline View Of Trust. *Academy of Management Review*, p. 395.
49. Rubin, J., Brown, B. (1975). *Social Psychology of Bargaining and Negotiation*. New York: Academic.
50. Ruble, T.L., Thomas, K.W. (1976). Support for a two-dimensional model of conflict behaviour. *Organizational Behavior and Human Performance, 16,* 143-155.
51. Saeed, T., Almas, S., Anis-ul-Haq, M., Niazi. G. (2014). Leadership styles: relationship with conflict management styles. *International Journal of Conflict Management, 25(3),* 214-225. https://doi.org/10.1108/IJCMA-12-2012-0091.
52. Saeed, T., Almas, S., Anis-ul-Haq, M., Niazi, G. (2014). Leadership styles: relationship with conflict management styles. *International Journal of Conflict Management, Vol. 25, No. 3,* p. 214.
53. Sass, J. (2005). Bizalommintázatok és bizalmi döntések a szervezetekben. PhD értekezés. Pécsi Tudományegyetem Pszichológia Doktori Iskola.
54. Seval, H. (2006). Effects and management of conflict. *Journal of Social Sciences, 15,* 245-254.
55. Smith, D.B., Tonidandel, S. (2003). Taking account of time: the application of event history analysis to leadership research. *Leadership Quarterly, 14,* 241-256.
56. Smith, W.P. (1987). Conflict and negotiation: Trends and emerging issues. *Journal of Applied Social Psychology, 17,* 641-677.

57. Spence, J.T., Helmreich, R.L. (1978). *Masculinity & femininity: their psychological dimensions, correlates, & antecedents*. Austin, TX: University of Texas Press.
58. Uzonwanne, F. (2016). Influence of age and gender on decision-making models and leadership styles of non-profit executives in Texas, USA. *International Journal of Organizational Analysis, 24(2),* 186-203. DOI: 10.1108/IJOA-05-2013-0667.
59. Wachter, R. (1999). The effect of gender and communication mode on conflict resolution. *Computers in Human Behavior, 15(6),* 763-782.
60. Watson, C., Hoffman, L. (1996). Managers as negotiators: a test of power versus gender as predictors of feelings, behavior, and outcomes. *Leadership Quarterly, 7(1),* 63-85.

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# KNOW YOURSELF: PSYCHOLOGICAL CONCEPTS OF THE HUMAN BEING APPLIED IN HELPING PROFESSIONS USING THE EXAMPLE OF COACHING

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**Purpose:** The paper presents selected psychological concepts supporting the professional work of a coach as well as supporting representatives of other helping professions. The aim of the article is to indicate how many psychological sources are already present in coaching practice and to describe those which are most important for its practice.
**Design/methodology/approach:** Coaching is a new form developmental approach to working and interacting with other people. In the article, I use the method of comparative analysis.
**Findings:** According to the authors, it is an unjustified conclusion to connect coaching with only the humanistic-behavioral approach. Consequently, the authors' aim is to convince the reader that coaching uses many psychological and psychotherapeutic approaches, while the aim of this text is to organize them and to indicate how various concepts can support coaches and other helping professionals. The first part of the article explains the concept of coaching and its relation to philosophy, psychology and psychotherapy. This is followed by a description of the psychological concepts and methods, with an indication of their possible application in coaching.
**Research limitations/implications:** The research is limited to the analysis of the impact of broadly understood humanistic knowledge on the quality of the coach's work and coaching as a modern/new form of helping profession.
**Practical implications:** This text proves that coaching uses psychological concepts/positions and philosophical theories. These become a specific theoretical and scientific basis for coaching.
**Social implications:** Coaching is a subdisciplinary practical discipline drawing from humanistic knowledge: psychological and sociological.
**Originality/value:** Coaching is a new form of the helping professions. The article explains the concept of coaching and its relation to philosophy, psychology and psychotherapy. This is followed by a description of the psychological concepts and methods, with an indication of their possible application in coaching.

**Keywords:** practical philosophy, history of philosophy, coaching, psychological concepts of human being, Socrates.

**Category of the paper:** review article.

## 1. Introduction

The paper discusses selected psychological concepts of the human being which can be used in helping professions. These approaches may be important in the work of coaches, school guidance counsellors, tutors, guardians, community workers, job counsellors and philosophical counsellors. The authors of the paper focused on the example of coaching because coaching is sometimes described as a different way of working with the client compared to the psychological and therapeutic approach (cf. Starr, 2015). The aim of the paper is to indicate how many psychological sources are already present in coaching practice and to describe those (both historical and more recent) which are most important for its practice. The authors refer to the psychological concept types described, among others, by Józef Kozielecki (2000), i.e. to the psychoanalytic, behavioural, cognitive and humanistic-existential approaches, at the same time performing analyses from the angle of contemporary psychology, i.e. for example that in which psychoanalytic assumptions are challenged as unscientific or in which empirical research is conducted in order to confirm or refute assumptions adopted in the history of psychology concerning human functioning (cf. Grzesiuk, 2006; Paruzel-Czachura, 2015).

It can be assumed that one of the objectives pursued by helping professions, including that of a psychologist, a psychotherapist or a coach, is the philosophical *gnōthi seauton* (know yourself), to be able to provide effective professional support. Initially, this Greek maxim was inscribed in the Temple of Apollo at Delphi, and although the relevant fragment has not survived to this day, Socrates, who repeatedly referred to it, and Plato, who wrote down the thoughts of this ancient master of method[1], contributed to the current situation, in which the aphorism is considered an important element of practice in modern-day helping professions (cf. Negri, 2016). All these professions can be based on different concepts of the human being. It is not the case that a specific concept is characteristic of a given helping profession. For example, according to the authors, it is an unjustified conclusion to connect coaching with the humanistic-behavioural approach. Consequently, the authors' aim is to convince the reader that coaching uses many psychological and psychotherapeutic approaches, while the aim of this text is to organise them and to indicate how various concepts can support coaches and other helping professionals in their work.

[1]At present, Plato's dialogues are a significant source of knowledge about Socrates and his teachings. It is worth mentioning at this point that due to the philosophical method applied by Socrates, he is nowadays referred to as the first coach in history. The certain relevance between the approach adopted by Socrates in ancient times and the job of a coach as a contemporary form of a helping profession is described by Artur Negri in the article entitled *Dialog Sokratejski w coachingu* [*Socratic dialogue in coaching*].

The first part of the article presents an attempt to explain the concept of coaching and its relation to philosophy, psychology and psychotherapy (cf. Musioł, 2018a, p. 150). This is followed by a description of the psychological concepts of the individual (psychoanalytic, behavioural, cognitive as well as humanistic-existential ones), with an indication of their possible application in coaching using examples of specific psychotherapeutic concepts and methods. The authors devote most attention to the humanistic concepts, as they have had the greatest impact on contemporary coaching, but also indicate other areas of psychotherapy which coaching makes use of (Scoular, 2014, pp. 157-177; Gornall, Bird, 2015), often ignoring their psychological sources (Kozielecki, 2010). In the conclusion, the authors indicate why it is important to constantly refer to psychological theories in helping professions, as well as describe the limitations of their analyses and further directions of their development.

## 2. The relationship of coaching to philosophy, psychology and psychotherapy – the human being as a shared subject of interest

When writing about psychology and coaching, it is impossible to ignore the source from which they both stems, namely philosophy. Philosophers have been developing their science for over two thousand years now, analysing different aspects including nature, God, soul, the human being, and language. Thus, a certain problem still exists when it comes to defining philosophy in a manner satisfactory to all researchers, especially since it has undergone a huge transformation over these two thousand years. Arno Anzenbacher once wrote that „every branch of philosophy is ultimately about the human being" (Anzenbacher, 1992, p. 239). Similarly, psychology, psychotherapy, as well as coaching refer to philosophy to a significant extent, giving priority to the question concerning the human person. The difference between them is related mainly to the time when the relevant approaches appeared and their role in the world of science and practice.

It is commonly said, when comparing psychology to philosophy, that „psychology has an long past but a short history" (Stachowski, 2000, p. 12). If we wanted to honestly pinpoint the place of coaching in this relationship, coaching would be the most recent practice, which emerged in the mid-1970s[2]. This does not mean that coaching, or for that matter psychology, had not been practised before. The coaching methodology had started to be applied much earlier, but coaching began to be referred to relatively late as a helping profession, i.e. a process

[2] Coaching has been described as a profession since the 1970s. At that time, exactly in 1974, Timothy Gallwey's book was published under the meaningful title *The Inner Game of Tennis*. It connected the world of business to the results achieved by athletes working with their coaches. The systematic cooperation between business managers and sports coaches became a distinctive fashion back in the day. At the subsequent stages of coaching development, sports coaches were replaced by psychologists and trainers. Currently, the roles associated with the function of coach and trainer differ slightly, although the two words tended to be commonly used as synonyms in English.

that helps to realise some elementary yet vital components of human existence, often difficult to identify.

Psychology is the science of individual behaviour and mental processes (Zimbardo, Johnson, McCann, 2010), and psychotherapy is a process of treatment or development of the individual, based on the results of scientific research conducted in the fieldof psychology (Paruzel-Czachura, 2015). This does not mean that psychologists do not engage in practical activities, as they also support people, although not in the therapy process, but rather through prevention and education, for instance. Psychologists can also be psychotherapists, but they do not have to. Psychotherapists, on the other hand, do not need to have a psychological education, although it is recommended. In Poland, a psychologist holds a master's degree (having completed a course lasting usually five years), and a psychotherapist is a specialist who completed a four-year psychotherapy course after obtaining a master's degree. However, it happens in practice that people refer to themselves using these terms without meeting the requirements recommended by the Polish Psychological Society in the Code of Ethics of the Psychologist's Profession (cf. Brzeziński, Chyrowicz, Toeplitz-Winiewska, Poznaniak, 2017).

Authors of the article will subsequently focus on explaining what coaching is, referring the reader to the source mentioned above. In order to understand the relationships between coaching, philosophy and psychology, it is necessary to acknowledge that coaching is based on philosophical as well as on psychological and psychotherapeutic concepts, focusing on the practical development of the individual.

Coachingwas born as a form of practical continuation of philosophical, psychological and psychotherapeutic thought. It usually takes the form of a processual relationship, developing over time, of the alliance between the coach and the coachee (Whitworth, Kimsey-House, Kimsey-House, Sandahl, 2010). The term „professional coach" is usually used to describe someone who uses professional methods, tools and techniques in their work that are appropriate for coaching, skilfully separating them from strictly advisory, training, consulting, therapeutic and mentoring services. A future coach acquires the appropriate competences in the course of higher education in the field of coaching. These are usually full-time or part-time studies lasting from one year (for instance in the case of postgraduate studies) to several years (bachelor's and master's studies). The following types of coaching are distinguished most often: *life coaching*, *business coaching*, *corporate coaching*, *executive coaching*, *career coaching*, *leadership coaching* and *team coaching* (Wilson, 2010). Regardless of the type of coaching practised, any coaching practice requires the coach to comply on an obligatory basis with the Code of Ethics for the coaching profession[3].

The essence of this dialogical meeting consists in a gradual, step-by-step, multi-phase process of self-cognition on the part of the coachee as a result of active work on selected levels of his or her existence. The coaching process is an interactive procedure in which the coach,

[3] Coaches' work pursued in each of the coaching types listed above is regulated by the provisions of the Code drawn up by the *International Coach Federation* (ICF), whose members are professional coaches. The organisation's headquarters are in Lexington, USA.

using methods and systems of tools[4] characteristic of coaching (cf. Scoular, 2014, pp. 157-177; cf. Gornall, Bird, 2017), supports their client in genuine participation and assessment of the quality of various areas of his or her life in a *pro futuro* context. The work of a coach focuses on various spheres of the coachee's life. The coach supports the client in identifying individual, more or less significant components of his or her life; releases energy in the client helping the latter to recognise his or her own axiological horizon, including both the sphere of declarative values and that of the ones actually put into practice; the coach also supports change design processes, and consequently also the process of setting the paths to reach a specific *scopus*. The coach focuses on analysing the environment in which the client lives, his or her behaviour, abilities, competences and skills, beliefs and values, identity, vision, mission and life purpose (cf. Musioł, 2018b, pp. 279-290; Dilts, 2003). Each of these levels fosters cognitive participation in various spheres of life by referring to a selected/different coaching level. These levels are usually defined as operational, competence, psychological and transformational coaching (cf. Świeży, 2017; Czarkowska, 2014, pp. 85-103, Baca-Lönn, 2014, pp. 129-144, Dąbrowska, Wiśniewska 2014, pp. 169-200).

To sum up, this paper assumes that the task of obtaining knowledge about the human being is pursued by philosophy, psychology and psychotherapy as well as coaching. Philosophy and psychology seek to give a scientific answer to this question (remaining more in the realm of science theory), while psychotherapy and coaching reduce this question more to practice: through the process of self-cognition, the client obtains a chance to accept themselves or change. Coaching is therefore, like psychotherapy, a meeting (or a series of meetings) with the client, whose objectives may include improved self-acceptance, a subjective feeling of happiness, regaining mental health or coping with one's life. A distinct practical difference between psychotherapy and coaching is that a psychotherapist usually works with mentally ill individuals who suffer from certain disorders or dysfunctions that prevent them from functioning in life in a satisfactory manner. It may be anorexia, but also a situation of divorce, mourning, or marital conflict. The work of a coach, on the other hand, involves the development of a mentally healthy individual, through acceptance-based support given to the individual in their life choices or in important decisions. However, this is a simplified vision, as psychotherapists also work with people who want to realise their potential, redefine their values and improve their perceived quality of life. Coaches, on their part, also happen at times to work with people in divorce situations, etc. The difference between the goals of psychotherapy and coaching may therefore become blurred in practice. The same is true of their clients.

[4] Professional coaches rely most often on their work on individual coaching structures (GROW, T-GROW, SCORE, SKILLED HELPER, as well as the popular STEPPPA structure, which takes into account the element of goal reformulation and work on values and emotions) or on group/team coaching structures (COACH, STORM, GOLD, DROPS and STAGES). These structures have varying degrees of complexity, covering different aspects or levels of life of individual or collective clients (groups or teams).

To sum up, it is difficult to indicate unambiguous definitions of the concepts analysed, because there are situations in which their objectives, assumptions and working methods are very similar. Nevertheless, in very simple terms, coaching can be described as based on philosophy, psychology and psychotherapy, focusing rather on supporting individual development, while psychotherapy can be described as being based on philosophy and psychology, with the aim of restoring the individual's functioning to a normal level. Below, significant psychological concepts of the human being are described, using the division suggested by Kozielecki (2010), applied in psychotherapy practice and potentially equally important in coaching practice.

## 3. Can a coach continue to draw inspiration from scientifically refuted psychoanalysis?

When describing the psychological approaches to the individual, it is first worth looking at the psychoanalytical concept, as this is the oldest psychotherapeutic vision of the individual, perceiving the latter as an imperfect and flawed being, guided by internal, usually unconscious motivating forces. The author of this approach was the founding father of psychoanalysis, Sigmund Freud (1967), who referred to ancient philosophical systems, including Plato. The Austrian psychiatrist and neurologist, who valued natural sciences, wrote that the only purpose of his life was to „infer or guess how the mental apparatus is constructed and what forces interplay and counteract in it" (Skinner, 1956, p. 77, quoted in: Paszkiewicz, 1983, p. 121). Freud concluded that the structure of the human consciousness (the mental apparatus was usually explained as a combination of id, ego, and superego[5]) is like Plato's chariot pulled by two winged horses and driven by a charioteer. While one horse is disobedient and stubborn, symbolically expressing the activity of base motives, the other is composed and calm, symbolizing the noble aspirations of the soul (Plato, 1993, p. 35). The self, just like Plato's chariot, is a "regulator of opposing inclinations" (Grobler, Koczanowicz, 2016, p. 41). In the Freudian approach, human behaviour is irrational, albeit fully pre-determined, so this irrationality can be predicted with a certain pattern of behaviours. The father of psychoanalysis tried to describe this pattern, and the concepts that were developed on the basis of his deliberations included that of the Oedipus and Electra complex (being a manifestation of the sexual drive, i.e. the libido), the drive for death and aggression (the idea of *Thanatos*), as well as the huge impact of childhood on adult life. However, these concepts are now perceived merely as a part of the history of psychotherapy, and modern psychotherapists no longer make literal use Freud's approach in their work, even though psychotherapy still draws on some of the findings of the psychoanalytical school. With time, the approach kept changing, creating new branches such as the psychodynamic school (cf. Nieckarz, Celińska-Nieckarz, Godlewska-

[5] According to Bruno Bettelheim (1983), this explanation is incorrect. The correct one is the human soul.

Werner, 2013, pp. 35-36), Alfred Adler's individual psychology, Carl Gustav Jung's analytical psychology, and neopsychoanalysis (Grzesiuk, 2006; Jacobi, 2014). Some of these branches are currently considered merely a part of the history of psychotherapy, just like psychoanalysis. It should be emphasised that many of Freud's views have been refuted for lack of scientific evidence, subjectivity, and unethical actions in the process of psychotherapy and in his scientific activity (Witkowski, 2015; Prochaska, Norcross, 2006). Still, however, the Freudian philosophical concept of the individual may provide inspiration for contemporary coaches. Why is that?

It could seem that human nature understood in this manner has nothing to do with the coaching process. In coaching, emphasis is placed primarily on the possibility of changing, on individual responsibility and freedom, as opposed to classical psychoanalysis, in which determinism is the core of the vision of the individual.

However, two aspects can be indicated that may be used in the coaching process and have their sources in psychoanalysis. Firstly, in the sphere of coaching work, the psychoanalytical approach supports activities consisting in becoming conscious of the unconscious: gaining knowledge about one's own unconscious behaviour, ways of acting, feelings, emotions, motivations and thoughts. Secondly, it also helps in the identification of the psychological phenomenon of transference (projection[6]) and countertransference; as well as in recognising the phenomenon of natural resistance to change. It can be helpful for the therapist to adopt the blank screen approach (Paruzel-Czachura, 2015), and to use a couch separating the therapist from the patient, so that the patient obtains a chance to redirect his or her experiences related to some other individual from the past to the therapist, which can in turn help in the process of treatment and proper interpretation of the patient's problem. Therefore, while most of Freud's concepts have been refuted by empirical research, psychology still recognises the existence of certain defensive mechanisms that provide helpful terminology in attempts to explain human behaviour.

## 4. Deterministic behaviourism vs indeterministic coaching

The second concept of the individual after psychoanalysis is the behaviourist approach. The mechanistic behaviourist concept dehumanizes the individual and makes him or her dependent on the influence of genes and of the physical and social environment, pointing in a way to outer-direction, lack of autonomy and being determined by external factors (Kozielecki, 2010). According to the father of behaviourism, John Broadus Watson, and his continuator Burrhus Frederic Skinner, the autonomous individual is a myth. The overriding principle of behaviourism is environmental determinism, and the human mind is like a closed

[6] Projection as an unconscious defence mechanism is a habitual method of "dealing with conflicts" (Kozielecki, 2000, p. 117). It consists in projecting personal negative traits on another individual.

box one must cease to try to open, focusing instead on what is observable as human behaviour understood in terms of stimulus and response. Behaviourists believed that personality is a set of consolidated behavioural habits, not a result of operation of internal human processes. Charles Duhigg (2013) analysed the contemporary concepts in scientific research on the power of habit.

Can coaching draw inspiration from another deterministic psychotherapeutic approach (after psychoanalysis)? It may be valuable for the coaching process to emphasise the role of the external environment in the formation of human behaviour, thoughts and emotions. Although this role will not be as significant as behaviourism would like it to be (i.e. 100%), it is worth referring in coaching to the concept of the so-called positive and negative reinforcements (commonly referred to as awards and penalties), i.e. to instrumental conditioning (cf. Paruzel-Czachura, 2015). The idea of conditioning can be helpful in the development of new behaviours by the client. It should be stressed that the source of reinforcement (rewards) may be sought in what is referred to as self-reinforcement, i.e. positive thoughts about oneself (Bandura, 1977).

Moreover, during coaching sessions it is possible to use the modelling phenomenon known from the social psychology branch, albeit with reference to the influence of external stimuli on the individual. It allows the client, by observing a person who, in his or her opinion, has achieved a goal like the one pursued, to start imitating the model and achieve similar success (Bandura, Walters, 1959).

Behaviouristic techniques such as systematic desensitisation can also be used successfully in coaching (Wolpe, 1969). This consists in inducing a state of relaxation in the client in order to present stimuli to them that cause their fear (gradually, slowly, in an increasingly strong form). As such attempts intensify, the likelihood of anxiety disappears. This method can be used not only in real life, especially since sometimes one does not have the opportunity to attend a preliminary job interview before the actual one, for instance, but also in one's imagination or as part of an enacted scene. The implosive technique is like this, consisting in the client being immediately exposed to a strong stimulus causing their fear (e.g. you can ask them what the worst thing is that could happen during a job interview). In coaching, one speaks of working with the Kantian schematism paradigm[7], referring precisely to this behaviourist technique. In order to support the client in getting rid of harmful habits, aversion therapy may be applied, which consists in associating undesirable habits (e.g. beer drinking) with negative stimuli (e.g. emetics), which leads to the association of two stimuli, so that the undesirable habits are no longer repeated (cf. Paruzel-Czachura, 2015).

[7] Schematism is reflected in the "taming the tiger" allegory. The tiger reflects the patterns of thinking which we engage in and which often increase our feelings of fear, tension or anxiety. The only way of overcoming these mental states is to address them boldly by trying to stand face to face with them. By taming these fears (as the trainer tames the tiger), we notice that we can live with them, and then they become less terrible than they seemed at the beginning.

## 5. Closer to coaching – cognitive psychotherapy

In the coaching process, elements of cognitive psychology are used successfully in terms of shaping the client's thinking styles and in altering their thought patterns. Psychoanalysis and behaviourism are based on a deterministic concept of the individual. Cognitive therapy, on the other hand, assumes that our thoughts can influence what we do, so it allows indeterminism to enter, in a way, into our way of thinking about who we are. Consequently, it has become a great source of inspiration for coaching.

This approach gives the individual the philosophical status of an autonomous subject: a person that freely controls their fate; a being who defines himself or herself according to their own idea, independently and unhindered by unconscious drives or environmental factors; a person endowed with intelligence, with the ability to think abstractly, who „receives, stores, interprets, creates and communicates information (knowledge, data) through language/speech, giving them a certain value (meaning, sense), building culture" (Kozielecki, 2000, p. 170). In the perspective of cognitive psychotherapy, the subject perceives and consciously changes their thoughts using the power of their intellect.

The best-known within this trend are Albert Ellis's rational emotive therapy and Aaron Temkin Beck's cognitive therapy (cf. Paruzel-Czachura, 2015). The first psychotherapist mentioned above focused on dysfunctions of cognitive processes, on irrational thinking and on the fight against it (Ellis, 2013). Examples of unhealthy thinking include phrases such as "I will never be happy", "If I had done that, everything would be better now", or "I always have to win". The second psychotherapist focused on erroneous cognitive patterns and on inappropriate ways of interpreting events, such as Beck's famous negative triad: when people with depressive disorders see themselves, the world and the future negatively. The task of the therapist and of the coach is therefore to bring about a situation in which the client does not make unreasonable conclusions, does not select facts in a biased manner, does not generalise, exaggerate and underestimate the problem, and finally does not look at the world pessimistically (Kratochvil, 2003, p. 83). Beck is also the author of the Socratic dialogue method, making use of the open dialogue method mentioned before, which Socrates applied in Plato's dialogues, and whose aim is to allow the interlocutors to reach legitimate conclusions themselves (cf. Reale, 2000, p. 371). The coach, practising Socratic maieutics, i.e. "spiritual midwifery" (Reale, 2000, p. 379), is to become like a midwife helping a woman bear a child, i.e. to help the client discover the problem and solve it on their own. This trend also involves self-instruction training, which consists in teaching clients to say phrases about themselves in their mind, which helps to constructively modify their behaviour, and stress-resistance training (Meichenbaum, 1975, 1985). Both types of training can be used in the coaching process.

## 6. Humanistic and existential concepts for coaching process practice

The final group of psychotherapeutic approaches described in this paper involves the area of humanistic and existential therapies. Psychologists explain the differences between these approaches, although they are described at times as a more similar branch of psychotherapy (Grzesiuk, 2006) and at other times as a separate method of working with people (Prochaska, Norcross, 2006). This includes the following therapies: Carl Rogers's client-oriented therapy, Victor Frankl's logotherapy, Irvin Yalom's existential psychotherapy, and Gestalt therapy developed by Fritz Perls and his collaborators. The humanistic approach to the individual psychology was also present in books by Abraham Maslow, Gordon Allport and Kazimierz Dąbrowski in Poland.

This approach is characterised by a philosophy of affirmation of the individual, emphasising the value – assuming a process – of striving towards self-fulfilment. According to this trend, humans are by their nature good, unique, autotelic and, above all, free. They have a chance of changing and this change depends to the greatest extent on themselves – not on their parents, the environment or the therapist. The aim of therapeutic work is to increase awareness of the client's own needs *here and now*, including the need for self-development and change (cf. Kozielecki, 2000; Dąbrowski, 1974). Examples of techniques used here are empathy, unconditional acceptance of the patient, reflecting feelings, the therapeutic alliance and openness of the therapist. Selected concepts from this area, which can be used in the coaching process, are described below.

## 7. Abraham Maslow's affirmative-humanistic approach

In the history of psychology, a psychologist who wrote about the important value of individual self-fulfilment more than anyone else was Abraham Maslow. Although Maslow's theses have never been confirmed empirically, which is particularly the case of Maslow's famous pyramid (cf. Aronson, 2011), his theory can still be used in coaching. The creator of the psychology of existence project called the humanistic concept helpful in generating an individual way of life of the individual, "not only for the person himself within his own private psyche, but also for the same person as a social being, a member of society" (Maslow, 1986, p. 7).

The origins of Maslow's humanistic system of psychology had already appeared in ancient philosophy, especially in Plato's teachings and in the stoicism of Seneca and Epicurean thought (Reale, 2000). It is worth adding at this point that since the ancient times, the value of self-fulfilment or self-actualisation has been widely used by various branches of knowledge about humans. The significance and importance of this knowledge are fulfilled in the perspective of the effort made to discover and utilise one's own potential and thus become who one wants to

be. The possibility of self-determination, as the ability to fulfil one's own vocation and destiny, leads to fulfilment and to a complete life (i.e. what is referred to as *eudemonia*). A self-fulfilling person is someone who opens himself or herself up to another individual and finds fulfilment in the relationship with another person, at the same time pursuing their own life projects.

Maslow's affirmative-humanistic, relational, human-centred approach is consistent with what philosophers and social psychologists' postulate, namely that if an individual has good relations with other people, his or her projects will be efficiently implemented. It is enough to recall at this point the numerous studies on work-life balance (Matuska, Christiansen, 2009; O'Bannon, 2007).

## 8. Carl Rogers's person-centred therapeutic approach

The above words correspond with Carl Rogers's non-directive, person-centred therapy. This influential 20th century psychotherapist created a system expressing a certain way of life conducive to healthy change and facilitating human development in the personal dimension. His approach to psychotherapeutic help assumes that the individual as a single whole is a being with a high capacity of self-comprehension (cf. Jakubowski, 1970, pp. 68-91). The sources of the individual's behaviour lie immanent in themselves, which is why, as Rogers himself wrote, „the individual essentially lives in their own subjective world and even the most objective aspects of their functioning (…) are the result of subjective goals and subjective choices" (Rogers, 2016, p. 175). According to him, the human individual is prepared to make constructive changes in their way of life and in their behaviour. However, each person's Self develops „through interactions with the environment, including in particular with the environment composed of significant persons" (Rogers, 2016, p. 79). Hence in this trend one sees the specific nature emerge of the interpersonal, individual and fully authentic helping relationship with the person providing professional support: a therapist or a coach, someone who displays an unconditionally positive attitude, a non-judgemental, empathetic attitude of understanding, congruity and acceptance towards the client (Rogers, 1991, pp. 5-6). In such a situation, both the psychotherapist and the coach can be a trusted companion for reflective wanderings within the inner world of their client; they can act as an assistant who, during the process, suspends their own views, personal types, subjective judgments and value-judgment patterns in order to enter the other person's world without prejudice (cf. Rogers, 1991, pp. 80-85), and provide reliable, credible and balanced feedback as an active and tolerant listener.

## 9. The open personality according to Gordon Allport

Gordon Allport's approach (1950) completes the humanistic vision of the individual in the field of psychology. The American psychologist reflected on the theory of motivation, conscience and human personality, considering the methodology of its formation. In his opinion, the aspects mentioned above play a leading role in the structure of the system of values of each individual.

The author of *The Nature of Prejudice* abandoned all attractive, albeit schematic programmes that merely contributed to the creation of distorted forms of human nature. According to his idea „personality is too complex to be forced into a strictly scientific conceptual corset" (Allport, 1988, p. 70). The psychologist attributed an open and eclectic character to personality. According to him, every individual develops their own personal style of functioning (existing) and shapes their own axiology, which determines the quality of their life. Developing one's own individual form of life allows one to put one's own personal image in sharp focus and to live a happier life, in harmony with oneself. This now-historical approach used in psychology can still be used now as a source of inspiration for therapeutic and coaching work. Above all, it is the client who determines their own hierarchy of values and the way in which they want their life to progress. Neither a therapist nor a coach provides specific solutions or advice in this respect. They do not judge the client's system of values either, and their only goal is that the client should feel comfortable with themselves and their values. Of course, such an approach may trigger some ethical controversy, especially in psychotherapeutic work, hence the client's acceptance should have its limits. If another person's life or if the client's life is threatened, the therapist should try to modify the client's value system, and if they do not succeed, they should notify the relevant services, so they have the right to breach the psychologist's professional secrecy (cf. Brzeziński, Chyrowicz, Toeplitz-Winiewska, Poznaniak, 2017).

## 10. Kazimierz Dąbrowski's approach

Kazimierz Dąbrowski also wrote about the human being as an autonomous personality. As a clinical psychologist, philosopher and educationalist at the same time, Dąbrowski a Polish representative of the humanistic concept of the individual. Looking from the humanistic perspective, he noticed that every developed personality is as complete, cohesive, harmonious and self-aware as possible. It is characterised by a high degree of self-insight, i.e. insight „into one's own structure, one's own aspirations and goals" (Dąbrowski, 1984, p. 4). This self-conscious individuality unwaveringly believes in the correctness of this attitude and in the legitimacy of the goals set.

The author of the theory of positive disintegration went beyond the analyses of human development levels used by biologising psychologists, educationalists and physicians, which he considered inadequate. Dąbrowski believed that research was usually limited to strong and exclusive emphasis being placed on physiological-biological determinants. He, on the other hand, stressed the role of focusing on the individual's hierarchy of values and goals, including the importance of the position according to which such values are not only intellectually founded, but are above all an expression of developing human emotions. The author explained that „the higher the levels of consciousness are that come to the fore in human actions, the more connections there are between the hierarchy of feelings and drives, and the rather clear hierarchy of goals. The higher levels of experiencing active in us set creative imagination and organised fantasy in motion" (Dąbrowski, 1988, p. 11). An example of reason and emotions combined is provided by outstanding individuals with distinctive "mental traits, talents, interests, ways of life, ambitions or aspirational power. […] Individuality is determined by […] the tone, by a certain trace, most often associated with temperament and character features, the specificity of approaching the given matter as well as the tension of will and the power of external expression (Dąbrowski, 1988, p. 4). Coaching is also based on a system of values and on supporting the creativity and development of the client. Examples of methods that effectively help to organise the client's value system in coaching focus on specific tools for creating visions and setting goals, tools for working with motivation and values as well as tools for reflection, breaking deadlocks and creative thinking. The most commonly mentioned practical coaching tools that are used include: the value hierarchy chart, core values and beliefs worksheets, motivation discovery worksheets, creative self-visualisation, individual mission plan, and change context determination matrix (cf. Marciniak, Rogala-Marciniak, 2013, pp. 195, 211, 217, 227, 265, 297).

## 11. Closing remarks

Regardless of the individual psychological preferences of the specific systems, each psychological concept (according to Kozielecki's approach) contains valuable aspects that can be used within the coaching process. The aim of the paper was to present selected concepts that may support the professional work of a coach, but also other helping professionals.

Although only a small percentage of professional coaches currently have appropriate psychological preparation, the number of coaches expanding their knowledge in the field of psychology is systematically growing (Smółka, 2016). Psychology provides elementary information about the individual and the latter's mental condition (the meaning and the value of inner life); the impact of life experiences on human behaviour, including the impact of situational variables (such as random circumstances) and the role of the genetic equipment one

is born with, which constantly influences human functioning, especially on the cognitive level (Zimbardo, Johnson, McCann, 2010). It is extremely important for practitioners in every helping profession, including coaching, to broaden psychological knowledge about the human person. In addition to acquiring information, it is also important to work on psychological competences in working with people, referred to as soft skills (such as empathy, emotional intelligence, active listening, constructive feedback, assertiveness), which make it possible to support the client's development (Marczyszyn-Berendt, Tyralik-Kulpa, 2016).

Finally, the authors would like to point to the limitations of this text and to further directions of development of analyses in this area. It should be emphasised that the authors relied in their deliberations on Kozielecki's division, passing over other important contemporary psychotherapeutic approaches, such as the systemic approach, the Ericksonian approach, Gestalt psychotherapy and transactional analysis, for which there was insufficient space. These trends can also be valuable sources of knowledge and practice for coaches. The authors encourage practising coaches to familiarise themselves especially with Eric Berne's transactional analysis and his concept of life script, with a distinction made between the parent, the adult and the child (present in every person), and types of attitudes (I'm OK, you're OK, I'm not OK, you're not OK) (cf. Berne, 1965; cf. Stewart, Joines, 2017), as well as with Gestalt psychotherapy, including especially its concept of figure and ground, closure, the topdog/underdog distinction, working in here-and-now, the role of bodywork and the paradoxical theory of change (Perls, 2018).

Moreover, within the framework of the psychological concepts of the individual they analysed, the authors did not analyse all the varieties of the concepts, focusing only on the main and most popular approaches. Further analyses in this field could concern different psychological and psychotherapeutic approaches, as well as more in-depth analyses within a specific psychological concept of the individual.

Another important aspect that may be addressed as a follow-up to this issue is that of empirical research in psychology, i.e. the current replication movement taking place in the 21st century. It turns out that some of the psychological finding practitioners rely on have been refuted empirically. For example, fifty years ago psychology used more imperfect methods to confirm scientific hypotheses, inappropriate research samples used to be selected (e.g. Bandura studied modelling for the first time among children of researchers from the university campus), the samples were either too small or very homogeneous (so-called WEIRD psychology is mentioned most often, namely analysing data only from countries with a high socioeconomic status, such as the USA). Nowadays, scientists replicate studies and therefore conduct them once again applying stricter methodological requirements, often in parallel in many countries across the world (cf. Bago, 2019; Landy et al., 2019). It would therefore be worthwhile for practitioners to take into consideration the increasingly frequent reference made to research conducted over the last few years, whose findings have been published in scientific journals, but which have not found their place yet in academic textbooks.

To sum up, the aim of this paper was more to present historical sources of value for helping professions, which would be worth expanding in further works by adding new psychological concepts and empirical data. It should be stressed, however, that it will never be possible to verify some of these concepts empirically, for instance the idea of determinism or indeterminism of the individual, as this is a certain *a priori* assumption and although we have a certain set of scientific data available, e.g. suggesting a significant influence of genes on our behaviour, it is impossible, from the point of view of psychological methodology, to provide definitive answers to such philosophical questions as the question of human freedom or human good.

## References


1. Allport, G.W. (1950). *The Individual and His Religion: A Psychological Interpretation.* New York: The Macmillan Company.
2. Anzebnacher, A. (1992). *Wprowadzenie do filozofii* [*Introduction to the philosophy*], transl. J. Zychowicz. Cracow: WAM.
3. Aronson, E. (2011). *The social animal*. Duffield: Worth Publishers.
4. Baca-Lönn, L. (2014). Coaching transformacyjny z zastosowaniem analizy grafologicznej [Transformational coaching using graphological analysis]. In: L.D. Czarkowska (ed.). *Coaching transformacyjny jako droga ku synergii* [*Transformational coaching as a way to synergy*] (pp. 129-144). Warsaw: Poltext.
5. Bago, B. (2019). *Moral thinking across the world: Exploring the influence of personal force and intention in moral dilemma judgments*. Retrieved from https://www.researchgate.net/publication, 06.01.2020.
6. Bandura, A. (1977). *Social learning theory*. New Jersey: Prentice-Hall.
7. Bandura, A., Walters, R.H. (1959). *Adolescent Aggression: A study of the influence of child-training practices and family interrelationships*. New York: Ronald Press.
8. Berne, E.(1965). *Games People Play. The Psychology of Human Relationships*. New York: Grove Press.
9. Bettelheim, B. (1983). *Freudand Man's Soul*. New York: Vintage.
10. Brzeziński, J., Chyrowicz, B., Toeplitz, Z., Toeplitz-Winiewska, M., Poznaniak, W. (2017). *Etyka zawodu psychologa* [*Ethics of the profession of psychologist*]. Warsaw: PWN.
11. Czarkowska, L.D. (2014). Transformacja w coachingu, aby stawać się sobą – inspiracje z psychologii zorientowanej na proces oraz model Homo Creator [Transformation in coaching to become yourself – inspirations from process-oriented psychology and the Homo Creator model]. In: L.D. Czarkowska (ed.), *Coaching transformacyjny jako droga ku synergii* [*Transformational coaching as a way to synergy*]. Warsaw: Poltext.

12. Dąbrowska, A., Wiśniewska, A. (2014). Wyzwania coachingu transformacyjnego dla pokolenia Y – jak wspierać synergię pokoleń. Refleksja na podstawie własnych doświadczeń i badań [Coaching challenges for generation Y – how to suport generation synergy. Reflection based on own experience and research]. In: L.D. Czarkowska (ed.), *Coaching transformacyjny jako droga ku synergii* [*Transformational coaching as a way to synergy*]. Warsaw: Poltext.
13. Dąbrowski, K. (1988). *Pasja rozwoju* [*Develop passion*]. Warsaw: Polskie Towarzystwo Higieny Psychicznej.
14. Dąbrowski, K. (1974). *Zdrowie psychiczne a wartości ludzkie [Mental health and human values]*. Warsaw: Polskie Towarzystwo Higieny Psychicznej.
15. Dąbrowski, K. (1984). *Osobowość i jej kształtowanie poprzez dezintegrację pozytywną* [*Personality and its formation through positive disintegration*]. Lublin: Ośrodek Higieny Psychicznej dla Ludzi Zdrowych w Lublinie.
16. Dilts, R. (2003). *From Coach to Awakener*. California: Meta Publications.
17. Duhigg, C. (2013). *The Power of Habit: Why we do what we do in life and business*. New York: Random House Publishing Group.
18. Ellis, A. (2013). *Better, Deeper, and More Enduring Brief Therapy*. New York: Brunner/Mazel Publishers.
19. Freud, Z. (1967). *Człowiek, religia, kultura* [*Human, religion, culture*], transl. J. Prokopiuk. Warszawa: Książka i Wiedza.
20. Gornall, S., Bird, J. (2015). *The Art. Of Coaching, A Handbook of tips and tools*. Abingdon: Routledge.
21. Grobler, A., Koczanowicz, L. (2016). Elementy filozofii dla psychologów. In: J. Strelau, D. Doliński, *Psychologia akademicka [Academic psychology]. Vol. 1.* Gdansk: GWP.
22. Grzesiuk, L. (2006).*Psychoterapia. Badania i szkolenie* [*Psychotherapy. Research and training*]. Warsaw: Eneteia.
23. Grzesiuk, L.(2006). *Psychoterapia. Praktyka [Psychotherapy. Practice]*. Warsaw: Eneteia.
24. Jakubowski, J. (1970). Zarys teorii osobowości Karola R. Rogersa [Carl R. Rogers' outline of personalitytheory]. *Studia Philosophiae Christianae*, Vol. 6, 1, 1-10, pp. 68-91.
25. Kozielecki, J. (2000). *Koncepcje psychologiczne człowieka [Human psychological concept]*. Warsaw: Wydawnictwo Akademickie „Zak".
26. Kozielecki, J. (2010). *Moje wzloty i upadki: autobiografia z psychologią w tle [My ups and downs: autobiography with background psychology]*. Gdansk: GWP.
27. Kratochvil, S. (2003). *Podstawy psychoterapii [The Basic of Psychotherapy]*. Transl. M. Czabak, E. Matuska. Poznan: Zysk i Sp-a.
28. Marciniak, Ł.T., Rogala-Marciniak, S. (2013). *Coaching. Zbiór narzędzi wspierania rozwoju* [*Coaching. Collection of development support tools*]. Warsaw: Wolters Kluwer.
29. Marciszyn-Berendt, J., Tyralik-Kulpa, E. (2016). Empatia jako narzędzie dialogu w coaching [Emparhy as a tool for dialogue in coaching]. In: L.D. Czarkowska (ed.),

*Coaching jako konstruktywny dialog* [*Coaching as a constructive dialogue*]. Warsaw: Poltext.

30. Maslow, A. (1986). *W stronę psychologii istnienia* [*Toward a Psychology of Being*]. Transl. I. Wyrzykowska. Warszawa: Instytut Wydawniczy PAX.
31. Matuska, K., Christiansen, C. (2009). *Life Balance. Multidisciplinary Theories and Research*. New York: Balboa Press.
32. Meichenbaum, D. (1985). *Stress Inoculation Training.* Oxford: Pergamon Press.
33. Musioł, A. (2018a). Prakseologia w coachingu jako interaktywnym procesie odkrywania zasobów i możliwości Coachee [Praxeology in coaching as the interactivediscovery process of the coachee's resources and possibilities]. *Studia Philosophiae Christianae*, *Vol. 3,* pp. 149-162.
34. Musioł, A. (2018b). Sześć perspektyw coachingu globalnego w paradygmacie złożoności holograficznego modelu Philippe'a Rosinskiego [Six perspectives of global coaching in paradigm of the complexity Philippe Rosinski's holographic model]. *Zeszyty Naukowe Politechniki Śląskiej. Seria: Organizacja i Zarządzanie*, *Vol. 123,* pp. 279-290.
35. Negri, A. (2016). *Dialog Sokratejski w coachingu* [*Socratic dialogue in coaching*]. In: L.D. Czarkowska (ed.), *Coaching jako konstruktywny dialog* [*Coaching as a constructive dialogue*] (pp. 65-75). Warsaw: Poltext.
36. Nieckarz, Z., Celińska-Nieckarz, S., Godlewska-Werner, D. (2017). Coaching jako obszar psychologii stosowanej [Coaching as an area of applied psychology]. In: Z. Nieckarz, S. Celińska-Nieckarz, D. Godlewska-Werner (eds.), *Psychologia coachingu biznesowego* [*Business coaching psychology*]. Gdansk: Harminia universalis.
37. O'Bannon, B. (2007). *Balance matters. Turing Burnout Into Balance.* Sherman: R&B.
38. Paruzel-Czachura, M. (2015). *Między psychologią, psychoterapią i filozofią praktyczną. Poszukiwanie autentycznego życia w nurcie Gestalt* [*Among psychology, psychotherapy and practical philosophy. Looking for authentic life in Gestalt approach*]. Sopot: GWP.
39. Paszkiewicz, E. (1983). *Struktura teorii psychologicznych* [*Structure of psychological theories*]. Warsaw: PWN.
40. Perls, F.S. (1992). *Gestalt therapy Verbatim*. Gouldsboro: Gestalt Journal Press.
41. Platon. (1993). Fajdros [Phaedrus]. In: Platon, *Dialogi* [*Dialogues*]. Transl. W. Witwicki, Warsaw: Unia Wydawnicza Verum.
42. Prochaska, J.O., Norcross, J.C. (2009). *Systems of Psychotherapy: A Transtheoretical Analysis*. San Francisco: Cengage Learning.
43. Reale, G. (2000). *Historia filozofii starożytnej* [*A History of Ancient Philosophy*]. *Vol. 1. Od początków do Sokratesa* [*From the Origins to Socrates*]. Transl. E.I. Zieliński. Lublin: RW KUL.
44. Rogers, C. (1991). *Terapia nastawiona na klienta* [*Client Centred Therapy*]. Transl. A. Dodziuk, E. Knoll. Wroclaw: Thesaurus-Press.

45. Rogers, C. (2016). *Teoria terapii, osobowości i relacji interpersonalnych rozwinięta w oparciu o podejście skoncentrowane na kliencie [A theory of therapy, personality, and interpersonal relationships: As developer In the client-centered framework*]. Transl. M. Król. Warsaw: Zielone Drzewo.
46. Scoular, A. (2014). *Coaching biznesowy* [*The Financial Times guide to business coaching*]. Transl. M. Nosorowska. Sopot: Gdanskie Wydawnictwo Psychologiczne.
47. Skinner, B.F. (1956). *Critique of psychoanalytic concepts and theories*. Minneapolis: University of Minnesota Press.
48. Smółka, P. (2016). *Coaching. Inspiracje z perspektywy nauki, praktyki i klientów* [*Coaching. Inspirations from the perspective of science, practice, and clients*]. Gliwice: Onepress.
49. Stachowski, R. (2000). *Historia współczesnej myśli psychologicznej. Od Wundta do czasów najnowszych* [*History of modern psychological thought. From Wundt to modern times*]. Warsaw: PWN.
50. Starr, J. (2015). *Podręcznik coachingu. Sprawdzone techniki treningu personalnego* [*The Coaching Manual: The Definitive Guide to the Process, Principles and Skills of Personal Coaching*]. Transl. A. Trzcińska. Warsaw: Oficyna Wolters Kluwer business.
51. Świeży M. (2017). *Psychologia dla Coachów* [*Psychology for coaches*]. Crakow: Wszechnica UJ.
52. Whitworth, L., Kimsey-House, K., Kimsey-House, H., Sandahl, P. (2010). *Coaching koaktywny. Umiejętności wspierające sukces klienta* [*Co-active coaching. Changing business transforming lives*]. Transl. M. Piechnik-Potęga. Warsaw: Oficyna Wolters Kluwer business.
53. Wilson, C. (2010). *Coaching biznesowy. Praktyczny podręcznik dla coachów, menedżerów i specjalistów HR* [*Business coaching. A practical handbook forcoaches, managers and HR specialists*]. Transl. M. Lisek-Derek, Warsaw: MT Biznes.
54. Witkowski, T. (2015). *Zakazana psychologia* [*Forbidden psychology*], *vol. 1. Pomiędzy nauką a szarlatanerią* [*Between science and quackery*]. Poznan: BEZ MASKI.
55. Wolpe, J. (1969). *The Practice of Behavior Therapy (Pergamon General Psychology Series)*. Boston: Allyn & Bacon.
56. Zimbardo, P., Johnson, R.L., McCann, V. (2003). *Psychology: core concepts*. *Vol. 5*. Transl. J. Radzicki. Boston: Allyn & Bacon.

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# THE PERCEPTION OF THE MUNICIPAL HOUSING MANAGER'S CSR ACTIVITIES IN THE CONTEXT OF ITS STAKEHOLDERS

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**Purpose:** The growing complexity of the environment in which they operate causes modern enterprises, including various types of organizations, to develop competitive management models aimed at meeting the expectations of various groups of stakeholders involved in their activities in the long-term perspective. This article focuses on the importance of corporate social responsibility (CSR) in the activities of the municipal housing manager in the context of its stakeholders. The study examines how stakeholders (employees, resource residents, entrepreneurs) perceive the city's housing manager's CSR activities.
**Design/methodology/approach**: In this study, in addition to the analysis of the literature on the subject, the results of the survey conducted in the first and second quarter of 2022 among 363 stakeholders of the municipal housing manager were used. In the study, the impartiality test $\chi 2$ and the coefficient of T Czuprow convergence were used, with the significance level $\alpha = 0.05$.
**Findings:** The results suggest that each of the three selected groups of stakeholders perceive the necessity of CSR activities differently. The group that is the most interested in such activities are employees, the inhabitants of resources expect only actions aiming to improve the quality of their lives, and therefore actions within the aspect of local responsibility. Entrepreneurs in turn, are interested in activities in the social, external and environmental aspects. In addition, the results of these studies may contribute to the state of knowledge in the scientific literature by pointing to the importance of CSR activities by entities not focused on maximizing profits.
**Originality/value**: It can be expected that the developed models will help decision makers of city housing managers to gain a perception of the stakeholder's awareness of and attitudes towards the CSR concept.

**Keywords:** social responsibility, stakeholders, municipal housing manager.

**Category of the paper:** Research paper.

## 1. Introduction

The outlining of social responsibility, both in the theory and practice of management, has raised numerous debates and controversies from the very beginning. This was due to the fact that the CSR concept changed the current model of business thinking (Olejniczak-Szuster, 2021), and becoming an important element of business practices (Porter, Kramer, 2006). Tomaselli et al. (2018) believe that despite the differences in the approach to CSR, there is a respectable consensus as to the responsibility for their impact on society, the environment and various stakeholders. According to I. Kuraszko, it can be stated that "CSR is a process of learning about and incorporating changing social expectations into a management strategy, as well as monitoring the impact of such a strategy on market competitiveness (...) it is a search for a dynamic balance between all interested parties in accordance to law and ethical norms. (Kuraszko, 2010). In practice, this means that enterprises can (positively or negatively) influence the surrounding reality by taking responsibility for their actions or by ignoring social expectations towards them (Mele, 2009; Skiba, 2021). At the core of CSR lies the issue of business ethics, taking into account the core values and corporate culture aimed at promoting responsible behavior. Although the concept of CSR may differ depending on the context, it is widely expected that organizations will focus their activities on poverty reduction, environmental protection, improved public health and better education, as well as accountability to various stakeholders (Ullah et al., 2014; Macassa et al., 2017; Bylok, 2005).

As CSR gains more and more attention from the company's stakeholders, the question arises as to what extent companies can and should be interested in the public interest and contribute to solving global and local problems (Nadanyiova, 2021). This is particularly important in the context of the activities of the municipal housing management, which in its activities does not aim to maximize the value in the form of profit, but to meet the housing needs of the society (inhabitants of the city of Częstochowa).

This study aims to fill the research gap by examining the activities of the municipal manager in the aspect of social responsibility from the point of view of three groups of stakeholders, i.e. employees, people living in local housing and entrepreneurs. Hence, the authors proposed a model for identifying the relationship between the perception of CSR and activities in its field.

This model can help decision makers of city housing managers gain an insight into stakeholder awareness and attitudes towards the CSR concept.

## 2. Literature review and conceptual framework

In the current market reality, balancing economic goals with social and environmental goals is an important element of the activities of a modern organization (Banerjee, Wathieu, 2017).

Until recently, issues related to CSR did not evoke admiration among business owners, managers and their employees or other market participants, because they were associated with some vague, legally underdeveloped and new way to show the transparency of the organization's activities (Borowska-Żywno, 2018). Currently, social responsibility is an element of enterprises' orientation towards harmonious development, taking into account the expectations of various stakeholder groups, including one of the most important aspects of modern management (Dziadkiewicz, 2014; Sacconi, 2009). For this reason, organizations undertake, on the one hand efforts to minimazie and/or eliminate the harmful effects of their activity on the market, and on the other hand, efforts to maximize the long-term (positive) impact on society and the environment (Mohr, Webb, Harris, 2001; Correia, 2019). In this context, CSR refers to social or environmental activities focusing on organizational results that go beyond financial results (Ellemers, Chopova, 2022). McAdam, Leonard (2003) state that corporate social responsibility is manifold, covering such areas as employee welfare, local community, care for the environment and sustainable development of the company. Kowalczyk and Kucharska (2020) state that CSR refers to the obligations that organizations have towards a wide range of stakeholders, i.e. those who are influenced by and those that have influence on corporate policies and practices. In turn, Post et al. (2002) explain that stakeholders are essential to the proper functioning of an organization. This is because they provide the resources of the organization (e.g. customers, investors, employees), create an industry structure (e.g. partners in the supply chain, strategic alliances) and create the socio-political arena (e.g. communities, governments). Stakeholders can be divided into at least three categories: direct and indirect influence of the external environment and the influence of the internal environment, whose functions are unique in social dialogue and at the same time complement each other (Zukauskas et al., 2018). The existing literature shows that pressure from a wide range of stakeholders convinced managers of many companies or organizations to adopt CSR practices (Delmas and Toffel, 2008). Similar conclusions were drawn in the studies of Sarkis et al. (2010), or Yu, Choi (2016) according to which the pressure of stakeholders positively determines the level of adoption of CSR practices. Taking into account the activities of the municipal housing administrator, the following hypotheses were formulated:

*H1: the stakeholders of the city housing manager expect the implementation of socially responsible activities.*

*H2: Conscious identification, listening and acting in accordance with the priorities of each individual group of stakeholders translates into increased CSR activity.*

According to the stakeholder theory, the essence of business lies primarily in building relationships and creating value for all stakeholders. Organizations are expected to take care of their employees (internal stakeholders) and fulfill their obligations towards local communities and the entire society, including the natural environment (Barić, 2017; Kabus, 2017). Therefore, organizations should first identify their stakeholders, understand their expectations and then manage them appropriately (Harrison et al., 2010; Kabus, 2017). This is because organizations experience various pressures from their stakeholders (Yu, Lo, Li, 2017; Watson et al., 2018; Tang, Tang, 2018). Researchers indicate that ignoring the needs of stakeholders and the lack of CSR activity negatively affects the organization's performance (Story, Neves, 2015). As shown by the research by Bhattacharya, Sen (2004), the perception of CSR initiatives by stakeholders is not uniform. This is because different stakeholders produce different assessments of such initiatives. Recent research has identified two strands of this perception.) In the first, the stakeholders assess CSR initiatives through the prism of the results achieved, and in the second, the assessment is based on the motives of the organization's involvement in CSR initiatives (Bhattacharya et al., 2008). Based on the research to date, the following hypothesis was put forward in the aspect of the municipal housing manager:

*H3: Internal and external stakeholders have different perceptions of the implementation of the municipal housing manager's CSR activities.*

## 3. Research methodology and research sample

In order to achieve the main goal of the article, the empirical study was carried out in two stages. In the first stage, according to the typology of Zukauskas et al. (2018), the stakeholders of the city housing manager were selected, and then the relationships at the level of the city housing manager – individual groups of stakeholders were determined (Table 1).

The second stage related to the conducted diagnostic survey, and then testing the hypotheses. This research was exploratory in nature, with random sampling to identify respondents (Palinkas et al., 2015). To decide the size of the sample for this study, reference was made to the study by Kang (2014), which conducted the perception of corporate social responsibility on a 200-person sample. Thus, a structured survey questionnaire was used for the study, which was addressed to 500 stakeholders of the municipal housing manager. It should be noted that some of the respondents did not answer all the questions; as a result, a significant number of rejected questionnaires emerged. Ultimately, 362 correctly completed questionnaires were obtained from the data analysis, representing first-level stakeholders having a direct impact on the activities of the municipal housing manager. And so, 28.9% of internal stakeholders – employees, and 71.1% of external stakeholders participated in the study, of which: 83.3% were people living in apartments belonging to the audited entity (tenants and owners of properties), and 16,7% were entrepreneurs using commercial properties.

To assess the perception of CSR activities by the city housing manager in the context of its stakeholders, a five-point Likert scale was used, which measured the average level of assessment of selected elements in the business and social area. The perception of CSR activities was: measured by dividing them into three aspects which were social internal, social external and environmental, based on Mona et al. (2015). Due to the fact that the municipal housing manager does not seek to maximize the value in the form of profit, but to meet the housing needs of the society (inhabitants of the city of Częstochowa), the economic aspect was omitted in the study.

The obtained data was subjected to statistical analysis, in which a choice was made between two contradictory hypotheses:

*H0: for the stakeholders of the city housing manager, the given feature does not matter – there is no relationship.*

*H1: for the stakeholders of the municipal housing manager a given feature is of great importance – there exists a relationship.*

For the estimation of H0 and H1, after Ratajczak (2016), arithmetic averages, the $\chi 2$ impartiality test and the T Czuprow's convergence coefficient were used, retaining a level of significance.

## 4. Results and discussions

The analysis of the stakeholders (Table 1) showed that the expectations towards the municipal housing manager differ between the selected types of stakeholders.

According to the research of Polonsky (2015), Khuong et al. (2021), employees are considered to be the most influential stakeholder group in the CSR decision making process. It was found that the stakeholders with a low impact, but which were largely interested in the activities of the municipal housing manager, were primarily residents of the resources (tenants, owners of properties). It should be remembered that the municipal property manager belongs to specific entities on the market. Their activities focus on improving the quality of life of residents (Dziadkiewicz, 2020).

**Table 1.**
*Stakeholders of the city housing manager*

| Kind | | Characteristic | | Strength | Predictability | Interest |
|---|---|---|---|---|---|---|
| First Degree | Internal Stakeholders | | | | | |
| | Employees | A group of people employed in the Company having an impact on the efficient functioning of the Company Large | | Large | Large | High |
| | External Stakeholders | | | | | |
| | Tenants (Type A) | Low-income people in social or municipal housing belonging to the Companies | Direct influence | Large | Low | High |
| | Tenants (Type B) | People with stable but moderate incomes who have the right to rent a flat under the TBS | | Large | Low | High |
| | Property Owners | Housing communities as well as people with the ownership (usufruct) right to the housing premises | | Large | Low | High |
| | Entrepreneurs | People or entities renting out utility premises for the purpose of running a business | | Small | Low | Low |
| Second Degree | Local government bodies | Self-government of the city of Częstochowa | Indirect influence | Large | Large | High |
| | Organizational units of the commune | MOPS, State Employment Office and other institutions with which the Company cooperates as part of its operations | | Small | High | Low |
| | Academic environment | Czestochowa University of Technology | | Small | High | High |
| | Local society | People living in the city of Częstochowa | | Medium | Low | High |
| | Service Providers | Entities providing certain services to the resources of the Company | | Small | High | Low |
| | Social organizations | Entities and institutions implementing social goals | | Small | High | Low |
| | Media | Mass media through which information about the Company is provided | | Medium | Low | High |

Source: own study.

The obtained results (Table 2) showed that in the case of H1 and H2, the null hypothesis should be rejected in favor of the alternative hypothesis. In view of the above, it can be concluded that the stakeholders of the municipal housing manager expect him to engage in socially responsible activities (as well as understand their needs and expectations).

**Table 2.**
*Dependencies in the perception of CSR and the implementation of the activities of the municipal housing manager*

| Stakeholders | Statistic value | Meter value | Value that determines the area of rejection | Adopted hypothesis |
|---|---|---|---|---|
| engaging in CSR activities | 207,71 | 0,31 | 37,65 | H1 |
| understanding needs and expectations | 57,39 | 0,18 | | H1 |

Source: own study.

Taking into account H3, the analyses were carried out in each of the three selected groups (employees, residents of resources, entrepreneurs) in relation to the three CSR goals pursued by the company:

- OBJECTIVE 1 local responsibility.
- OBJECTIVE 2 responsible employer.
- OBJECTIVE 3 environmental responsibility.

The obtained results allowed for the creation of three models (Figures 1-3).

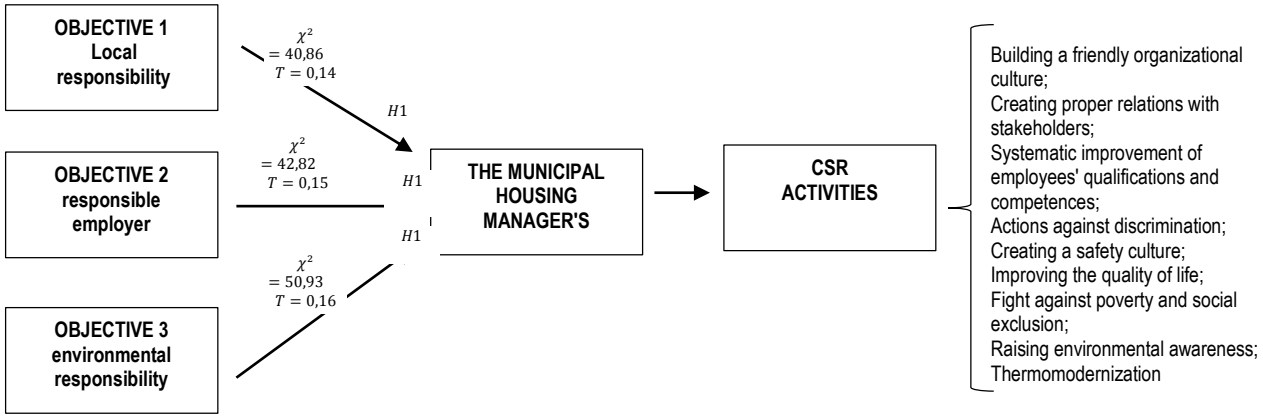


**Figure 1.** Model of the perception of CSR activities by the internal stakeholders of the city housing manager. Source: own study.

Model 1 results show that employees have a positive perception of socially responsible activities in each of the three goals pursued by the city housing manager. This is confirmed by the values obtained in the case of Objective 1, Objective 2 and Objective 3. Therefore, for each of the three considered objectives, the null hypothesis should be rejected in favor of the alternative hypothesis.

The obtained values are slightly different in the case of the perception of CSR activities by the inhabitants of the resources (Figure 2).

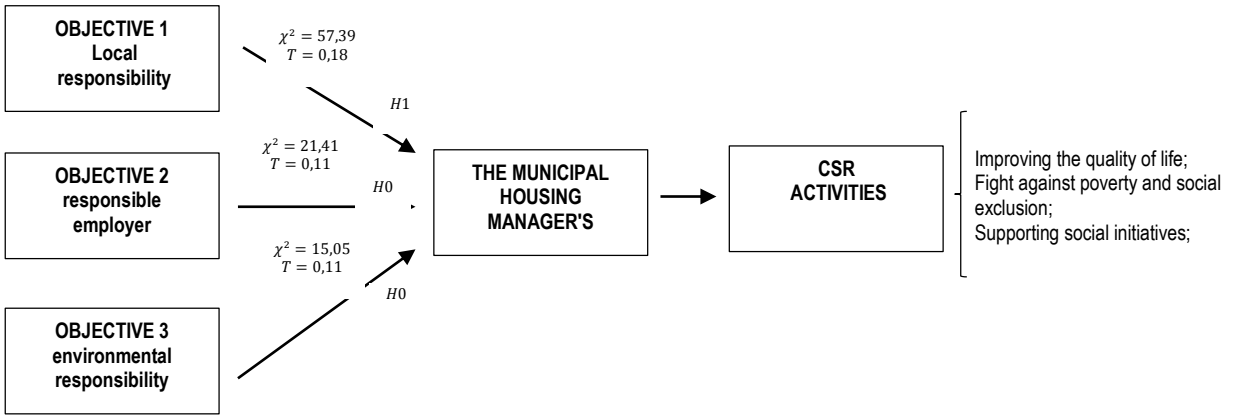


**Figure 2.** Model of the perception of CSR activities by external stakeholders of the city housing manager – residents of the resource. Source: own study.

As can be seen, the inhabitants of the resources positively perceive only the measures related to Objective 1 – which mainly refer to measures aimed at improving the quality of life in the housing resources. In other cases, the null hypothesis should be adopted, therefore, actions directed at employees (responsible employer) and the environment (responsibility for the environment) do not matter for the residents. Also entrepreneurs (Fig. 3) differently perceive the activities of the city housing manager in terms of CSR.

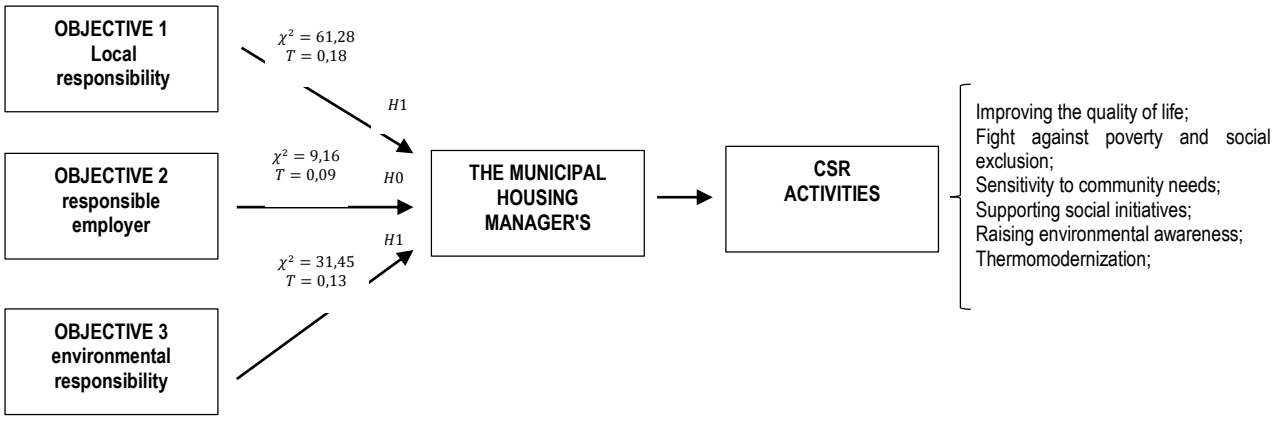


**Figure 3.** Model of the perception of CSR activities by external stakeholders of the city housing manager – entrepreneurs. Source: own study.

Entrepreneurs positively perceive the activities of the city manager in terms of local (and environmental) responsibility. For this group of stakeholders, actions towards employees are of little importance. Therefore, the null hypothesis should be rejected for Objectives 1 and 3, and adopted for Objectives 2.

Over the last few years, researchers (Song et al., 2013; Abugre and Anlesinya, 2019) emphasize that stakeholders play an important role in the implementation of CSR activities. The results of the available studies show that stakeholder pressure has a significant and direct impact on the adoption of CSR practices. While the relationship between CSR and stakeholders was previously viewed as characterized by constraints and exchange, an additional value-creation trait is now increasingly accepted. Our results show that in the case of municipal housing management, the implementation of CSR activities is perceived in various ways.

## Summary

This article refers to the perception of CSR activities by the municipal property manager. The research found that: the key stakeholders of the municipal housing manager are its employees. In addition, internal stakeholders perceive the need for CSR activities carried out by the municipal housing manager to a greater extent than external stakeholders. Tenants of the properties and owners of properties are stakeholders who are very interested in the activities of the Company, but have very little opportunity to influence its activities. In terms of CSR activities, they positively perceive the activities of the municipal housing manager in relation to the implementation of activities that have an impact on the local community. Entrepreneurs are influential stakeholders but do not have much interest in the activities of the Company, nor are they actively involved. In terms of CSR activities, they positively perceive the Company's activities that affect the local community and the natural environment. Concluding this article,

however, two issues should be noted: the results of the research conducted allowed to establish that, firstly, the stakeholders of the municipal housing manager expect actions related to the improvement of the quality of life, which applies to both employees and residents. The great role and possibilities of the manager of council flats in achieving social effects thanks to CSR activities should also be noted. Especially in the field of creating social innovations that increase the quality of life in a common space, the safety of residents and build their environmental awareness, both from the point of view of employees and residents

## References


1. Anlesinya, A. and Abugre, J. (2021). Strategic CSR practices, strategic orientation and business value creation among multinational subsidiaries in Ghana. *Society and Business Review*.
2. Banerjee, S., and Wathieu, L. (2017). Corporate social responsibility and product quality: Complements or substitutes? *International Journal of Research in Marketing*, *Vol. 34, Iss. 3,* 734-745.
3. Barić, A. (2017). Corporate social responsibility and stakeholders: review of the last decade (2006-2015). *Bus. Syst. Res.*, *8,* 133.
4. Bhattacharya, C.B., Korschun, D. and Sen, S. (2008). Strengthening Stakeholder–Company Relationships Through Mutually Beneficial Corporate Social Responsibility Initiatives. *Journal of Business Ethics, 85,* 257-272.
5. Borowska-Żywno, A. (2018). Innowacje społecznie odpowiedzialne, społeczna odpowiedzialność biznesu – wyzwania, dylematy, trendy. *Marketing i Rynek, No. 11,* 49-55.
6. Bylok, F. (2005). Wzór sukcesu w społeczeństwie polskim w okresie transformacji społeczno-ustrojowej. *Annales*, *8(1),* pp. 87-96.
7. Correia, M.S. (2019), Sustainability: An Overview of the Triple Bottom Line and Sustainability Implementation. *International Journal of Strategic Engineering*, *Vol. 2(1).*
8. Delmas, M.A. and Toffel, M.W. (2008). Organizational responses to environmental demands: Opening the black box. *Strategic Management Journal, 29(10),* 1027-1055.
9. Dziadkiewicz, M, Cichowski, P. (2018). Participation of tenants and the quality of management services of communal apartments. *European Journal of Service Management 26,* 61-69.
10. Dziadkiewicz, M. (2014). Centre of Social Integration as a tool of professional reintegration of the permanently unemployed in Czestochowa. *Polish Journal of Management Studies, Vol. 9*, pp. 23-33.

11. Ellemers, N. and Chopova, T. (2022). *The social responsibility of organizations: Perceptions of organizational morality as a key mechanism explaining the relation between CSR activities and stakeholder support.* Research in Organizational Behavior. Available online, 2.02.2022, 100156.
12. Kabus, J. (2017). External Stakeholders in Higher Education Governance. *Ekonomika i Organizacja Przedsiębiorstwa, nr 9(812)*, pp. 32-41.
13. Kang, B. (2014), Corporate Social Responsibility Perceptions and Corporate Performances. *Journal of Applied Sciences*, *vol. 14, iss. 21*, pp. 2662-2673.
14. Khuong, M.N., Truong, N.K. and Hang, T.T. (2021). Stakeholders and Corporate Social Responsibility (CSR) programme as key sustainable development strategies to promote corporate reputation—evidence from Vietnam. *Cogent Business & Management*, *8, 1,* 1917333.
15. Kucharska, W., and Kowalczyk, R. (2019). How to achieve sustainability?—Employee's point of view on company's culture and CSR practice. *Corporate Social Responsibility and Environmental Management*, *26*(2), 45.
16. Kuraszko, I., (2010). *Nowa komunikacja społeczna wyzwaniem odpowiedzialnego biznesu.* Warszawa: Difin.
17. Macassa G., Francisco, J.C., and McGrath, C. (2017). Corporate social responsibility and population health. *Health Science Journal*, *11*, 528.
18. McAdam, R., and Leonard, D. (2003). Corporate social responsibility in a total quality management context: Opportunities for sustainable growth. *Corporate Governance, 3(4),* 36-45.
19. Mele, D. (2009). *Business Ethics in Action. Seeking Human Excellence in Organizations.* New York: Palgrave Macmillan.
20. Mohr, L.A., Webb, D.J. and Harris, K.E. (2001). Do consumers expect companies to be socially responsible? The impact of corporate social responsibility on buying behavior. *Journal of Consumer Affairs, 35*, 45-72.
21. Mona, H.T. Saleh, Ebeid, A.Y. and Abdelhameed, T.A. (2015). Customers' perception of Corporate Social Responsibility (CSR): its impact on word-of-mouth and retention. *Innovative Marketing*, *11(2),* 49-55.
22. Nadanyiova, M. (2021). The perception of corporate social responsibility and its impact on consumer buying behaviour in the process of globalization. *SHS Web of Conferences, 92,* 06024.
23. Olejniczak-Szuster, K. (2021). *Przedsiębiorca społecznie odpowiedzialny: motywy strategie działania w dobie pandemii COVID-19*, Częstochowa: Wydawnictwo Politechniki Częstochowskiej.
24. Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Adm. Policy. Ment. Health., 42(5),* 533-44.

25. Polonsky, M.T. (2015). A stakeholder approach to corporate social responsibility, reputation and business performance. *Social Responsibility Journal*, *11(2),* 340-363
26. Porter, M.E., and Kramer, M.R. (2006). Strategy and society: The link between corporate social responsibility and competitive advantage. *Harvard Business Review*, *84(12),* 78-92.
27. Post, J.E., Lee, E.P., and Sachs, S. (2002). Managing the Extended Enterprise: The New Stakeholder View. *California Management Review*, *45(1),* 6-28.
28. Ratajczak, M. (2016). Knowledge of the concept of corporate social responsibility in agribusiness enterprises (based on the example of the SME sector in Malopolska). *Management, Vol. 20, No. 1,* 337-351.
29. Sacconi, L.A. (2006). Social contract account for CSR as extended model of corporate governance (I): Rational bargaining and justification. *Journal of Business Ethics,* 63, 259-281.
30. Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management, 28(2),* 163-1.
31. Skiba, Ł. (2021). Managing Employee Engagement in the Reality of Organisational Changes. *Polish Journal of Management Studies*, *24(1),* pp. 354-372.
32. Song, H., Lin, W., Lin, Y., Wolf, A.B., Neggers, R., Donner, L.J., Del Genio, A.D., and Liu, Y. (2013). Evaluation of precipitation simulated by seven SCMs against the ARM observation at the SGP site. *J. Climate*, *26*, 5467-5492.
33. Story, J. and Neves, P. (2015), When corporate social responsibility (CSR) increases performance: Exploring the role of intrinsic and extrinsic CSR attribution. *Business Ethics: A European Review, 24(2),* 111-124.
34. Tang, Z., & Tang, J. (2018). Stakeholder corporate social responsibility orientation congruence, entrepreneurial orientation and environmental performance of Chinese small and medium-sized enterprises. *British Journal of Management*, *29(4),* 634-651.
35. Tomaselli, G., Garg, L., Gupta, V., Xuereb, P.A., and Buttigieg, S.C. (2018) Corporate social responsibility communication research: state of the art and recent advances. In: D. Saha D. (ed.), *Advances in Data Communications and Networking for Digital Business Transformation, Chapter 9* (pp. 272-305). Hershey, PA: IGI Global.
36. Ullah, S., Jamali, D. and Harwood, I.A. (2014). Socially responsible investment: Insights from Shari'a departments in Islamic financial institutions. *Bus. Ethics: Eur. Rev.*, *23,* 218-233.
37. Watson, R., Wilson, H.N., Smart, P., & Macdonald, E.K. (2018). Harnessing difference: A capability-based framework for stakeholder engagement in environmental innovation. *Journal of Product Innovation Management, 35(2),* 254-279.
38. Yu, J., Lo, C.W.-H., & Li, P.H.Y. (2017). Organizational visibility, stakeholder environmental pressure and corporate environmental responsiveness in China. *Business Strategy and the Environment*, *26(3),* 371-384.

39. Yu, Y., and Choi, Y. (2016). Stakeholder pressure and CSR adoption: The mediating role of organizational culture for Chinese companies. *The Social Science Journal*, *53*, 226-235.
40. Žukauskas, P., Vveinhardt, J., and Andriukaitienė, R. (2018). *Corporate Social Responsibility as the Organization's Commitment against Stakeholders*. London: IntechOpen.
41. Zukauskas, P., Vveinhardt, J., Andriukaitienė, R. (2018). *Corporate Social Responsibility as the Organization's Commitment against Stakeholders*.

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# AGILE PROJECT MANAGEMENT AS A CHANGE MANAGEMENT TOOL IN DYNAMIC CONSTRUCTION PROJECTS, A NECESSITY TO COOP WITH PROJECTS' INCREASING COMPLEXITY AND UNCERTAINTY

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**Purpose:** The construction industry has one of the most important roles in any countries economy, despite of that, construction projects remain under the spotlight when compared to other industries projects due to its special nature and scope, with their increase of complexity which by default increases the amount of changes occurring therefore rising the risks of low performance, which is already an issue in the sector, construction management is facing more challenges than ever, this research paper was carried out in order to provide possible alternatives for the traditional way of managing construction projects.
**Design/Methodology/Approach:** A literature review was carried out exploring the necessities of implementing agile management in the field in order to coop with the increasing complexity and uncertainty of construction projects therefore increasing the overall performance, alongside identifying the potentials and limitations of such an approach.
**Findings:** As a result it was found that a tailored approach could be the answer to improve the whole sector and bring it up to date, using an integration of various methods of lean and agile management with traditional waterfall method, the agile management tools do show promising potential for the dynamic project nature which shows the importance of such an implementation.
**Originality/Value:** This paper provides cognitive scientific value by adding needed knowledge in a relatively immature research area for the practical development of one of the largest industries.

**Keywords:** Agile Project Management, Change Management, Construction Management, Lean Management.

**Category of the paper:** Research Paper.

## 1. Introduction

The construction industry is considered a risky field with a lot of external and internal factors influencing the industries uncertainties in the construction process, making it hard to achieve its best possible performance mainly due to low productivity (Salunkhe, Patil, 2014), Actually low performance is a common issue within construction projects, more precisely cost overruns and time delays, which have triggered the interest of both researchers and practitioners' alike (Mansfield, Ugwu and Doran, 1994; Meng, 2012), a generalized statistical view on projects in the United States gathered in the Chaos report with data belonging to 2012 shows that 43% of projects carried were either late, over budget or did not meet the requirements, in which 59% were cost overruns and 74% were time overruns, while 18% were considered a complete failure, moreover only 39% were a success with respect to the project objectives (Time, Cost and Quality) (Standish Group, 2013).

One cause for projects low performance that may lead to cost overruns or even project failure is project complexity (Kaming et al., 1997), while another cause identified was changes that happen within the project due to the dynamic nature of the design-construction process, which encourages interaction between various project aspects (site conditions, site constraints, cost, stakeholders involved etc) (Lee, Peña-Mora, and Park, 2006), in the meantime other scholars pointed out that the reason behind a projects low performance is the way that these projects are being managed as it strongly affects successful delivery (Olsson, 2006; Gil, Tether, 2011).

Despite the importance of project management for successful project deliverables and performance improve, yet still research in this field remains immature (Davis, 2014), moreover that traditional project management being no longer efficient (Hertogh, Westerveld, 2010), in addition to the level of complexity in projects alongside their size shows the importance of adopting a dynamic tailored managerial approach, but the underestimation of the dynamic project environment influence remains (Priemus, Bosch-Rekveldt, and Giezen, 2013).

This article aims to point out the necessity and potential of agile management in the construction industry in a tailored approach, alongside identifying its enablers and limitations within the construction industry.

## 2. Literature Review

### 2.1. Changes in construction projects

Amendments that are made to the original contract are considered changes, these amendments are usually submitted written as a change order or a change request, and must be signed by all parties involved, these amendments can include one or more of the following changes, changes in the design, changes in the methodology, changes in the specification & requirements or even changes in materials, site, equipment and works completion, it should also be noted that these amendments are not limited to what was previously mentioned, thus they can change the provisions of the initial agreement effectively as they may also include money or time compensations (Klinger, Susong, 2006).

Despite the inevitability of changes in construction projects and the fact that these changes may occur from various sources by many different causes at any point of the project, furthermore them being considered as one of the main reasons behind projects' budget overruns and delays, yet still the decision making process in response to these changes often remains based on previous professional personal experience with them generally lacking sufficient information to base these decisions on.

Changes can be divided into different phases, the first one is specification related in which the architect or the client/owner is the stakeholder at this phase, amendments that occur during this phase include changes that are applied to project requirements, more precisely specification, scope or the design of a project, moving on to the second phase, changes at this phase tend to occur the design stage, at this phase of this stage the engineering consultant or the designer is considered to be the stakeholder, amendments at this phase usually include but also not limited to defects or errors in the design, changes in the design, buildability or site conditions omissions, the incompletion or inconsistency of drawings and codes or regulation changes, as for the third phase which happens during the construction stage of the project, at this phase the contractor is considered the stakeholder, as these changes are influenced/requested by the contractor, the amendments at this phase include modifications to the as-built drawings as they do not comply with the as-design drawings, quality defects, unanticipated site conditions, inclement weather conditions, value engineering and the unavailability of certain materials or equipment (Hao et al., 2008).

Although the previously mentioned changes are differentiated into phases, it should also be noted that these phases usually integrate in a way or another during the projects' lifecycle, in other words they can move back and forth within the project, which focuses the importance of improving the communication process by increasing its frequency in order to increase the flexibility and overall project performance.

The main objective of change management is to be able to foresee changes that might happen during the lifecycle of a project and since changes tend to go through a formal process, despite of them having a major impact on the project or not, nor them being variation orders or reworks, therefore a process model was created or rather say identified by reviewing synthesis models of change processes and their computational environment characteristics, which can be sequenced as follows (Hao et al., 2008):

1. Identification of Changes: In order to be able to implement changes while building an effective relationship between various possible outcomes and requirements, an effective managerial system forms a necessity rather than an accessory.
2. Purpose & Evaluation of Changes: a PCO (proposed change order) that has an impact assessment report of the possible outcomes of applying the changes requested on the project as a whole, this report must include but not be limited to the changes impact on the individuals and processes in both terms of time and cost, furthermore an analysis optimizing processes within the change with other projects' processes if possible, and whether a further investigation is needed or that it is alright to proceed.
3. Approval of Changes: a formal sequel of approvals takes a place right after the PCO identifying the changes has been submitted, this sequel varies from one contract to another depending on the type of the contract, moreover on the change type itself. After establishing a change review process all parties involved must agree on the submitted PCO, afterwards the final approval is the clients to make so the PCO can be finalized, this step may also include further improvements or modifications to these changes, after approving these changes, the contract is modified directly, otherwise it's either forced throughout a CCD (construction change derivative) or it is permanently rejected.
4. Implementation of Changes: this process step is more about documentation rather than decision making, all parties involved must record all relevant information of any change case that happens on their established database for future reference, the database should be kept up to date and all parties involved should be notified, to guarantee a smooth coordination between all activities and well executed in order to be able to produce a change analysis report at a later stage.
5. Analysis of Changes: after the implementation process is due, the data collected and recorded as a result is obtained for analysis and performance assessment.

The construction phase forms a challenge facing the efficient implementation of a change management process module as it requires an integrated coordination system where everyone and everything are involved in the process of changes, furthermore the change management modules that are available in the market are more of a document approval and information recording, rather than change order traceability, post-change or impact analysis and not even estimation (Hao et al., 2008).

A change management system that integrates many project aspects from a collaborative workflow with the system to the collaborative technologies including modelling, online documentation management tools in addition to web-based project management tools in a cooperative way is required (Hao et al., 2008).

### 2.2. Agile management necessity in construction projects

APM (Agile Project Management) can be defined as a broad managerial approach built on specific principles that aims to render the project management processes into a more straightforward, iterative and flexible type, so performance improvements can be achieved with a higher innovation levels and value adding to the customer, all while maintaining a lower effort in terms of management (Conforto, Amaral, 2010).

Tools and equipment are highly valued in the construction field in comparison with other fields, as the common belief states that the requirements of these kind of projects and work scope can't be achieved without machinery, more or less on the truthfulness of the previous statement, the construction industry did show promising managerial improvements in previous recent years, as it transacted to location based management system instead of traditional management system alongside an increase in reliance on personnel (Iqbal, 2015).

Furthermore both sides of the equation (documentation and successful product delivery) are equally and excessively valued in the construction industry, therefore changes in requirements that are not forced by special circumstances nor requested by the client in order to perfectionalize end result can sometimes be proposed, these changes in requirements often results in wastes which are considered not leant, the last planner approach does show potential for these cases (Iqbal, 2015).

It is not debatable that all businesses including the construction industry value the contract and its importance, as it the most binding document, yet still revisions that contracts go through remains tremendous and changes tend to happen, and since changes are already happening at this phase, therefore an agile index prioritizing the client shows a futuristic potential and applicability (Iqbal, 2015).

Agile management provides a framework that consists of work break down structure, in addition to working on a shorter iterations, improving project's activities and team's personnel responsiveness and adaptiveness to changes that occur (Iqbal, 2015), also (Demir et al, 2012) suggest that for construction projects agile IT can have a more suitable approach in the field rather than agile manufacturing.

### 2.3. Agile methodologies

Despite all the variations within agile methodologies from Kanban to Scrum and more, the primary objective of considering the most recent information available remains the same, in addition to minimizing changes impact and addressing risks as early as possible (Cooke, 2012; Yllén, 2012).

**SCRUM**

Scrum is one of agile management tools that focuses on organizational splitting by creating self-organizing teams and dividing the work activities into smaller iterations that have clear deliverables while maintaining a prioritization list of each, in addition to breaking down the overall time structure of each activity into a relatively shorter and fixed intervals, all that while maintaining frequent optimization of processes according to the plan, in the meantime keeping customers involvement, furthermore frequent updates after each phase completion is a must (Kniberg, Skarin, 2010).

According to (Kniberg, Skarin, 2010) Scrum has three prescribed roles:

1. Product Owner (Priorities and Vision).
2. Scrum master (Leadership).
3. Team (Implementation).

Moreover Scrum also has three prescribed fixed time iterations know as (sprints), following are these iterations as identified by (Kniberg, Skarin, 2010):

1. Beginning of Iteration (Planning & Prioritizing).
2. During Iteration (Improve & Complete Within Fixed Scope).
3. End of Iteration (Deliver, Discuss).

Additional roles can be added without any limitations despite of scrums prescriptions, as long as these tasks are well identified and clear so contradictions and conflicts can be avoided between any of the added roles (Kniberg, Skarin, 2010).

A WBS (work breakdown structure) is a necessity in scrum as it simplifies processes, and since processes within scrum must completely fit in the sprint so that when the sprint is completed, all included processes within it must be finished as will, therefore the WBS process simplification is important to adapt the processes with the specified sprint, since the sprint duration iteration period is optional as long as it is kept fixed, increasing sprint duration in order for the processes to fit within also proposes another option for adapting processes to sprints, and due to construction projects activities nature the second option does look appealing (Kniberg, Skarin, 2010).

Velocity calculation is also essential in scrum as the whole method evolves around sprints, the velocity in scrum is a measure of capacity therefore each team must determine the effort (amount/size) that was done for each completed process at the end of each sprint, calculating the velocity of each sprint can provide an information and indication of how much work can be

delivered within a certain specified time duration or in the sprints case iterative interval, in order to calculate the velocity the work completed must be summed up to end up with a measure of the whole size of work that was done within a sprint and the end result would be the sprints velocity, furthermore in order to improve futuristic predictions accuracy an average of velocities can be calculated and with the right WBS the time planning process improves in terms of completion dates accuracy (Kniberg, Skarin, 2010).

**Kanban**

Kanban is one of the other agile management tools which also supports splitting but using a different approach, in this tool a process visualization is created in which the work to be carried out is broken into a smaller work iterations where each work process that is a result of the work breakdown is specified under the phase that is most relevant, afterwards a WIP (work in progress) is created in order to limit the number of processes in each workflow to a certain number, then a measure of the cycle time (lead time) takes a place, cycle time is defined as the average time needed to complete on cycle and afterwards lead time is to be minimized as much as possible (Kniberg, Skarin, 2010).

Kanban focuses on cycle time reduction which creates a WBS by default, therefore the user of this agile tool is not obligated to establish a certain level of WBS for it to fit within a frame/board, in other words the same board consisting a certain timeframe can have processes that takes a month or more to complete an others that can be finished within one working day (Kniberg, Skarin, 2010).

Kanban has a more adaptive approach rather than the prescriptive approach that scrum has, therefore the user is not obligated to be using any certain calculation/estimation method, so this tool user has the freedom of choosing whatever method they find best fit for their project necessities (Kniberg, Skarin, 2010).

### 2.4. Agile management tools comparison

When comparing agile management tools with traditional managerial methods, agile is considered to be light weighted, in other terms it is less prescriptive. As for flexibility within agile itself, if it is to be identified by the number of rules that each tool uses and has, the scrum is considered to have more than Kanban, therefore it can be said that it is more prescriptive than adaptive, yet still it remains less prescriptive than approaches that use traditional methods and tools (Kniberg, Skarin, 2010).

If it was for agile tools to be organized from the least prescriptive tool to the most ordered respectfully, Kanban tool takes the lead and SCRUM follows it, then XP (eXtreme programming) takes a place and RUP (rational unified process) is considered the most prescriptive of them all, stating the obvious scrum comes in the centre of both extremes (Kniberg, Skarin, 2010).

When comparing scrum to Kanban, three prescribed roles can be found in scrum but that doesn't mean the Kanban cannot also have prescribed roles, but this tool as previously mentioned doesn't obligate the user to implement any, as for the time iterations scrum unlike Kanban has to have a start date while in Kanban the user starts whenever they see suitable, thus it can be concluded that Kanban limits the work in process per workflow state compared to scrum that limits work in progress per iteration, since both tools are considered to be empirical, they tend to give constraints rather than providing all the answers, so the user of any or both can personalize their method in relevance to their personal experience and projects requirements (Kniberg, Skarin, 2010).

In terms of planning velocity is calculate for scrum while cycle time is used within Kanban, moreover it is necessary to establish a work break down structure in scrum as for Kanban there is no limit for the work breakdown level, furthermore work in process within Kanban is directly limited directly while using scrum is limited indirectly, unlike scrum Kanban allows the user to add more processes in an ongoing sprint as long as the capacity allows it (Kniberg, Skarin, 2010).

The two tools that were discussed earlier are considered to be both agile and lean, as they both adopt the scheduling pull method, in addition to inventory management using JIT (just in time), in addition the continuity and process optimization is considered a part of kaizen lean management, furthermore scrum and Kanban are equally change responsive, therefore the key to a successful implementation is tools integration, so rather than having sticking to one tools limitations, integrating these tools maybe the way to ease improvements (Kniberg, Skarin, 2010).

### 2.5. Integrated project management

Many approaches are pointing out the great possible outcome of an integration, (Hassan, Khodeir, 2019) recommended Integrating agile project management with the traditional method, furthermore (Zender, de Soto, 2020) find a great potential in combining scrum with lean management, pointing out that it can be a mid-grounds between the two approaches (Sohi et al., 2016) also suggest an integrated combination of agile and lean supported by the correlation analysis conducted and concluded that the use of agile and lean practices can help coop with projects complexity increase.

#### Agile Integration with Lean

In order to improve adaptation to the increase of complexity in projects now a days, an agile-lean management integration was suggested as a solution, according to a correlation analysis that was conducted between the two methodologies, a total of twenty-five correlations were tested in which eight of them were found to be significant correlations between both managerial methodologies, the correlation elements also resulted in a significant reduction in project complexity, moreover in a subsequent research that was conducted it was concluded

that an overall improvement in project performance was documented due to the reduction of project complexity (Sohi et al., 2016).

Furthermore, an illustration of an agile-lean framework integration on the showed a combination of adaptability to changes alongside an elimination of wastes on the operational level, this integrated work frame serves best the more dynamic projects, as with higher dynamicity within a project the higher the uncertainty is, leaving the door open for more change causes to happen, the research also concludes that this integrated framework can be the best approach in improving projects performance by reducing projects' complexity (Demir et al., 2012).

A research investigation was initiated by reviewing literature and followed by quantitative analysis in order to identify the CSF (critical success factors) in both approaches, the identified multiple success factors included business strategies, motivation, leadership, trust in addition to organizational capabilities, the quantitative analysis also found that for agile the foremost important CSF is identifying the knowledge of the recipient, as in lean knowledge source identification was the CSF, furthermore the article concluded that trust between construction organizations and individuals is the most important CSF (Saini, Arif, and Kulonda, 2018).

Despite what was previously discussed regarding project complexity adaptation, agillean integration can cause an increase in project complexity due to the increased frequent collaboration between the small self-organizing teams increasing the complexity of these relationships, in addition to frequent changes, thus to facilitate smoother application of the agilean integration coping with the increased complexity, and in order to establish a well-coordinated system that also allows dynamicity, Interface Management is proposed (Chen, Reichard, Beliveau, 2007).

**Agile Integration with Waterfall**

There are three different life cycle types that are supported, the namely predicative, iterative and incremental in addition to the adaptive which is also considered as a part of the iterative type (PMBoK, 2013), a waterfall-agile integration was established using empirical analysis resulted not only in the project's success but also to the positive contribution in information accuracy alongside commitment and leadership (Conforto, Amaral, 2016).

Moreover (Singhto, Phakdee, 2016) found in another study conducted on a software development project that integrates agile with waterfall using scrum tool concluded positive outcomes, as the waterfall allowed early problem identification while scrum allowed a better adaptation to the circumstances, which also increased customers involvement.

Thus it can be reasoned that the argument has shifted from which method is more suitable, to which method is right for which project, or including an integration between both methodologies (Van Der Merwe, 2017).

### 2.6. Agile management potentials in construction projects

Managers that use iterative planning while maintaining an incremental repetitive process of continuous learning can improve projects responsiveness to changes, moreover improving the cooperative environment can increase agility of construction projects (Arefazar et al., 2019), furthermore the precision of the plan in addition to the continuous update of the construction projects progress is considered a primary assumption for completing the construction project successfully and according to the terms of the contract and aligned with project goals of cost, time and quality (Kozlovska, Mackova and Spisakova, 2016).

It was found possible to apply the four values of agile by all parties involved in the construction project in addition to applying eleven out of twelve agile principles by the main parties involved according to the case study conducted (Mohammed, Jasim, 2018).

One of the important advantages of agile construction is its adaptive response to changes that happen to project requirements, in addition to increasing the understanding between the teams and the client due to the increase of interaction which leads to continuity of inputs (Balaji, Murugaiyan, 2012), furthermore the impact of implementing agile management in order to optimize changes influenced by stakeholders in projects we found to be as follows, achieving project goals within budget, a lower risk of project failure, competitive growth enhancement moreover an increase in customers demand in marketplace (Hassan, Khodeir, 2019).

Scrum also shows great potential for application in the construction sector, as the result of another case study that was conducted in Peru resulted in a flexibility increase in terms of responsiveness to changes, in addition to the reduction of overall project duration which meant an earlier delivery deadline which resulted in client noticeable valuation, furthermore the case study also noted a lower risk rate in situations that included high uncertainty, therefore stakeholders overall satisfaction. The study also found that it was also feasible to apply scrum-agile in an environment that is characterized by accelerating uncertainty, also the researchers found the approach also applicable to other work areas within the same project environment such as logistics, safety and quality (Zender, de Soto, 2020), to achieve what was previously discussed it is important for the project delivery system to develop in a way that eliminates barriers between designers and contractors by promoting partnership (Arefazar et al., 2019).

### 2.7. Agile management limitations in construction projects

Some of the limitations that were identified in construction projects were referred to cultural problems which cause a hardship in terms of creating self-organizing (self-managing) teams (Arefazar et al, 2019; Han 2013), in other words the workforce is not prepared enough professionally nor financially (Koch, 2005), moreover agile construction management lack of codes therefore the benefits of this approach has not been solidly proven in this particular field, thus stakeholders can find it risky compromising their limited resources including initial investment, in addition to the changes in work conditions for the other parties involved in the

project, forcing then to adopt a relatively complicated coordination processes while taking into consideration other external factors (Arefazar et al., 2019; Han, 2013).

The unusual sub-contracting and employment agreements that takes a place in construction projects is also identified as an obstacle facing agile management implementation in the field (Owen, Koskela, 2006; Owen et al., 2006) also cited in (Vaz-Serra, Hui, and Aye, 2019), moreover certain construction project phases cannot be flexible enough for such a methodological implementation due to these phases sequential nature (Demir et al., 2012) also the strict deadlines and scope that are ruled out by contractual and regulatory constraints (Turner, Downey, 1993; Chin, 2004), therefore agile management adoption can limited to certain project phases rather than a fully integrated implementation, moreover the special circumstances of each project should be brought into spotlight and highlighted, in addition to the high level of project complexity can lead to conflicts throughout project phases (Demir et al., 2012; Gustavsson, 2007).

## 3. Discussion

The growth of the construction industry in any country is considered a corner stone for measuring it's economic growth (Alzahrani, Emsley, 2013), due to the nature of projects, more precisely construction projects, it was pointed out that these projects go through many changes throughout their life cycle, of which limits the success of the end result delivery by causing delays, cost overruns and unsatisfactory quality (Lee, Peña-Mora, Park, 2006). Launching from the fact that the integration of these three project objectives (Time, Cost and Quality) is a measure of any construction projects success, and failing to maintain a consistency between all three is causing severe issues that can lead to projects failure, moreover not being able to foresee these indicators nor forecast project fails makes it a larger issue (PMI, 2010).

To address causes previously identified and according to previous studies it was concluded that projects go through external and internal factors that lead to projects low performance (Meng, 2012), the internal causes source can be traced back to the client, contractor, consultant, designer and subcontractor (material, equipment or labor) in addition to these parties interaction methods and ways, while the external causes can be referred to weather conditions, market fluctuations, regularity changes and unforeseen site conditions (Assaf, Alhejji, 2006; Hertogh, Westerveld, 2010), as for changes which are very common in the construction industry, these changes include any modifications made from revisions to addition or deletion happening to the goals or scope of a project, regardless of them increasing or decreasing any of the projects' objectives previously mentioned (time, cost and quality), therefore the continual update of the construction management documentation is an essential part for managing these changes as the construction management planning documentation is a reflection of efficient planning (Ibbs,

Wong, and Kwak, 2001), furthermore these changes are hard to predict due to the special nature of each construction project in addition to the limited resources spent on planning, executing and delivering the project which makes an impact on the projects' overall performance (Hanna et al, 2004).

Agile management can be a good tool to handle changes and uncertainties within construction projects (Han, 2013), as the increased adoption of agile within projects that are characterized by their uncertainties and unpredictability (Alleman, 2005; Cicmil et al., 2006), also with more than 80% adoption in large public sector projects and projects executed by global firms (Mah, 2008), moreover projects that used agile were found to be twenty times more productive compared to the ones that used traditional methods according to a study by (Rico, Sayani, and Sone, 2009), Furthermore 60% of agile projects were a success compared to only 47% success rate for traditional projects, 28% were challenges using agile in comparison with 36% using traditional, as for failures agile had a lower failure rate with only 12% when compared to the 17% using traditional (Scanlon-Thomas, 2011).

## 4. Conclusion

The construction industry has one of the most important roles in any countries economy, despite of that, construction projects remain under the spotlight when compared to other projects due to its special nature and scope, with their increase of complexity which by default increases the amount of changes occurring therefore rising the risks of low performance, which is already an issue in the sector, construction management is facing more challenges than ever, while writing this article it was found that agile management forms an answer to the low performance of construction projects, in relevance to projects complexity levels and various types of changes that occur during the projects life cycle, furthermore to the challenges that face the construction management system, moreover when looking at the tools and methods that agile management provides it shows a great potential in improving construction projects in terms of (cost, time and quality), it was also found that a tailored approach could be the answer to improve the whole sector and bring it up to date, using an integration of various methods of lean and agile management with traditional waterfall method, the agile management tools do show promising potential for the dynamic project nature which shows the importance of such an implementation, yet still due to its limited implementation within the construction industry, in addition to the fact that research in this particular field is not mature enough, worries and limitations rise still, in regards of these limitations a tailored approach can be the answer, especially when integrating different managerial approaches as agile-lean and agile-waterfall, finally addressing these limitations in future research forms necessity.

## References


1. Alleman, G.B. (2005). *Agile project management methods for IT projects. The Story of Managing Projects: An Interdisciplinary Approach*. 324-333.
2. Alzahrani, J.I., & Emsley, M.W. (2013). The impact of contractors' attributes on construction project success: A post construction evaluation. *International Journal of Project Management, 31(2),* 313-322.
3. Arefazar, Y., Nazari, A., Hafezi, M.R., & Maghool, S.A.H. (2019). Prioritizing agile project management strategies as a change management tool in construction projects. *International Journal of Construction Management*, 1-12.
4. Assaf, S.A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International Journal of Project Management, 24(4),* 349-357.
5. Balaji, S., & Murugaiyan, M.S. (2012). Waterfall vs. V-model vs. agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management, 2(1),* 26-30.
6. Chen, Q., Reichard, G., & Beliveau, Y. (2007). Interface management-a facilitator of lean construction and agile project management. *International Group for Lean Construction, 1(1)*, 57-66.
7. Chin, G. (2004). *Agile project management: How to succeed in the face of changing project requirements.* AMACOM/American Management Association.
8. Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: Researching the actuality of projects. *International Journal of Project Management, 24(8),* 675-686.
9. Conforto, E.C., & Amaral, D.C. (2010). Evaluating an agile method for planning and controlling innovative projects. *Project Management Journal, 41(2),* 73-80.
10. Conforto, E.C., & Amaral, D.C. (2016). Agile project management and stage-gate model—A hybrid framework for technology-based companies. *Journal of Engineering and Technology Management, 40,* 1-14.
11. Cooke, J.L. (2012). *Everything you want to know about agile: How to get agile results in a less-than-agile organization.* IT Governance Ltd.
12. Davis, K. (2014). Different stakeholder groups and their perceptions of project success. *International Journal of Project Management, 32(2),* 189-201.
13. Demir, S.T., Bryde, D.J., Fearon, D.J., & Ochieng, E.G. (2012). *Re-conceptualising agile for lean construction: The case for" agilean" project management.* Paper presented at the Procs 28th Annual ARCOM Conference, 3-5.
14. Gil, N., & Tether, B.S. (2011). Project risk management and design flexibility: Analysing a case and conditions of complementarity. *Research Policy, 40(3),* 415-428.
15. Gustavsson, T. (2007). *Agile-konsten att slutföra project*. TUK Förlag AB.

16. Han, F. (2013a). *Defining and evaluating agile construction management for reducing time delays in construction*.
17. Hanna, A.S., Camlic, R., Peterson, P.A., & Lee, M. (2004). Cumulative effect of project changes for electrical and mechanical construction. *Journal of Construction Engineering and Management, 130(6),* 762-771.
18. Hao, Q., Shen, W., Neelamkavil, J., & Thomas, R. (2008). *Change management in construction projects.* Paper presented at the Proceedings of International Conference on Information Technology in Construction,
19. Hassan, E.N.E., & Khodeir, L. *Impact of agile management on the optimization of change in construction projects: A literature review*.
20. Hertogh, M., & Westerveld, E. (2010). *Playing with complexity. management and organisation of large infrastructure projects*.
21. Ibbs, C.W., Wong, C.K., & Kwak, Y.H. (2001). Project change management system. *Journal of Management in Engineering, 17(3),* 159-165.
22. Iqbal, S. (2015). *Leading construction industry to lean-agile (LeAgile) project management*.
23. Kaming, P.F., Olomolaiye, P.O., Holt, G.D., & Harris, F.C. (1997). Factors influencing construction time and cost overruns on high-rise projects in Indonesia. *Construction Management & Economics, 15(1),* 83-94.
24. Klinger, M., & Susong, M. (2006). *The construction project: Phases, people, terms, paperwork, processes.*
25. Kniberg, H., & Skarin, M. (2010). *Kanban and scrum-making the most of both*. Lulu.com
26. Koch, C. (2005). *Failures in building operations-an occasion for learning?* Paper presented at the International Conference on Operations and Global Competitiveness-EurOMA. Budapest-Hungary,
27. Kozlovska, M., Mackova, D., & Spisakova, M. (2016). Survey of construction management documentation usage in planning and construction of building project. *Procedia Engineering, 161,* 711-715.
28. Lee, S., Peña-Mora, F., & Park, M. (2006). Web-enabled system dynamics model for error and change management on concurrent design and construction projects. *Journal of Computing in Civil Engineering, 20(4),* 290-300.
29. Mah, M. (2008). *Measuring agile in the enterprise*. Paper presented at the Proceedings of the Agile Conference, Canada: Toronto.
30. Manifesto, C. (2013). *Think big, act small*. The Standish Group International Inc, 176.
31. Mansfield, N.R., Ugwu, O.O., & Doran, T. (1994). Causes of delay and cost overruns in nigerian construction projects. *International Journal of Project Management, 12(4),* 254-260.
32. Meng, X. (2012a). The effect of relationship management on project performance in construction. *International Journal of Project Management, 30(2),* 188-198.

33. Mohammed, S.R., & Jasim, A.J. (2018). Examining the values and principles of agile construction management in Iraqi construction projects. *Journal of Engineering, 24(7),* 114-133.
34. Olsson, N.O. (2006). Management of flexibility in projects. *International Journal of Project Management, 24(1),* 66-74.
35. Owen, R.B., & Koskela, L. (2006). *Agility in construction*. Paper presented at the Proceedings of 20th IPMA World Congress on Project Management, 1-4.
36. Owen, R., & Koskela, L. (2006). *An agile step forward in project management*. Paper presented at the 2nd Specialty Conference on Leadership and Management in Construction and Engineering, 216-224.
37. Owen, R., Koskela, L., Henrich, G., & Codinhoto, R. (2006). *Is agile project management applicable to construction?*
38. PMBoK (2013). *A guide to the project management body of knowledge (PMBOK guide).* Project Management Institute Inc., 3-48.
39. Priemus, H., Bosch-Rekveldt, M., & Giezen, M. (2013). *Dealing with the complexity, uncertainties and risk of megaprojects: Redundancy, resilience and adaptivity. International handbook on mega-projects*. Edward Elgar Publishing.
40. Rico, D.F., Sayani, H.H., & Sone, S. (2009). *The business value of agile software methods: Maximizing ROI with just-in-time processes and documentation*. J. Ross Publishing.
41. Saini, M., Arif, M., & Kulonda, D.J. (2018). *Critical factors for transferring and sharing tacit knowledge within lean and agile construction processes. Construction Innovation*.
42. Salunkhe, A.A., & Patil, R.S. (2014). Effect of construction delays on project time overrun: Indian scenario. *Int. J. Res. Eng. Technol, 3(1),* 543-547.
43. Scanlon-Thomas, E. (2011). *Breaking the addiction to process: An introduction to agile project management.* IT Governance Ltd.
44. Singhto, W., & Phakdee, N. (2016). *Adopting a combination of scrum and waterfall methodologies in developing tailor-made SaaS products for Thai service and manufacturing SMEs.* Paper presented at the 2016 International Computer Science and Engineering Conference (ICSEC), 1-6.
45. Sohi, A. J., Hertogh, M., Bosch-Rekveldt, M., & Blom, R. (2016). Does lean & agile project management help coping with project complexity? *Procedia-Social and Behavioral Sciences, 226,* 252-259.
46. Turner, J.R., & Downey, A.B. (1993). The handbook of project-based. Management. Boston: McGraw-Hill.
47. Van Der Merwe, C. (2017). *How Relevant are Waterfall Project Management Methodologies in Today's Modern Project Environment*.
48. Vaz-Serra, P., Hui, F., & Aye, L. (2021). *Construction project managers graduate agile competencies required to meet industry needs*. Icsecm 2019. Springer, pp. 601-607.

49. Yllén Johansson, M. (2012). *Agile project management in the construction industry: An inquiry of the oppurtunities in construction projects*.
50. Zender, Y.O., & de Soto, B.G. (2020). *Use of scrum in the rehabilitation of a commercial building in Peru. Construction Innovation*.
51. Zhai, L., Xin, Y., & Cheng, C. (2009). Understanding the value of project management from a stakeholder's perspective: Case study of mega-project management. *Project Management Journal, 40(1),* 99-109. doi:10.1002/pmj.20099.

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# THE IMPACT OF INDUSTRY 4.0 ON THE EMPLOYMENT STRUCTURE IN PRODUCTION PLANTS

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**Purpose:** The aim of the study is to present the changes taking place in the employment structures of production plants, occurring as a result of the implementation of modern production management and control systems as well as the automation of production processes in line with the assumptions of Industry 4.0**.**
**Design/methodology/approach**: The study uses methods of analyzing literature sources and quantitative research with the use of interviews among production plants implementing new technologies in line with the assumptions of Industry 4.0.
**Findings:** As a result of the analysis, the results were obtained indicating the direction of changes taking place in the employment structures of production plants implementing automation of production processes in line with the assumptions of Industry 4.0.
**Social implications:** The conducted analysis may increase social awareness of the need to adapt the skills and competences of employees to the needs of the market in the Industry 4.0.
**Originality/value:** The article presents an alanlize indicating the direction of changes taking place in the employment structure in production plants implementing the assumptions of Industry 4.0, which were compared with the assumptions of the literature.

**Keywords:** Industry 4.0, employment structure, market needs.

**Category of the paper:** Case study.

## 1. Introduction

Recently, a dynamic development of technology has been observed, allowing for revolutionary changes in the way production plants operate. Changes in the technological area, as well as those concerning the philosophy of management, relate to virtually all areas of business operations. The technological possibilities that we currently have at our disposal and the prospect of their development mean that an unprecedented industrial revolution is taking place before our eyes (Woźniak et al., 2019). The great interest in the new approach is due to the potential benefits of using solutions appropriate for a given production plant. Changes

taking place in the area of technology of production works, but also management systems, cause, among others, an increase in the production capacity of the plant while reducing the waste (Rüßmann et al., 2015). To obtain a competitive level in the area of manufacturing process management, it is necessary to digitize production processes with artificial intelligence processes (Bieńkowski, 2018). This fact becomes the basis for the implementation of Industry 4.0 (Zhong et al., 2017). The ability of decision-makers to quickly adapt a production plant to the prevailing standards in the technological sphere and the method of process management is the basic factor enabling the survival on a market characterized by a high level of competition. Adapting production plants to the prevailing technological standards in line with Industry 4.0 requires a huge commitment of all employees, regardless of their position (Rymuszewska et al., 2017; Pedone, Mezgar, 2018). It is recognized that adapting to the ongoing changes may be particularly difficult for small and medium-sized enterprises (Müller et al., 2017). The implementation of new systems and reorientation of the method of conducting production works requires a partial or, in some cases, complete reconstruction of the organizational structure of the production plant, taking into account the human factor, as a key substitute for a properly functioning production process. Due to the scale of changes that take place in the structure of employment in a production plant and the role of a human being in the light of the implementation of the assumptions of Industry 4.0, many works have been written to describe the potential consequences that directly result from increasing the level of automation and reorienting the production management method (Müller et al., 2017, 2018b; Bendkowski, 2017; Birkel et al., 2019; Kiel et al., 2017). Research is also carried out (Müller, 2019) in the field of analysis and identification of difficulties that an employee may encounter in the case of implementing Industry 4.0 solutions and the associated consequences.

The purpose of the article was identification the changes taking place in the employment structures of production plants, occurring as a result of the implementation of modern production management and control systems as well as the automation of production processes that fit into the framework of Industry 4.0. The conducted analysis was based on the analysis of data from production plants with a high level of automation and computerization of production processes, in line with the philosophy of Industry 4.0. The collected information will allow to present the current situation on the labor market and the needs of production plants for a strictly defined profile of an employee.

## 2. The essence of Industry 4.0

Industry 4.0 marks the fourth industrial revolution, which is defined as a new standard of organization and control management throughout the product life cycle chain (Vaidhya, 2018). The aim of the fourth industrial revolution is to meet the individual needs of customers and to

develop other areas of the industry such as research and development of production concepts (Sang, 2018). In order to achieve the assumed goals, it is necessary to build intelligent IT platforms that will allow the monitoring of selected data in real time, which will directly facilitate the process of identifying potential inconsistencies in the manufacturing process (Almado-Lobo, 2015; Bahrin et al., 2016). Industry 4.0 is a generic term for sets of strategic frameworks and initiatives, and a technical term that refers to the newly emerging, digitization of business assets, processes and services (Radanliev et al., 2021). It is assumed that the fourth industrial revolution in the coming decades will be the engine of industrial development (Richert et al., 2016).

Huge interest in the subject of Industry 4.0 is caused by the deep conviction that the solutions proposed by this revolution will allow for the growth of individual production indicators, determining the position of a given entity on a highly competitive sales market (Kagermann, 2014). As already mentioned, Industry 4.0 is also often called the "fourth industrial revolution", thus referring to the previously occurring changes taking place in industry, i.e (Lis, Małysa, 2021):

- Industry 1.0 – an industrial revolution aimed at mechanization of production processes using water and steam powered machines.
- Industry 2.0 – increasing efficiency through the use of division of labor and electrification of machines.
- Industry 3.0 – automation of production processes using IT technology.

The concept of the fourth industrial revolution was first used in 2011 in Germany by a group associating representatives of science, business and politics. The initiative taken was related to the increase in the competitiveness of German companies on the global market (Kagermann, 2014). The increase in competitiveness is caused by assumptions based on the full integration of systems, computer networks and people with maximally (as far as possible) automated production processes using information technologies and the ubiquitous unification of the world of machines with constantly developing new data transmission technologies (Hermann et al., 2015). In Industry 4.0, cyber-physical systems are treated as general-purpose technologies that are based on the so-called "Internet of Things" (Lasi et al., 2014). The Internet of Things represents a developed and interconnected control system that uses a sensor and other connected devices to collect, exchange and analyze data to improve performance, energy management and other economic benefits (Boyes et al., 2018). Cyber-physical systems offer human-to-human relationship mechanisms, human-object and object-object interactions, which in the context of industrial production can be defined as cyber-physical production systems (Schlechtendahl et al., 2015). The use of cyber-physical systems in industry covers both production areas and logistics processes, while supporting the entire the production chain through real-time monitoring, forecasting, remote diagnostics of potential errors and remote control (Müller et al., 2018; Nicolescu et al., 2018).

The essence of the discussed industrial revolution is the reorientation of the decision-making side from the hands of people to the competences of artificial intelligence. Such action causes blurring the boundaries between what is digital and what is biological (Lis, Małysa, 2021). The assumptions of the new organization of work through the implementation of systemic activities in the area of Industry 4.0 are aimed at increasing the flexibility and efficiency of production works. The concept of automation of production processes supported by artificial intelligence tools allows for a comprehensive approach to the process by creating and using informal networks of knowledge and specialist knowledge cooperating with the human factor (Archibugi, 2015).

## 3. The role of man and the fourth industrial revolution

In the Industry 4.0 concept, human knowledge and skills play the most important role. One of the greatest concerns regarding the implementation and maintenance of the technological foundation that is the basis of the implemented industrial concept from the perspective of the human role is not a technological barrier, but a change in the organizational culture and the acquisition of new competences by employees (Bieńkowski, 2019).

The assumptions of Industry 4.0 assume that the role of man, his skills and qualifications will be the key to the effective implementation of the philosophy of Industry 4.0 in highly modern factories of the future (Gehrke et al., 2015). Progressive computerization production and focus on advanced technologies will be associated with significant changes in the professional qualifications profile of employees (Bendkowski, 2017). The requirements for the qualifications and skills of employees will be higher than today, because companies will use new technologies and intelligent media, therefore the method of educating employees will also change (Harkins, 2008; Huba, 2016). The selection of the right staff and the development of the current staff and their continuous training is a key factor and, at the same time, a challenge for the management of production plants (Armstrong, 2014).

In the Industry 4.0 concept, employees must perform more technologically complex tasks, such as cooperation with machines. The main task of employees is to observe and regulate highly automated complex processes and to supervise them rather than the physical execution of production works (Deuse, 2015). Therefore, the analysis of large amounts of data, design, control and interaction with machines in the case of Industry 4.0 are the basic elements of the future tasks of production plant employees (Gehrke et al., 2015). Due to the increase in automation and the change of the human role in the production process, in many cases the potential threat resulting from the implementation of Industry 4.0 is the reduction of employment (Ittermann et al., 2015). According to research conducted by the Fraunhofer Institute, most enterprises assume that the employment level in industry will remain unchanged

(Kurz, 2015). Undoubtedly, however, it can be said that regardless of the increase or decrease in employment in the context of the philosophy of Industry 4.0, the role of man in the organization is changing. The article (Bendkowski, 2017) presents two scenarios that describe the potential roles of humans in the highly automated factory of the future. The first scenario assumes full automation of production processes. Planning, scheduling and management of production resources will be carried out by social engineering production systems. The workforce will be reduced to a small group of highly specialized experts, whose primary responsibility will be to install and maintain systems coordinating production works. The group of blue-collar workers will be reduced, and they will perform basic activities that do not greatly affect the production capacity of the plant. The second scenario assumes that employees with specific skills control the production process with the support of intelligent computer systems. The discussed scenario describes the interaction and control of processes and employees with the assumption that a person is the decision-making party. In the works (Herrmann et al., 2014; Peukert et al., 2015) highlight the potential social benefits resulting from the implementation of industry 4.0 principles, which include compensation and increase in wages, which may directly translate into increased motivation in employees.

The impact of Industry 4.0 on human roles in a production plant is not yet known. Thanks to new technologies, the implementation of innovative control systems and the evaluation of existing production practices, we will not know the social consequences related to the implementation of the concept of Industry 4.0 until the future.

## 4. Purpose, scope and methodology of research

The aim of the study was identification the changes taking place in the employment structures of production plants, occurring as a result of the implementation of modern production management and control systems as well as the automation of production processes that fit into the framework of Industry 4.0. The conducted analysis was based on the analysis of data from production plants with a high level of automation and computerization of production processes, in line with the philosophy of Industry 4.0.

In order to carry out the analysis, first, production plants were selected, characterized by a high level of automation of production processes and an extensive IT network allowing for remote control of production processes and information flow. All analyzed production plants operated in the automotive industry, which over the years introduced numerous improvements in the implementation of automated production processes and changes in the level of management included in the assumptions of Industry 4.0. The decisive factor when choosing a given production plant was a significant increase in the degree of automation of individual production operations (at least 40% more than in the historical data). In each of the production

plants, by people with knowledge of the employment structure, questions were asked about the amount of employment in selected occupational groups and the level of education of employees (interview method). Then, the current state was compared with the historical state recorded in each of the production plants. Due to the different date of establishment of the analyzed plants, the period of historical data was between 5 and 10 years. For the purposes of the research, nine production plants with various levels of employment were analyzed (Figure 1).

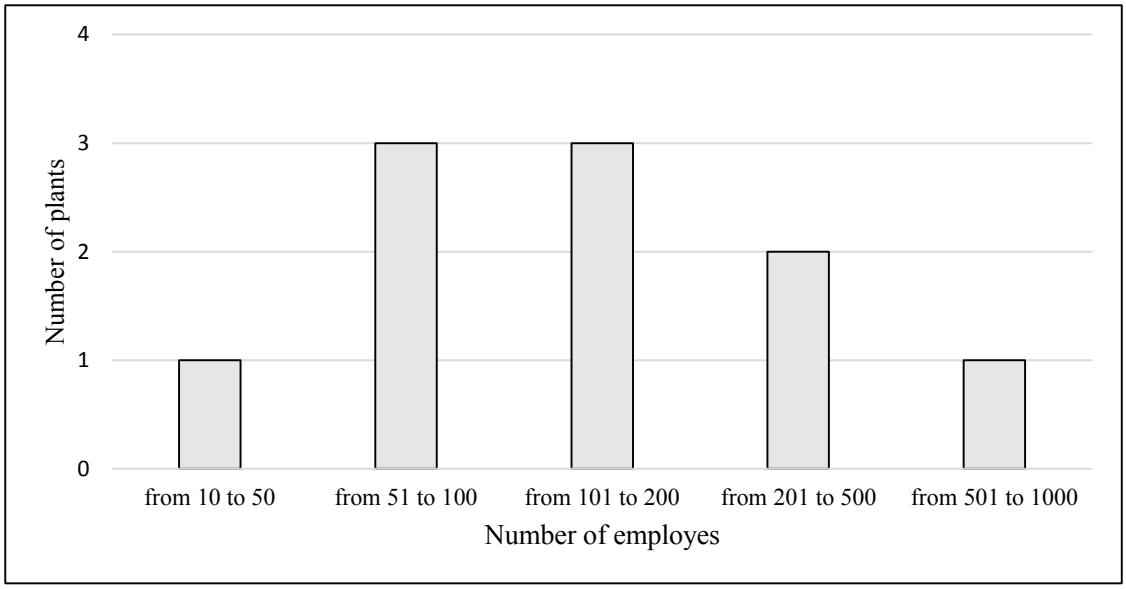


**Figure 1.** Employment in the analyzed production plants.

In each of the companies, the employment structure was divided and compared according to the positions held, which include, among others:

- Production workers (PW) – people who work physically on the production line, maintenance and warehouse.
- Engineers (E) – people managing production processes in terms of process control, production design and product technology, quality engineers.
- Administration staff (AS) – finance, HR, marketing, etc.
- Customer service (CS) – sales.

Then, an analysis of the level of education of employees was carried out, broken down into basic (B), primary (P), secondary (S) and higher education (H). The last verified element was the analysis of the number of people employed in the company over time. Due to the different level of quality of the information obtained in individual production plants, in 3 cases it was not possible to obtain information on the level of education of employees employed in the past.

## 5. Research results

As a result of the conducted analysis, average data on the employment structure in individual production plants were obtained, taking into account the positions held by employees and the level of their education now and in the past. The presented quantitative results also take into account the highest and the lowest levels recorded in the studied group (Figure 2, Table 1).

**Table 1.**
*Employment structure of employees of production plants in the past and today*

| Group | Current average employment [%] | Historical average employment [%] |
|---|---|---|
| **Production workers (PW)** | 61 | 72 |
| **Engineers (E)** | 9 | 10 |
| **Administration staff (AS)** | 19 | 12 |
| **Customer service (CS)** | 11 | 6 |

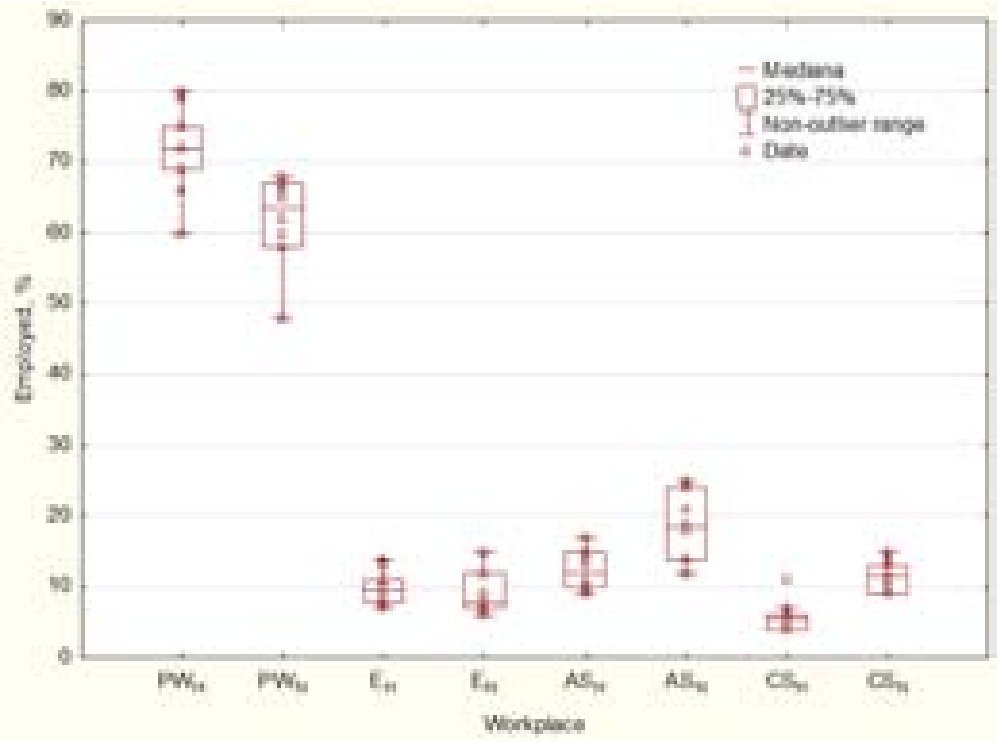


**Figure 2.** Employment structure of employees of production plants (where "H" – historical data, "N" – curent data).

The compiled data made it possible to indicate significant differences in the employment structure of production plants now and in the past. The biggest difference concerns the percentage increase in the administrative staff and sales compared to the historical data. There was also a significant decrease in the number of production workers, which seems to confirm the assumed trend described in (Kagermann et al., 2011). The high level of automation of individual production operations integrated with remote production control systems reduces the number of production stations to which manual workers are involved. The percentage decline in employment in a large group of production workers carries one of the threats

described, among others, in (Müller, 2019). It concerns the potential possibility of a decline in employment, which is directly related to an increase in the level of unemployment in the labor market.

In the case of the analysis of the level of education, the largest percentage change concerned the share of employees with higher education. Currently, the average level of employees with higher wages was recorded at the level of 39%, while in the previous years this share was 19%, which confirms the assumptions presented in (Müller et. al 2018b) concerning the greater demand for specialized staff in the case of implementing the assumptions of industry 4.0 (Figure 3, Table 2).

**Table 2.**
*Education of employees of production plants in the past and today.*

| Group | Current average employment [%] | Historical average employment [%] |
|---|---|---|
| **Higher (H)** | 39 | 19 |
| **Medium (M)** | 42 | 39 |
| **Professional (P)** | 15 | 30 |
| **Basic (B)** | 4 | 12 |

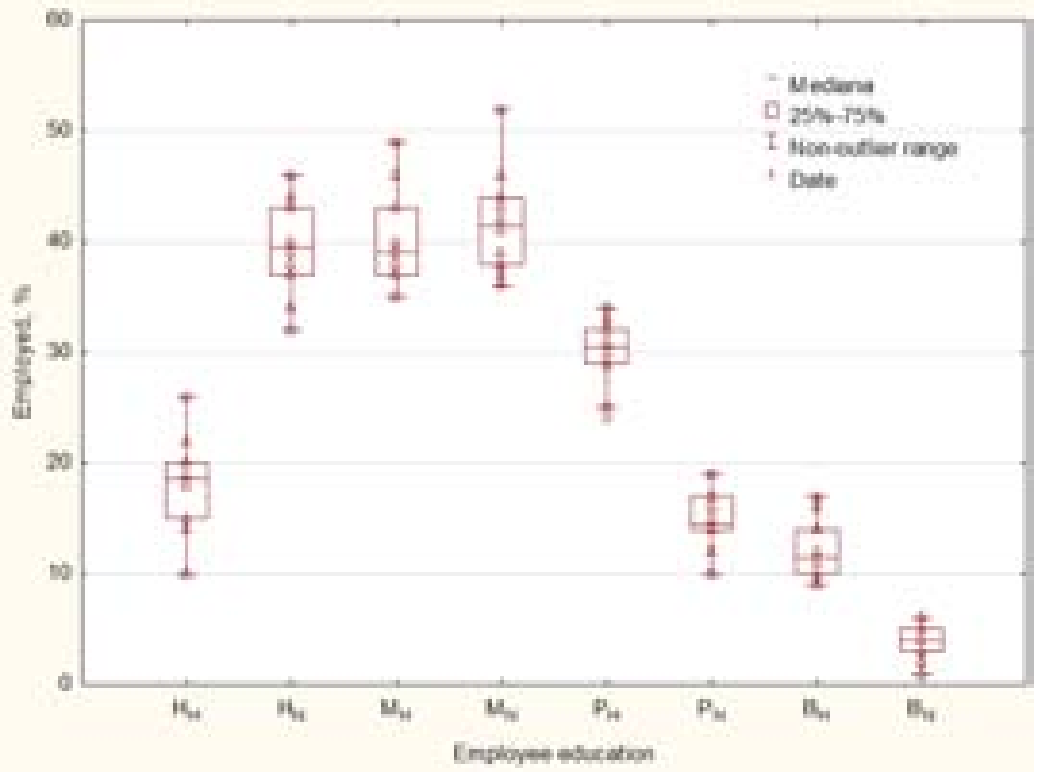


**Figure 3.** Education of employees of production plants where "H" – historical data, "N" – curent data).

One should also pay attention to a significant decrease in the case of employees with vocational and primary education. Currently, secondary vocational and elementary education in the analyzed production plants is 15% and 4%, respectively, while in the past it was 30% and 12%, respectively. Such a significant change may be related to the reduction of selected positions, e.g. in production, resulting from replacing human work with a machine. The social

risk related to the decline in employment of employees with a lower level of education, resulting, inter alia, from the reduction of many positions, is described in (Birkel et al., 2019; Kiel et al., 2017).

The obtained results in terms of the analysis of the percentage level of education seem to confirm the theses presented in the BGC (Boston Consulting Group) forecasts (Bendkowski, 2017). Indicating that due to the increase in automation and computerization of production processes and control, a larger number of specialized staff is necessary.

## 6. Summary

The increase in the level of automation of production processes resulting from the need to adapt to competition and the ubiquitous computerization of all production processes forces changes taking place in the employment structure. The requirements for the skills and competences of employees are evolving, many new positions are created that did not exist before, for example, manual workers who are replaced by robots or machines with a high level of automation. The occurring changes increase the level of production efficiency and the quality of the finished product, but may have a negative impact on certain groups of workers, which in many cases were the foundation in manufacturing plants (manual workers). As a result of the literature analysis and quantitative research aimed at identifying changes taking place in the structures of production plants with a high level of automation, it was found that:

- Currently, the average number of production employees has decreased by approximately 11% from the pre-deployment highly automated advanced production systems.
- There was an increase by 20% of employees with higher education compared to previous years.
- There has been a decline in the percentage of employees with basic and primary education as compared to the historical data (before the introduction of automated manufacturing systems).
- The data obtained from the quantitative analysis confirm most of the forecasts made in the literature on the subject of significant changes in the employment structures of production plants as a result of the implementation of advanced production systems with a high degree of automation and a change in the orientation of the management method in line with the assumptions of Industry 4.0.

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## References

1. Almada-Lobo, F. (2015). The Industry 4.0 revolution and the future of Manufacturing Execution Systems (MES). *Journal of Innovation Management, JIM,* pp. 16-21.
2. Archibugi, D. (2015). Blade Runner Economics: Will Innovation Lead the Economic Recovery? *Social Science Research Network.*
3. Bahrin, M., Othman, M., Nor, H., Azli, M. (2016). *Industry 4.0: A Review on Industrial Automation and Robotic.* Jurnal Teknologi (Sciences & Engineering), 137-143.
4. Bendkowski, J. (2017). Zmiany w pracy produkcyjnej w perspektywie koncepcji „Przemysł 4.0". *Zeszyt Naukowy Politechniki Śląskiej,* pp. 21-33.
5. Bieńkowski, M. (2018). Innowacyjne rozwiązania dla Przemysłu 4.0. *Automatyka,* pp. 26-34.
6. Birkel, H.S., Veile, J.W., Müller, J.M., Hartmann, E., Voigt, K.I. (2019). Development of a Risk Framework for Industry 4.0 in the Context of Sustainability for Established Manufacturers. *Sustainability*, pp. 384
7. Boyes, H., Hallaq, B., Cunningham, J., Watson, T. (2018): Przemysłowy internet rzeczy (IIoT): ramy analizy. *Komputer*, pp. 1-12.
8. Deuse, J. (2015). Gestaltung von Produktionssystemen im Kontext von Industrie 4.0. In: A. Botthoff, E.A. Harmann, *Zukunft der Arbeit in Industrie 4.0*. Berlin: Springer Vieweg.
9. Gehrke, L. (2015). *A Discussion of Qualifications and Skills in the Factory of the Future, A German and American Perspective.* Conference Paper.
10. Harkins, A.M. (2008). Leapfrog Principles and Practices: Core Components of Education 3.0 and 4.0. *Leapfrog Principles and Practices*, pp. 1-15.
11. Hermann, M., Pentek, T. (2015). Design Principles for Industrie 4.0 Scenarios: A Literature Review. *Technische Universität Dortmund Fakultät Maschinenbau, Working Paper*, pp. 23-24.
12. Herrmann, C., Schmidt, C., Kurle, D., Blume, S., Thiede, S. (2014). Sustainability in manufacturing and factories of the future. *International Journal of Precision Engineering and Manufacturing – Green Technology,* pp. 283-292.

13. Huba, M., Kozák, Š.F. (2016). *From E-learning to Industry 4.0.* International Conference on Emerging eLearning Technologies and Applications, pp. 103-108.
14. Ittermann, P., Niehaus, J., Hirsch-Kreinsen, H.: *Arbeiten in der Industrie 4.0: Trendbestimmungen und arbeitspolitische Handlungsfelder.* Düsseldorf: Hans-Boeckler-Stiftung.
15. Kagermann, H. (2014). Chancen von Industrie 4.0 nutzen. In: T. Bauernhansl T., M. ten Hompel, B. Vogel-Heuser, *Industrie 4.0 in Produktion, Automatisierung und Logistik*. Wiesbaden: Springer Fachmedien, p. 607.
16. Kagermann, H., Lukas, W., Wahlster, W. (2011). Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution. *VDI nachrichten, Nr 13*.
17. Kiel, D., Müller, J.M., Arnold, C., and Voigt, K.-I. (2017). Sustainable Industrial Value Creation: Benefits and Challenges of Industry 4.0. *International Journal of Innovation Management*, *21*, 8.
18. Kurz, C. (2014). Industrie 4.0 verändert die Arbeitswelt. Gewerkschaftliche Gestaltungsimpulse für „bessere" Arbeit. In: W. Schröter (Hrsg.), *Identität in der Virtualität. Einblicke in neue Arbeitswelten und „Industrie 4.0".* Mössingen: Talheimer Verlag.
19. Lasi, H., Kemper, H, Fettke, P., Feld, T., Hoffmann, M. (2014). Industry 4.0. *Business and Information Systems Engineering*, pp. 239-242.
20. Lis, T., Małysa, T. (2021). Zarządzanie bezpieczeństwem i higieną pracy w aspekcie wdrażanych rozwiązań Przemysłu 4.0. *ZN WSH Zarządzanie*, pp. 95-105.
21. Müller, J.M., Buliga, O., Voigt, K.-I. (2018). How SMEs approach business model innovations in Industry 4.0. *Technological Forecastingand Social Change,* pp. 2-17.
22. Müller, J.M., Kiel, D., and Voigt, K.I. (2018b). What Drives the Implementation of Industry 4.0? The Role of Opportunities and Challenges in the Context of Sustainability. *Sustainability*, *10*, 1.
23. Nicolescu, R., Huth, M., Radanliev, P., De Roure, D. (2018), Mapowanie wartości IoT. *J. Inf. Technol*, pp. 345-360.
24. Pedone, G., Mezg´ar, I. (2018). Model similarity evidence and interoperability affinity in cloud-ready Industry 4.0 technologies. *Computers in Industry*, pp. 278-286.
25. Peukert, B., Benecke, S., Clavell, J., Neugebauer, S., Nissen, N.F., Uhlmann, E. (2015). Addressing Sustainability and Flexibility in Manufacturing Via Smart Modular Machine Tool Frames to Support Sustainable Value Creation. *Procedia CIRP*, pp. 514-519.
26. Radanliev, P., De Roure, D., Nicolescu, R. (2021). Artificial Intelligence and the Internet of Things in Industry 4.0. *Pervasive Comp. Interact*, pp. 329-338.
27. Richert, A., Shehadeh, M., Plumanns, L., Schuster, K., Jeschke, S. (2016). *Educating Engineers for Industry 4.0.* Global Engineering Education Conference (EDUCON), Abu Dhabi, pp. 142-149.

28. Rüßmann, M., Lorenz, M., Gerbert, P., Waldner W. (2015). *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*, pp. 1-14.
29. Rymaszewska A., Helo P., Gunasekaran A. (2017). IoT powered servitization of manufacturing – an exploratory case study. *International Journal of Production Economics*, pp. 92-105.
30. Schlechtendahl, J., Keinert, M., Kretschmer, F., Lechler, A., Verl, A. (2015). Making existing production systems Industry 4.0-ready. *Production Engineering,* pp. 143-148.
31. Tae, K.S. (2018) A Korea perspective, Technological Forecasting and Social Change. *Industry 4.0*, *132*, pp. 40-45.
32. Vaidhya, S., Ambad, P., Bhosle, S. (2018). Industry 4.0 – A Glimpse. *Procedia Manufacturing*, *20*, pp. 233-238.
33. Woźniak, J., Zimon, D., Budzik, G. (2019). Industry 4.0 – identyfikacja technologii, które zmieniły przemysł oraz ich znaczenie w zarządzaniu logistycznym. *Przedsiębiorczość i Zarządzanie*, pp. 359-371.
34. Zhong, R.Y., Xu, X., Klotz, E. (2017). Intelligent Manufacturing in the Context of Industry 4.0: A Review. *Engineering*, *Vol. 3, No. 5,* pp. 616-630.

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# CULTURAL DETERMINANTS OF EVIDENCE-BASED HUMAN RESOURCES MANAGEMENT: A CROSS-COUNTRY ANALYSIS

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**Purpose:** This paper aims at providing comparative analysis of the influence of cultural determinants on the managers' perceptions of human resources management practices, as a factor conditioning application of evidence-based management.
**Design/methodology/approach:** This article presents the study of 121 managers in Poland, on their perception of HRM practices and analyses the consistency of findings with the Hofstede cultural dimensions model. Structured questionnaire developed by Rynes et al. (2002) in the US and used by Tenhiälä et al. (2016) in Finland, Spain and South Korea including 34 items on management practices, employment practices, training and development, staffing and compensation and benefits have been used. Comparative analysis of managers' perceptions in 5 countries have been performed, and analysed from the perspective of cultural determinants.
**Findings:** Significant differences among analysed countries have been noted in relation to managers' perceptions of HRM practices, interpreted using the Hofstede's model of cultural determinants. Five dimensions have been identifies as the most likely determinant of observable differences. Cultural factors have been found to explain perceptions of HRM practices in Poland, as well as in countries with both similar cultural dimensions profiles or shared characteristics.
**Research limitations/implications:** The empirical part – questionnnaire in Poland – was performed during Covid-19 pandemic, which might have affected the perceptions of managers on what works in relation to HRM practices, as well as the external conditions under which the research was performed changed significantly over the course of last two years.
**Practical implications:** Findings from the managers' survey have been analysed from the perspective of cultural determinants, therefore making a link between perceptions and measurable and well defined variables of cultural origin, as represented by Hofstede's dimensions. This implies, that more attention should be paid to culturally-grounded differences in cases where more evidence-based practices are intended to be implemented in organisations.
**Originality/Value:** Paper presents original research findings, by providing comparative evidence on the managers' perceptions of HRM practices in cross-cultural context, with application of the Hofstede cultural dimensions model.

**Keywords:** human resources management, culture, evidence-based management, managers' perceptions, cross-cultural management.

**Category of the paper:** Research Paper.

## 1. Introduction

As underlined by numerous studies, in their decisions managers are often guided to an inadequate extent by information, data or empirically verified evidence, stemming from reliable sources, including scientific study findings. This is not only due to the tendency to rely on one's own intuition or gut feeling, use of heuristics or succumbing to numerous errors of assessment. While evidence-based approaches are successfully used in other fields of science (e.g. in clinical medicine, but also other social sciences) management research and publications in this area are still underdeveloped. This results from contextual conditions, like dependence on "what works" on organisational or cultural determinants, but also from methodological or practical limitations (e.g. a small number or lack of controlled trails or points of reference, commonly used in other fields of science).

In practice, it is often difficult to find evidence for the effectiveness of specific Human Resources Management (HRM) practices, the consequences of various decisions, or a structured analysis of contextual factors, including cultural influences. Such information is often fragmentary, not based on sufficiently rigorous methodological assumptions, or is verified on small and randomly selected research samples. Thus, it is not only impossible to generalize them, but also to indicate conditions under which the conclusions can be transposed into other (analogous) situations or cultural contexts.

There is a growing interest in research of cultural differences on the use of evidence-based management, and more specifically HRM. Perceptions of managers of "what works" in relation to these practices, can influence their adoption in management practice. These perceptions are often not based on evidence, being sometimes contrary to scientific research findings. Differences of perceptions can be attributed to various factors, including individual characteristics or personal traits, diverse backgrounds or experiences. They may also be affected by cultural differences, but the available research on this problem is limited. Therefore an important research question emerges: *To what extent can the differences in managers perceptions on HRM practices be attributed to cultural differences?*

This article presents the study of 121 managers in Poland, on their perception of HRM practices and analyses the consistency of findings with the Hofstede cultural dimensions model. The article is structured as follows. First, I discuss the theoretical background of evidence-based HRM concept and influence of national culture on managers' perceptions of effective HR practices, using the Hofstede's cultural dimensions model. Then, I describe the methodology, the survey and analytical approach, as well as present key findings. Finally, I conclude with a discussion of the findings and their implications, limitations of the study, and directions for future research.

## 2. Literature review

### 2.1. Evidence-based Human Resource Management

Evidence-based HRM is a developing area of research, but at the same time inadequately defined and being explored empirically to a small extent. Managerial work involves in the first place rational and accurate decision making. Therefore, the term 'evidence-based' is often used in a broad sense to cover situations where data and evidence are used to inform decisions, together with other considerations. Barends et al. (2014) define evidence-based management as making decisions through the conscientious, explicit and judicious use of the best available evidence from multiple sources by translating a practical issue into an answerable question, systematically searching for and retrieving evidence, critically judging the evidence, pulling together the evidence, incorporating the evidence into the decision-making process, and then evaluating the outcome of the decision taken. Evidence-based HR uses data, analysis and research to understand the connection between people management practices and business outcomes such as profitability, customer satisfaction and quality (Economist…, 2015).

Barends et al. (2014) note that practitioners use different sorts of evidence in their decisions, but usually pay little attention to the quality of that evidence. Evidence used for decision making should be reliable, preferably based on scientific approach. As argued by Cooper & Schindler (2014), the scientific method**,** guides the approach to problem solving and decision making and is conditional on essential tenets, such as: direct observation of phenomena; clearly defined variables, methods, and procedures; empirically testable hypotheses; ability to rule out rival hypotheses; statistical rather than linguistic justification of conclusions; self-correcting process. According to the principles of evidence-based practice (Barends et al., 2014), evidence from four sources should be taken into account: (1) scientific evidence – findings from published scientific research, (2) organizational evidence – data, facts and figures gathered from the organization, (3) experiential evidence – the professional experience and judgment of practitioners, (4) stakeholder evidence – the values and concerns of people who may be affected by the decision.

According to Pfeffer and Sutton (2006), "evidence-based management is based on the belief that facing the hard facts about what works and what doesn't, understanding the dangerous half-truths that constitute so much conventional wisdom about management, and rejecting the total nonsense that too often passes for sound advice will help organizations perform better". Barends et al. (2014) provide evidence – referring mostly to clinical literature and studies, including meta-evaluations – that professional judgments based on hard data or statistical models are more accurate than judgment based on individual experience, and that knowledge derived from scientific evidence is more accurate than the opinions of experts. Therefore organisations are interested in an accurate assessment of the way things really are, one not skewed by emotion or limited to anecdotal evidence, as well as must diagnose the causes of whatever problems exist

and create plans to address the underlying causes (Harris et al., 2011). A study of Fortune 1000 companies by Falletta (2014), managers are interested in HR research and analytics primarily to make better human capital decisions by using the best available scientific evidence and organizational facts with respect to 'evidence-based HR' (i.e. getting beyond myths, misconceptions, and 'plug and play' HR solutions, fads, and trends). As Cooper & Schindler (2014) argue, the use of evidence and scientific method should grow with the hierarchy. While at the base tier "intuitive decision makers" prevail, at the top tier, every decision made by what they refer to as "visionaries" should be guided by research, performed on the basis of carefully controlled methodologies, with enterprise-wide access to research data and findings.

Firms which believe in evidence-based decision making have been more profitable as compared to their competitors (Ross et al., 2013), also in the field of human resources management (Subramony, 2009). Therefore, as duly noted by Tenhiälä et al. (2016), it „would seem reasonable that HR practitioners make use of scientific HR evidence in order to improve their decisions on which practices to implement within their organizations". However, the gap between research and practice is considered so enduring and pervasive that the shear possibility of it being narrowed is questioned (Lange 2013). On the practitioners side, Pepitone (2019) notes that managers' effectiveness is often closely linked to established decision guidelines and projectable performance outcomes, and as such, they are not expected to experiment and innovate in order to optimise their decisions. Environmental conditions can therefore "discourage managers from seeking and implementing new methods, even when these methods are validated through compelling research" (Pepitone, 2019). This observation is further supported by Carol (2018), who notes that one of the key barriers to using evidence-based practices is that neither HRM practitioners nor academia are incentivized to learn about evidence based practice and to change current practice, which has negative consequences for employees and organisations. In such innovation unsupportive environments there is high risk in deviating from organisational norms, even at the – often unclear – promise of possible increased performance outcomes stemming from new practices (Pepitone, 2019).

There might also be other rationales for ubiquitous scarce use of evidence-based HRM. One of the most important is availability of evidence for decision-making (Lange, 2013). Study by Bezzina et al. (2017) in three EU developing countries (Poland, Croatia and Malta) aimed at assessing the extent to which managers adhere to evidence-based HRM practices and not to unsupported beliefs. Findings revealed that managers tend to focus on easily accessible sources of knowledge, due to time constraints, inaccessibility and inability to evaluate evidence. As noted by Bezzina et al. (2017) this might imply that practitioners decisions are based on their personal experiences and beliefs, rather than evidence-based knowledge.

Also, decision-makers' background might be an important factor. Boudreau (2012) suggests that decisions made by leaders of diverse backgrounds (not HR-trained professionals) can be influenced by their dominant 'mental models', that are connected to their main management discipline (e.g. operations, finance or marketing).

### 2.2. National culture as a determinant of evidence-based approach

The application of evidence-base management practices can be dependent on cultural differences of respective managers. Environments in which managers function, as well as their work and life values can be strongly influenced by national cultures and their characteristics. One of the most recognised models is "cultural dimensions" model developed by Geert Hofstede (Hofstede, 1980; Hofstede and Hofstede, 2004). These dimensions (Power Distance Index, Individualism vs Collectivism, Masculinity vs Femininity, Uncertainty Avoidance, Long-term vs Short-term Orientation, Indulgence vs Restraint) represent collective values or orientations shared in a given nation/society, acquired through a process of socialization ("programming") in a particular country.

The six cultural dimensions are explained as follows[1]:

- **Power Distance –** the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally.
- **Individualism –** the extent to which people feel independent, as opposed to being interdependent as members of larger wholes. With a metaphor from physics, people in an individualistic society are more like atoms flying around in a gas while those in collectivist societies are more like atoms fixed in a crystal.
- **Masculinity –** the extent to which the use of force in endorsed socially. In masculine societies, "quantity is important and big is beautiful". In a feminine society, the genders are emotionally closer, competing is not so openly endorsed, and there is sympathy for the underdog.
- **Uncertainty Avoidance** deals with a society's tolerance for uncertainty and ambiguity. Uncertainty avoidance is neither the same as risk avoidance, nor following rules. It has to do with anxiety and distrust in the face of the unknown, and conversely, with a wish to have fixed habits and rituals, and to know the truth.
- **Long-term orientation** deals with change. In a long-time-oriented culture, the basic notion about the world is that it is in flux, and preparing for the future is always needed. In a short-time-oriented culture, the world is essentially as it was created, so that the past provides a moral compass, and adhering to it is morally good.
- **Indulgence** is about the good things in life. In an indulgent culture it is good to be free and doing what your impulses want you to do, is good. Friends are important and life makes sense. In a restrained culture, the feeling is that life is hard, and duty, not freedom, is the normal state of being.

As noted by Ybema and Nyíri (2015) "Geert Hofstede's work can be credited for making 'national culture' popular amongst academics and practitioners, sensitizing them to the impact of national cultures on organizations with a culturally diverse work staff or operating in

[1] https://geerthofstede.com/culture-geert-hofstede-gert-jan-hofstede/6d-model-of-national-culture/.

a globalizing world. His canonical work proved to be extremely influential in the theory and practice of international management".

Therefore a problem of cultural determinants of gaps in evidence-based management based on cultural dimensions has been analysed by a number of studies. In one of the most recognised research effort to study research-practice gap, Rynes, Colbert, and Brown (2002) surveyed nearly 1,000 HR practitioners in the United States, members of the Society for Human Resource Management. Their research covered several HR areas (general management, employment practices, training and development, staffing, and compensation and benefits), where items were constructed on the basis of empirically verified research findings, often wider meta-analytical studies.

Tenhiälä et al. (2016) replicated the Rynes et al. (2002) study in Finland, Spain and South Korea. Their research provided initial evidence on the influence of national culture on HR professionals' beliefs and perception of management practices in differentiated cultural settings. Tenhiälä et al. (2016) recourse to cultural differences to explain variability of observed results among countries. Analysis performed by these authors cover Finland, Spain and South Korea. This study aims at replicating research by Rynes et al. (2002) and Tenhiälä et al. (2016) by providing evidence on research-practice gap and its cultural determinants in Poland.

## 3. Methodology

Questionnaire used by Tenhiälä et al. (2016) based on Rynes et al. (2002) have been used to gather information on managers' perception on HRM practices, including management practices, general employment practices, training and development, staffing and compensation and benefits (see Table 3 for full questionnaire). A total of 34 items were covered in the questionnaire, based on scientific evidence (including meta-analyses). Respondents were asked to assess each statement for being either "true" or "false" on the basis of their own perceptions, knowledge and experience. The results were analysed on the basis of percentage of correct answers, as based on original questionnaire by Rynes et al. (2002) to provide comparability. Respondents were managers, the participants of post-graduate studies of the Warsaw School of Economics and Gdańsk University of Technology as well as managers – participants of MBA courses. They were surveyed between 7.11.2020 and 21.03.2021 using an online survey. It has been prepared and made available in two language versions – English and Polish. A total of 121 responses have been received, allowing for the comparative analysis for Poland on the previous research in USA, Finland, Spain and South Korea.

Findings from the managers' survey have been analysed from the perspective of cultural determinants, with the aim to answer the key research question: *To what extent can the differences in managers perceptions on HRM practices be attributed to cultural differences?*

More precisely, the analytical approach was based on the assumption that adoption of Hofstede's cultural dimension can help to underpin the observed similarities and differences in managers' perceptions. If so – that would mean perceptions on HRM practices can be analysed from a more positivist research perspective, as they can clearly be linked to measurable and well defined variables. If not – the meanings (or more precisely – interpretations) attributed collectively to HRM practices by managers in a given cultural context cannot be explained by these variables. In this case we should opt for an interpretive approach to cultural differences in perceptions.

Therefore, cultural dimensions by Hofstede constitute a starting point for the analysis performed in this article, with the special focus on Poland. Table 1 presents the Hofstede dimensions by countries covered by the analysis, including Poland, Finland, South Korea, Spain and United States (original study by Rynes et al., 2002).

**Table 1.**
*Hofstede cultural dimensions in analysed countries*

| | **Poland** | **Finland** | **South Korea** | **Spain** | **United States** |
|---|---|---|---|---|---|
| Power Distance Index (PDI) | 68 | 33 | 60 | 57 | 40 |
| Individualism vs collectivism (IDV) | 60 | 63 | 18 | 51 | 91 |
| Masculinity vs femininity (MAS) | 64 | 26 | 39 | 42 | 62 |
| Uncertainty Avoidance (UAI) | 93 | 59 | 85 | 86 | 46 |
| Long-term vs short-term orientation (LTOWVS) | 38 | 38 | 100 | 48 | 26 |
| Indulgence vs restraint (IVR) | 29 | 57 | 29 | 44 | 68 |

Source: Data retrieved from Hofstede's Dimension data matrix: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/, 20.06.2021).

As can be seen from the data (Table 1), in Hofstede classification, as compared to other countries, Poland is characterised by:

- High level of PDI – highest among analysed countries. Such high Power Distance Index indicates high acceptance (and even expectancy) of unequal distribution of power in organisations. Lower level employees are likely to accept that hierarchy is established and executed in society and organisations, sometimes without reason or doubt.
- Above-average level of IDV – at the level of Finland and Spain, however much lower than in US. Being rather more individualistic than collective society means, that people tend to be integrated with close family rather than broader societal groups, and focus on individual targets and achievements, for which they can sacrifice common good or purpose.
- Above-average level of MAS – highest among analysed countries (comparable only to US). As defined by Hofstede, societies with high levels of masculinity prefer and value traits such as achievement, heroism, assertiveness and material rewards for success. On the contrary, less effort is spent on cooperation, modesty or caring for the weak.

- Very high level of UAI – highest among analysed countries and noticeably higher than in Spain and South Korea. This indicates low tolerance for ambiguity, unexpected behaviours, unknown or status-quo. Preference is given to rigid norms, codes of behaviour, guidelines or laws and behaviours that follow a known and widely accepted paths.
- Below-average level of LTOWVS – same as Finland, higher than US, lower than Spain, and much lower than in South Korea. Lower degree indicate more "short-term" thinking societies, but at the same time where traditions are honoured and maintained.
- Low level of IVR – same as in South Korea and lower than in the rest of analysed countries. Societies with low levels of indulgence (more restrain or restrictive) are more focused on controlling gratification of needs and its regulation by strict social norms, rather than allowing freedom in fulfilling human desires.

## 4. Research findings

Table 2 summarises the mean percentages for correctly answered items for each area of questionnaire based on Tenhiälä et al. (2016) and Rynes et al. (2002).

**Table 2.**
*Mean percentages for correctly answered items for each area.*

| | **Poland (34)*** | **Finland (34)** | **South Korea (32)** | **Spain (34)** | **United States (35)** |
|---|---|---|---|---|---|
| Management Practices | 68% | 62% | 57% | 65% | 63% |
| General Employment Practices | 48% | 54% | 71% | 61% | 68% |
| Training and Development | 77% | 68% | 64% | 69% | 71% |
| Staffing | 35% | 30% | 34% | 32% | 39% |
| Compensation and Benefits | 65% | 53% | 55% | 66% | 50% |
| Total | 57% | 52% | 54% | 58% | 57% |

* Number in parentheses indicates number of items analysed in a corresponding country.
** The Finnish (N = 86), Spanish (N = 196), and South Korean (N = 147) samples were published by Tenhiälä et al. (2016); The US sample (N = 959) was published by Rynes et al. (2002); the Polish sample (N =121) was collected by the author.

The mean percentage for correctly answered items for the area of **Management Practices** in Poland (68%) is higher than in all analysed countries, at the level comparable to Spain (65%) (Table 2.). Detailed analysis reveals that lower than average percentage was observed in item related to leadership training (item 1, Table 3) and employees' performance target setting (item 3, Table 3). Higher than average share of correct answers is clearly evident in items relating to leader's qualities (item 2, Table 3), professionals turnover (item 5), and most notably – ability to manage change as HR managers key competence (item 7, highest score in the analysed sample).

In the Polish sample, the mean percentage of correctly answered items for the area of **General Employment Practices** was the lowest in all analysed countries (48%), closest in the score to Finland (54%) (Table 2). The lowest scores were noted on items relating to accuracy of performance appraisals (items 9 and 10, Table 3). Other items noted below-average or average levels, apart from relation of team composition and effectiveness (item 11), which noted high score (90%), but comparable to other countries (Finland - 89%, Spain – 89%, US – 88%).

The mean percentage for correctly answered items for the area of **Training and Development Practices** in Poland (77%) is highest among analysed countries, with the closest proximity to US (71%) (Table 2.). Out of the four items under this heading (items 15-18, Table 3), Poland falls short only on one relating to higher effectiveness of training for older adults (item 16, Table 3). Highest average scores among analysed countries were observed for perception of the use of training being connected to actual learning (item 17) and relation of training effectiveness for simple skills with condensation of training sessions (item 18), which both notions not being supported by research findings.

Polish sample indicates low (35%), but comparable to other countries, mean percentage for correctly answered items for the area of **Staffing Practices**. The closest proximity was noted to average score of the South Korean sample (Table 2). Lowest scores for correct answers were noted in items related to designing interviews around candidate's unique background (item 19, Table 3), relation of (high) intelligence to low-skills job performance (item 22) and conscientiousness being a better job performance predictor than intelligence (item 25). Two items show a slightly higher level of correct answers than in other countries, which relate to screening job applicants for values (item 26) and predictive powers of personality inventories (item 23). In other items variability of correct answers share can be observed, but at the levels comparable to other countries.

The mean percentage for correctly answered items for the area of **Compensation and Benefits** Practices in Poland (65%) is among the highest in analysed countries, at the level comparable only to Spain (66%) (Table 2). Detailed analysis reveals that share of correct answers is at or above scores of other countries for almost all items (Table 3). Outstanding are high scores for items on relationship between managers' pay incentives and company profitability (item 30), including pay discussions during performance appraisal negative effect on morale and future performance (item 32) and preference of variable pay systems among employees (item 33).

**Table 3.**
*Correctly answered items by area in analysed countries*

| | Correct answer | Poland | Finland | South Korea | Spain | United States |
|---|---|---|---|---|---|---|
| **Management Practices** | | | | | | |
| 1. Leadership training is ineffective because good leaders are born, not made. | FALSE | 86% | 94% | 88% | 90% | 96% |
| 2. The most important requirement for an effective leader is to have an outgoing, enthusiastic personality. | FALSE | 83% | 69% | 61% | 71% | 82% |
| 3. Once employees have mastered a task, they perform better when they are told to "do their best" than when they are given specific, difficult performance goals. | FALSE | 67% | 66% | 72% | 79% | 82% |
| 4. Companies with vision statements perform better than those without them. | TRUE | 89% | 79% | 92% | 85% | 62% |
| 5. Companies with very low rates of professionals' turnover are less profitable than those with moderate turnover rates. | FALSE | 69% | 47% | 30% | 54% | 62% |
| 6. If a company feels it must downsize employees, the most profitable way to do it is through targeted cuts rather than attrition. | TRUE | 55% | 64% | - | 54% | 54% |
| 7. In order to be evaluated favourably by line managers, the most important competency for HR managers is the ability to manage change. | TRUE | 78% | 62% | 31% | 59% | 50% |
| 8. On average, encouraging employees to participate in decision making is more effective for improving organizational performance than setting performance goals. | FALSE | 19% | 15% | 26% | 26% | 18% |
| **General Employment Practices** | | | | | | |
| 9. Most managers give employees lower performance appraisals than they objectively deserve. | FALSE | 46% | 68% | 74% | 82% | 94% |
| 10. Poor performers are generally more realistic about their performance than good performers are. | FALSE | 51% | 87% | 86% | 81% | 88% |
| 11. Teams with members from different functional areas are likely to reach better solutions to complex problems than teams from single areas. | TRUE | 90% | 89% | 56% | 89% | 88% |
| 12. Despite the popularity of drug testing, there is no clear evidence that applicants who score positive on drug tests are any less reliable or productive employees. | FALSE | 26% | 22% | - | 19% | 57% |
| 13. Most people over-evaluate how well they perform on the job. | TRUE | 50% | 39% | 88% | 74% | 54% |
| 14. Most errors in performance appraisals can be eliminated by providing training that describes the kinds of errors managers tend to make and suggesting ways to avoid them. | FALSE | 26% | 18% | 50% | 21% | 25% |
| **Training and Development Practices** | | | | | | |
| 15. Lecture-based training is generally superior to other forms of training delivery. | FALSE | 96% | 98% | 78% | 81% | 96% |
| 16. Older adults learn more from training than younger adults. | FALSE | 66% | 70% | 78% | 71% | 68% |

Cont. table 3.

| | | | | | | |
|---|---|---|---|---|---|---|
| 17. The most important determinant of how much training employees actually use on their jobs is how much they learned during training. | FALSE | 80% | 49% | 60% | 59% | 60% |
| 18. Training for simple skills will be more effective if it is presented in one concentrated session than if it is presented in several sessions over time. | FALSE | 68% | 56% | 37% | 66% | 59% |
| **Staffing Practices** | | | | | | |
| 19. The most valid employment interviews are designed around each candidate's unique background. | FALSE | 28% | 41% | 54% | 29% | 70% |
| 20. Although people use many different terms to describe personalities, there are really only four basic dimensions of personality, as captured by the Myers-Briggs Type Indicator (MBTI). | FALSE | 61% | 67% | 35% | 44% | 49% |
| 21. On average, applicants who answer job advertisements are likely to have higher turnover than those referred by other employees. | TRUE | 51% | 19% | 54% | 34% | 49% |
| 22. Being very intelligent is actually a disadvantage for performing well on a low-skilled job. | FALSE | 37% | 42% | 54% | 68% | 42% |
| 23. There is very little difference among personality inventories in terms of how well they predict an applicant's likely job performance. | FALSE | 47% | 27% | 37% | 32% | 42% |
| 24. Although there are "integrity tests" that try to predict whether someone will steal, be absent, or otherwise take advantage of an employer, they don't work well in practice because so many people lie on them. | FALSE | 23% | 18% | 12% | 18% | 32% |
| 25. On average, conscientiousness is a better predictor of job performance than is intelligence. | FALSE | 12% | 22% | 16% | 23% | 18% |
| 26. Companies that screen job applicants for values have higher performance than those that screen for intelligence. | FALSE | 20% | 6% | 5% | 11% | 16% |
| **Compensation and Benefits Practices** | | | | | | |
| 27. When pay must be reduced or frozen, there is little a company can do or say to reduce employee dissatisfaction and dysfunctional behaviours. | FALSE | 74% | 75% | 43% | 83% | 72% |
| 28. Most employees prefer to pay on the basis of individual performance rather than on team or organizational performance. | TRUE | 71% | 61% | 42% | 73% | 81% |
| 29. Merit pay systems cause so many problems that companies without them tend to have higher performance than companies with them. | FALSE | 65% | 59% | 67% | 85% | 66% |
| 30. There is a positive relationship between the proportion of managers receiving organizationally based pay incentives and company profitability. | TRUE | 71% | 60% | 29% | 60% | 62% |
| 31. New companies have a better chance of surviving if all employees receive incentives based on organization-wide performance. | TRUE | 67% | 54% | 66% | 67% | 59% |
| 32. Talking about salary issues during performance appraisal tends to hurt morale and future performance. | FALSE | 70% | 58% | 66% | 60% | 51% |

Cont. table 3.

| | | | | | | |
|---|---|---|---|---|---|---|
| 33. Most employees prefer variable pay systems (e.g., incentive schemes, gain sharing, stock options) to fixed pay systems. | FALSE | 71% | 57% | 80% | 62% | 40% |
| 34. Surveys that directly ask employees how important pay is to them are likely to overestimate pay's true importance in actual decisions. | FALSE | 35% | 17% | 50% | 41% | 35% |

* Percentages indicate the share of correct answers for each item in corresponding samples.

There are significant differences noted among analysed countries, which represent differences in managers' perceptions of HRM practices. While in itself this is not a surprising finding (as the managers in each group can also have various backgrounds – including education and experience or individual characteristics. The analysis below aims at shedding some light on the key research problem whether the observed differences in managers perceptions on HRM practices can be attributed to cultural difference by providing explanatory rationale.

In **Management Practices** various cultural dimensions might provide rationale for observed differences. In relation to perception on effectiveness of leadership training (item 1) an explanatory factor might be Power Distance Index. According to Hofstede acceptance of unequal distribution of power and existence of hierarchy can lead to more frequent belief that leaders are born not made (or trained). The result obtained for Poland is consistent with this dimension, and closest matching score is observed for South Korea, with which this dimension is shared. Power Distance Index can also help to explain item 3 task performance. In countries with higher PDI (as is the case of Poland and close matching score – South Korea) hierarchical order is accepted easier, so more people believe in reason behind official orders, even when they are inaccurate. Long-term orientation can be an explanatory factor for item 5 on professional turnover. As societies with lower scores (more "short-term") might not put emphasis on employees' tenure as a characteristic connected to business success, the results for Poland are consistent with its LTOWVS score. However, Tenhiälä et al. (2016) attribute differences in results of item 4 on having company visions statements also to long-term orientation culture, as it focuses on the durability of organizations such that they are here to serve the stakeholders and society at large for many generations to come. This observation is inconsistent in terms of Poland, as it is a short-term culture country, and the majority of surveyed managers believe this statement to be true. The same applies to item 7 (ability to manage change as key competence of HR managers), where the score for Poland is inconsistent. In this case the better explanatory factor would be individualism dimension. As noted by (Tenhiälä et al., 2016) in individualistic cultures individual competencies (merit) might be valued more than other qualities, which is the case for Poland, as well as Finland, which noted the closest matching score in this answer. Also, the observed results cannot be unambiguously explained by cultural dimensions in case of items number 2, 6 and 8 under Management Practices field.

In the area of **General Employment Practices** the consistency of scores with country cultural dimension could be observed in relation to item 11 (ability of complex problem solving by functionally diverse teams). Tenhiälä et al. (2016) attribute it to individualism dimension, as in more individualistic cultures more diverse teams (in terms of individual characteristics (e.g. background information or values) are deemed more effective. This is consistent with Poland score in IDV, which is above average, and closely matching Finland, which obtained similar percentage of correct answers in this question. As for other items, more diversity in score consistency is observed. For example in item 13 (tendency to over-evaluating of performance by most people), attributed by Tenhiälä et al. (2016) to masculinity dimension (as in masculine culture modesty is not a virtue, individuals tend to overrate their own performance), the scores observed for Poland are only partially consistent. About half of managers in PL agree with this statement; while the highest share of correct answers was noted in countries (Spain, South Korea) with lower degrees of masculinity, not the ones closest in this cultural dimension (USA, with high MAS). The same can be said about item 12 (on drug testing). While no single dimension provides explanation to this item, uncertainty avoidance could indicate that rigid norms or laws are closely followed, with no room for own interpretations or unexpected behaviours. If in fact UAI is an explanatory dimension, the result suggest partial consistency for Poland. With highest level of UAI among analysed countries it should be more prone to follow the strict rules and generally accepted norms. This also makes the result similar to Spain (with the shared level of UAI). However, drug testing of applicants in not practiced in PL, so the knowledge of managers on this practice might be limited. Partial attribution to cultural dimensions can also be observed in item 10 (on poor performers being more realistic about their performance). There is no single dimension that provides explanation to this item. However, IDV and/or MAS could indicate that in more individualistic and masculine societies individual achievement is recognised, so good performers should be conscious of their performance level (have high self-awareness). If this is the case, the scores for Poland are inconsistent as it is above-average on both dimensions, while almost half of managers deem this statement to be true. In item 9 (on managers giving employees lower performance appraisals than they deserve), the attributing dimension is inconsistent with Poland sample findings. Tenhiälä et al. (2016), after Hofstede (2001), attribute it to high Power Distance cultures, which demonstrate a great respect for and are less likely to challenge authority. Poland with the highest degree of PDI dimension among analysed countries, noted the lowest score under this particular item among analysed countries. The observed scores and differences cannot be unambiguously attributed to cultural determinants in item 14.

In relation to **Training and Development Practices** it is worth noting that Tenhiälä et al. (2016) do not provide culturally-based explanation of items under this heading. Therefore the explanation should start by looking at the countries with the closest matching scores in each item. In terms of item 15 (on superiority of lecture-based training), these have been observed in USA (with which Poland shares MAS and LTOWVS dimensions) and Finland (IDV and

LTOWVS shared dimensions). Almost all of managers in Poland (96%) provided a correct answer that this statement is false. Similar situation was observed in item 16 (on more effective learning of older adults), with the closest matching scores from USA and Finland. However, in this case the correct answers were lowest in the analysed sample. Therefore, it is unlikely to find a cultural dimension that unambiguously explains the observed results. The situation is even more complex in case of item 17 (on the learning as a predictor of training results use on the job). This statement was deemed false (which is a correct answer) by 80% of surveyed Polish managers, which means there is no closest matching scores among other countries. In terms of item 18. (dependence of training effectiveness on its concentration in one session), it is similar, with the high score of correct answers in Poland (deeming this statement to be false by 68%), comparable only to Spain (with UAI/IDV being the shared cultural dimensions). As Poland is characterised by high level of Power Distance Index and very high level of Uncertainty Avoidance according to Hofstede, the explanatory factors are likely to relate to these dimensions. However, there is no clear link between observed scores and country cultural profiles.

**Staffing Practices** form a significant part of the questionnaire, represented by eight items. However, Tenhiälä et al. (2016) provide cultural explanation only to one item number 19. (about interviewing process based on candidate's unique background). In this case they argue, that high scores on individualism cultures value employment interviews designed around a candidate's individual (or unique) background, i.e., an unstructured interview. This is consistent with the score for Poland, where majority of managers (72%) deem this statement true (although this being incorrect answer), as is similar to Spain, being close on IDV dimension. As other items lack explanation from previous studies, it would again be useful to look at countries with closest matching scores. For item 20 (on basic dimensions of personality), closest score was noted in Finland, which shares dimensions of IDV and LTOWVS. As the latter provides no rationale, the above-average level of individualism in both countries might suggest that high share of correct answers stem from this characteristic. Individualism is valued, so simplifications of personality traits, such as MBTI model, are not regarded accurate. The same dimension (individualism) might be explanatory factor for item 24 (on predictive abilities of integrity testing), where – similarly to Finland and Spain (which also shares the IDV dimension score with Poland), vast majority managers believe that these test do not work well in practice. IDV can also be responsible for highest level of distrust of Polish managers in predictive powers of personality inventories (item 23), although at the share of correct answers at the level incomparable to other analysed countries. The same goes for item 22 (on intelligence as disadvantageous in performing low-skilled job), where Polish sample noted the lowest share of correct answers (63% of managers deem this statement true). In relation to item 25 (conscientiousness being a better predictor of performance than intelligence) one can assume Power Distance Index an explanatory factor. In countries like Poland or South Korea (where similar scores in this item were noted) employees are expected to respect hierarchy and order,

without questioning established relationships. In this case conscientiousness seems to be more decisive for future performance than a trait that might lead to rising doubts in managers decisions. PDI might also be explanatory in case of highest noted score in item 26 (on screening applicants for values).

Differently from staffing, in case of **Compensation and Benefits Practices**, Tenhiälä et al. (2016) provide culturally-based explanation for a number of items. In item 27 (on company ability to limit negative employees' behaviours during times of reduction or freezing of wages) IDV is deemed explanatory. An noted by the authors, in highly individualistic cultures employees might exhibit dysfunctional behaviours if pay is cut as there is limited feeling of collective good for the survival of the organization. This is consistent with the score in Poland, as well as for closest matching country – Finland, which shares similar level of IDV. The same factor can be attributed to item 28 (on preference of workers of individual performance-based pay). In this case, in higher individualism culture, individual incentives are preferred over team incentives (Tenhiälä et al., 2016). This is consistent with Polish score, as is in its closest match – Spain. Masculinity is regarded explanatory factor in two items: 29 (on merit pay) and 34 (on importance of pay surveying among employees). In the first case, in masculine cultures individual merit is valued over equality in pay systems, and in the latter individuals in masculine cultures live in order to work and tend to prefer more money over leisure time (Tenhiälä et al., 2016). In both cases, closest matching score was noted in USA, with which Poland shared MAS dimension, making it a consistent observation. This might also be extended to item 30 (on linking managers pay to organisational performance), although not directly explained by earlier studies. In case of item 33 (on preference of variable pay), Tenhiälä et al. (2016) note, that High Uncertainty Avoidance cultures are less likely to accept risk in pay schemes. This observation seems not to be confirmed by this study, as majority of managers in Poland believe this statement to be true, while UAI levels are very high in this country. The same can be said about a closest match, which is South Korea. One should rather attribute this to the high levels of Power Distance Index in both countries. The same explanation could be used for item 32 (on talking about salaries during performance appraisal), noted at high levels both in Poland and South Korea. Uncertainty Avoidance could be used to explain high level of correct answers on item 31 (on organisation-wide performance as a basis of incentives in newly founded companies). Similar levels were noted in Poland, Spain and South Korea, which share UAI as cultural dimension.

## 5. Conclusions and discussion

This research, through replication of the Rynes et al. (2002) and Tenhiälä et al. (2016) studies, provides further comparative evidence on the managers' perceptions of HRM practices in cross-cultural context. It also contributes and develops further understanding of cultural determinants of managers' perceptions, with the use of Hofstede's cultural dimensions model. It can generally be concluded, that this study evidenced the importance of cultural determinants for the perceptions of managers' of HRM practices. In many cases, countries that scored similar on a given item shared common explanatory characteristics in relation to Hofstede dimension. However, this was not the case in all areas, as explained above. This might indicate a general correctness of study assumptions and supports the key research question, that differences in managers perceptions on HRM practices can be attributed to a large extent to cultural differences. One should also accept, that these differences are not fully explained by cultural differences. The reason for this might be twofold. Firstly, the study did not control for other determinants, including respondents personal characteristics, diverse background, experience, etc. that might have significant influence on perceptions, focusing solely on the cultural determinants as an explanatory factor. Secondly, as the Hofstede cultural dimensions have been used as the model for analysing differences between countries, innate limitations of this approach apply.

Hofstede's approach is based on the assumption that that national culture can be captured, measured, and counted in numerical terms (Ybema and Nyíri, 2015). Hofstede dimensions represent positivist – not interpretive - approach to analysing cultures and cultural differences, which is perceived as oversimplification. Positivism uses a realist ontology, and assumes an objective world exists that can be represented directly by scientific concepts and propositions, presuming that causal, deterministic relationships among variables can be verified, uncovered and specified in mathematical form (Harris et al., 2008). On the contrary, interpretive research is concerned to understand human meanings and definitions of respective contexts, and assumes that realities are socially constructed (Harris et al., 2008). As such, subjective realities emerge and are shared among social actors through dialectical process, creating objective realities. Although criticised, Hofstedean approach has proved to be resilient to change, perhaps because a dimensional approach to studying national cultural difference offers a lenient framework which easily absorbs alternative interpretations (Ybema and Nyíri, 2015). As Barmeyer et al. (2019) note, on the basis of their systematic review of 777 articles published in leading journals, corporate culture, human resources management, and cultural dimensions are main topics in cross-cultural management and that positivist and quantitative papers outweigh interpretative and qualitative articles[2]. As such, the model might oversimplify

[2] Although the authors note a convergence of the positivist and interpretive paradigm in 2016-2017, they see rise of positivist approach since 2017.

the complex nature of cultural determinants influencing managers' perception of HRM practices. Further studies are necessary to identify interwoven structure of personal and cultural factors that governs these perceptions, making introduction of evidence-based practices challenging.

However, it is necessary to point out important factors that may affect the rapid development of this area of research in the coming years. In particular, attention should be paid to the progressing digitization processes (including the development of artificial intelligence, big data analysis or machine learning) that allow for increasing the accuracy of inference based on complex data sets. More and more companies are interested in using analytics in the area of human resources management, which allows not only to track trends based on historical data, but also to conduct predictive analyses. Increasing interest and more frequent applications also increase the acceptance of personnel decision supported by data systems among managers. Therefore, one should consider this area of research to be both extremely interesting and not fully explored, which creates great research, publication and application opportunities.

On the limitations of this study one should note, that the empirical part (questionnaire in Poland) was performed during Covid-19 pandemic. This might have affected the perceptions of managers on what works in relation to HRM practices. It might also influence the correctness of studies that were used as the basis of the original questionnaire by Rynes et al., as the external conditions under which the research was performed changed significantly over the course of last two years. Therefore, further investigation is necessary to pinpoint the cultural determinants of the often limited use of evidence-based HRM practices.

## References

1. Barends, E., Rousseau, D.M., & Briner, R.B. (2014). *Evidence-based management: The basic principles*. Amsterdam: Center for Evidence-Based Management.
2. Barmeyer, C., Bausch, M., Moncayo, D. (2019). Cross-cultural management research: Topics, pardigms, and methods – A journal-based longitudinal analysis between 2001 and 2018. *International Journal of Cross Cultural Management, 19(2).* https://doi.org/10.1177/1470595819859603.
3. Bezzina, F., Cassar, V., Tracz-Krupa, K., Przytuła, S., Tipuric, D. (2017). Evidence-based human resource management practices in three EU developing member states: Can managers tell truth from fallacy? *European Management Journal, Vol. 35, Iss. 5,* 688-700. https://doi.org/10.1016/j.emj.2017.02.010.
4. Boudreau, J.W. (2012). Decision logic in evidence-based management: Can logical models from other disciplines improve evidence-based human resource decisions? In: D. Rousseau

(Ed.), *The Oxford handbook of evidence-based management*. New York, New York: Oxford University Press, 223-248.

5. Carless, S.A., Rasiah, J., Irmer, B.E. (2009). Discrepancy between human resource research and practice: Comparison of industrial/organizational psychologists and human resource practitioners' beliefs. *Australian Psychologist, 44,* 105-111. https://doi.org/10.1080/00050060802630015.
6. Carol, G. (2018). Don't know, don't care: An exploration of evidence-based knowledge and practice in human resource management. *Human Resource Management Review. Vol. 28, Iss 2,* 103-115. https://doi.org/10.1016/j.hrmr.2017.06.001.
7. Cooper, D.R., Schindler, P.S. (2014). *Business Research Methods*. New York: McGraw-Hill/Irwin.
8. Economist Intelligence Unit Study (2015). *Evidence-Based HR: The Bridge Between your People and Delivering Business Strategy, commissioned by KPMG International*.
9. Falletta, S. (2014). In Search of HR Intelligence: Evidence-Based HR Analytics Practices in High Performing Companies. *People & Strategy, Vol. 36, Iss. 4*.
10. Harris, J.G., Craig, E., Light, D.A. (2011). Talent and analytics: new approaches, higher ROI. *Journal of Business Strategy, Vol. 32 Iss. 6.* https://doi.org/10.1108/02756661111180087.
11. Harris, M.M. (ed.) (2008). *Handbook of Research in International Human Resource Management.* Psychology Press.
12. Hofstede, G. (1980). Motivation, leadership and organization: Do American theories apply abroad? *Organizational Dynamics, Summer,* pp. 42-63. https://doi.org/10.1016/0090-2616(80)90013-3.
13. Hofstede, G. (1991). *Culture's Consequences: International Differences in Work-related Values.* Newbury Park: Sage.
14. Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations.* Thousand Oaks, CA: Sage.
15. Hofstede, G., Hofstede, G.R., Minkov, M. (2010). *Cultures and organizations: Software of the mind: Intercultural cooperation and its importance for survival*. New York, NY: McGraw-Hill.
16. Lange, T. (2013). Evidence-based HRM: a scholarship perspective with a difference. *Evidence-based HRM: A Global Forum for Empirical Scholarship, Vol. 1, No. 1,* 4-15.
17. Pepitone, J.S. (2019). Are You Considering Evidence-Based Human Resource Management Decision-Making? *Management Services, Summer*.
18. Pfeffer, J., Sutton, R. (2006). *Hard Facts, Dangerous Half-Truths and Total Nonsense: Profiting from Evidence Based Management*. Boston: Harvard Business Press.
19. Ross, J.W., Beath, C.M., Quaadgras, A. (2013). You may not need big data after all. *Harvard Business Review, 91(12),* 90.

20. Rynes, S.L., Colbert, A.E., Brown, K.G. (2002). HR professionals' beliefs about effective human resource practices: Correspondence between research and practice. *Human Resource Management, 41,* 149-174. https://doi.org/10.1002/hrm.10029.
21. Sanders, K., van Riemsdijk, M., Groen, B. (2008). The gap between research and practice: A replication study on the HR professionals' beliefs about effective human resource practices. *International Journal of Human Resource Management, 19,* 1976-1988. https://doi.org/10.1080/09585190802324304.
22. Subramony, M. (2009). A meta-analytic investigation of the relationship between HRM bundles and fi rm performance. *Human Resource Management, 48,* 745-768. https://doi.org/10.1002/hrm.20315.
23. Tenhiälä, A., Giluk, T.L., Sven Kepes, S., Simón, C., Oh, I.S., Kim, S. (2016). The research-practice gap in human resource management: a cross-cultural study. *Human Resource Management, March-April 2016, Vol. 55, No. 2,* 179-200. https://doi.org/10.1002/hrm.21656.
24. Ybema, S., Nyíri, P. (2015). The Hofstede factor: the consequences of Culture's Consequences. In: *The Routledge Companion to Cross-Cultural Management.* Routledge.

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# E-GOVERNMENT – SOCIALLY EXPECTED OR OFFICIALLY IMPOSED?

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**Purpose:** the need to determine whether e-government is socially desirable or perhaps imposed on citizens by the government.
**Design/methodology/approach**: Survey research method - quantitative research using a survey questionnaire carried out using CATI technique and the "Voice bot" assistive technique.
**Findings:** the development of e-government is socially expected as well as imposed by the administration.
**Research limitations/implications**: Generations BB and Z showed slightly more resistance to e-government than the rest of the generations. In-depth research should be carried out to demonstrate or falsify regularities.
**Social implications:** If in-depth research shows that the BB and Z generations show greater resistance to e-government than other generations, then remedial steps should be identified and taken (especially in the case of Z-s that enter mature life and will be contacted more and more often with the administration). Convincing generations to e-government will affect the quality of social life.
**Originality/value:** Linking openness or resistance to the use of e-government with belonging to a specific generation. The article is particularly useful for the administration when targeting its services to generational groups.

**Keywords:** E-government, administration, generational groups.

**Category of the paper:** Research paper.

## 1. Introduction

### 1.1. E-government - definition and levels

E-government is defined somewhat differently, e.g. in Anglo-Saxon countries, the EU, OECD, and UN. For the purposes of this study, the term in question was taken from the Communication from the Commission to the Council of the European Parliament, where e-government is defined as: "the use of information and communication technologies (ICT) in public administration combined with organizational changes and new skills to improve

services and processes. democratic and strengthening support for public policy". (Communication..., 2003) E-government understood in this way will be something much broader than just the availability of administration services provided electronically (accentuated by e.g. the USA, Japan, Korea), as the presented approach to e-government indicates for a deep reconstruction, modernization of the administration, based on ICT solutions, in order to make the public sector more open and transparent, and friendly to the citizen, showing an increase in efficiency (Bogucki, 2005, Dziadkiewicz, 2014).

Due to the degree of advancement of the IT communication of e-government with the citizen and the type and complexity of the services provided by the office (Olejniczak-Szuster, 2021), five levels of development of these services can be identified:

- level one – the administration runs an information portal,
- second level – performing complex activities on the portal, such as registration of: business activity, vehicles; communication only with individual offices,
- level three – there is a possibility of free switching between services, there is no requirement to provide the same data a second time; only with individual offices,
- on the fourth level – there is a system that searches for and retrieves the data necessary to carry out a specific operation; data are collected by the system from all available sources (registers or records); communication with many offices – integration phase,
- fifth level – individualisation of cooperation between institutions and users; it is possible to take into account the non-standard situation of the applicant (Rzucidło, 2015).

The task of the state administration, by launching e-administration, is to be even more effective, but for this it is necessary to have an appropriate level of access to Internet services with equipment and digital education (Kuzior, Mańka-Szulik, Krawczyk, 2021, Kabus, 2017).

Education aimed at the "information society", ie citizens with an appropriate level of skills/ qualifications, will ensure the possibility of using websites, portals or e-administration applications (UNESCO, 2018).

The aim of this article will be to determine whether the remote way of dealing with official matters is imposed on Polish citizens, or whether they themselves expect the possibility of contact with the state administration in this way.

### 1.2. ePUAP platform – appointment time, possibilities of using and types of services offered

In Poland, the basic form of internet access to public services is the Electronic Platform of Public Administration Services (ePUAP). It was launched in 2008 and is a free tool for contacting citizens with public administration, as well as communication between public entities, as public authorities would be obliged to start accepting documents in electronic form on 1 May 2018 (pursuant to Art. section 1 of the Act of September 18, 2001 on electronic signature) (Gov.pl, 2022).

You can use ePUAP only with confirmation of your identity, which can be done in two ways, using:

- electronic signature – data (identifying a specific person) in electronic form, which serve as a signature equivalent to a handwritten signature; commercial product.
- trusted profile (eGo) – this is a data/ signature that only confirms the identity of a given person by assigning it to a specific PESEL number; non-commercial product (Łesak, 2022).

Due to the non-commercial nature, the needs of Poles and a much simpler form of access – the trusted profile is much more popular than the electronic qualified signature (in 2019 it is a ratio of 2.5 million to 500 thousand).

Based on the data presented in "Digitization – Website of the Chancellery of the Prime Minister", it can be concluded that from January 2018 to today, the number of users of a trusted profile in Poland doubles (approximately) every year (Cyfryzacja…, 2022).

Thanks to the electronic signature and trusted profile, citizens' trust in e-administration increases that their data is safe (Alzahrani, Al-Karaghouli, Weerakkody, 2017, pp. 164-175).

**Table 1.**
*Services provided on the ePUAP platform*

| Services for citizens | Business services |
|---|---|
| 1. send a general letter to a public entity,<br>2. file an application for a European Health Insurance Card (EKUZ),<br>3. report the loss or damage of the ID card,<br>4. submit an application for an ID card,<br>5. submit an application for a copy of a marital status certificate,<br>6. submit a request for a certificate of the right to vote at the place of residence on the day of the election,<br>7. submit a notification on entering or adding a voter to the roll of voters in another circuit,<br>8. submit a notification about the completion of the reported geodetic or cartographic works,<br>9. submit and check settlement documents at ZUS and US,<br>10. submit an application for business registration,<br>11. arrange official matters for your family: baby benefits, parental benefits, Large Family Card, Benefit from the Alimony Fund,<br>12. submit an application for annulment of a decision, provisions on – land and building records, land classification,<br>13. certify the documents developed by contractors of surveying works,<br>14. submit an application for disclosure of public information,<br>15. file an application for registration in the Water Company of a water company or association of water companies, etc.<br><br>**ePUAP is a platform on which other websites and registers provide their services, including:**<br>1) Universal Electronic System of Population Register PESEL<br>2) Central Register of Vehicles and Drivers CEPiK<br>3) Central Register of Issued and Canceled Passport Documents CEWiUDP<br>4) National official register of entities of the national economy REGON<br>5) National Official Register of the Territorial Division of the Country (TERYT) | 1. Public procurement – Central Portal<br>2. Customs declarations<br>3. Business registration<br>4. Tax on legal entities<br>5. Permits and certificates<br>6. Sending statistical data<br>7. VAT<br>8. Compulsory social insurance |

Source: own study based on *Serwis – ePUAP, gov.pl*.

The ePUAP Electronic Services Platform directs its services to citizens, like and entrepreneurs. As shown in Table 1, the range of public services provided on the ePUAP internet platform is very wide, as it applies not only to various types of offices, but also to their departments. In addition, the discussed portal contains the so-called links redirecting to the websites of offices, thus making the website address more reliable and saving the user unnecessary contact searches.

### 1.3. The level of implementation of e-administration solutions in Poland compared to the European Union countries

The European Commission research for 2020 shows that Poland increases its result by only 1% compared to the previous year, which does not change its position in the ranking of the 27 EU Member States and places it in 24th place in the edition of the index ranking (DESI) (Miłek, Nowak, 2021).

**Table 2.**
*Poland against the background of EU Member States in the edition of the Digital Economy and Society Index (DESI) ranking for the beginning of 2021 (report for 2020)*

| | **Poland** | | **UE** |
|---|---|---|---|
| | place | result | result |
| DESI | 24 | 41,0 | 50,7 |

Source: Komisja Europejska (2020), Indeks gospodarki cyfrowej i społeczeństwa cyfrowego na 2021 r. Polska; https://ec.europa.eu/newsroom/dae/redirection/document/80596.

The reports of the Central Statistical Office on the information society in Poland in 2021 are much more optimistic about the development of Polish e-government. We learn from them that almost half of people aged 16-74 use e-administration services.

**Table 3.**
*People using e-government services via the Internet*

| **Description** | **2019** | **2020** | **2021** |
|---|---|---|---|
| | **in %** | | |
| People using the services of public administration via the Internet **to:** | 40,4 | 41,9 | 47,5 |
| searching for information on public administration websites | 24,9 | 27,2 | 29,4 |
| downloading official forms | 24,6 | 25,4 | 27,4 |
| sending completed forms | 31,4 | 33,5 | 39,9 |

Source: own study based on – GUS, *Społeczeństwo informacyjne w Polsce.*

The data from the latest GUS report published for 2021 (Table 3) clearly shows that there is a constant increase in the number of people using e-administration services in our country. Moreover, the pace of this growth recorded in 2021 is much higher (and amounts to 5.6%) than in the previous year 2020 (1.5%).

The same report by the Central Statistical Office reports that in 2021, 92.4% of households had Internet access in Poland, which was 2.0% more than in the previous year.

The covid_19 pandemic is indicated as the reason for such a sharp increase in interest in dealing with official matters via the Internet (the delay may result from equipment shortages at suppliers and the need to settle tenders).

Another research document relating to the assessment of the level of development e-government, is the Capgemini report.


**Figure 1.** General maturity of electronic administration in the country (October 2021). Adapted from: Raport Capgemini: *eGovernment-Benchmark 2021*.

The Capgemini report differs slightly from the previous ones because it concerns the general maturity of e-government in the surveyed country and it includes not only the results from EU countries, but also from e.g. Great Britain, Iceland, Turkey (a total of 36 countries/ including 27 EU). Although the results of this study rank the overall maturity of Polish e-administration quite high, as they rate it at 58%, in the overall ranking of the surveyed countries it gives Poland only 28th place.

The presented reports differ only in minor details (e.g. 41% in 2020 and 41.9% in another report), however, the overall picture of e-administration is very clear - in Poland there is a constant increase in the use of e-services. -administration. On the other hand, a moot point could be the pace of this growth, which still does not allow us to reach the EU average and places us in the "tail" of the Member States.

### 1.4. Benefits and costs of implementing e-government solutions

The method of dealing with matters in the office remotely, online, despite the many benefits it brings, also generates costs:

- benefits: service from home – without travel, i.e. cheaper, without wasting time on travel, i.e. shorter, with the possibility of simultaneous supervision over household tasks (children, lunch, washing, etc.); without queues and the possibility of transmitting biological viruses – especially useful during a pandemic or other threats limiting mobility; outside the official opening hours of the office – the possibility of settling the

matter at any time (also at night); the possibility of reducing employment by the office – reduction of fixed costs;

- weaknesses of e-administration: the need to have an Internet connection (both on the part of the office and the applicant) – costs; link quality limited by the location and capabilities of the internet service provider; bandwidth – this is demonstrated by applications for subsidies in which the order of applications decides about their granting; (on the applicant's side) the need to have equipment to support the link / (on the office's side) the need to install servers 24 hours a day – hardware, premises, installation, service, depreciation, electricity costs; the need for appropriate software office / applicant – costs; service skills – properly trained administration employees of the institution; appropriate courses / training or general e-knowledge level of applicants; security (risk of losing personal data and means of payment; risk of activating computer viruses) – costs and multi-level authentication activation procedure – e-signature; trusted profile (confirmation: bank account, SMS code, e-mail, code cards); the need to connect many databases with each other – offices: tax, provincial, municipal, communal (their many departments); data from courts, prosecutor's office, police (e.g. fines, powers - to direct or possess); banking institutions; social assistance (income, disability group, chronic disease – ZUS; support programs for e.g. children up to 18 years of age, large families); etc.

A systematic division of benefits and costs (financial and non-financial) resulting from the use of e-government was presented by Brodnicki K., Kubiszewska K., Tymoszuk E. (Brodnicki et al., 2012).

From the list of e-administration benefits and costs presented, the numerical advantage of the former can be seen at first glance, and a careful analysis of them shows large financial savings (especially in the long term), as well as improved comfort of access to the office and increased speed and the number of cases handled.

### 1.5. Social conditions determining the propensity to use digital solutions

Although it may seem that it is only our will, skills and possession of equipment that determine the use of e-administration opportunities, it turns out that also the age of the citizen, and more specifically entering this age in a specific age range, plays a significant role in using the solutions. electronic.

The ranges discussed here determine the generations of people who perceive the world in a similar way, due to the formation of their views and preferences on the basis of the same civilization achievements.

Leńczuk J. describes the generational differences in the approach to work and the preferred method of contact resulting from technical and technological progress, it can be said that:

- Baby Boomers – (prefer personal contacts) They are the oldest people in organizations (usually bosses) born after World War II until 1964; the time of their youth and school fell on a period when it was not possible to communicate quickly over a distance (at that time, pen, letters, telegrams); if they want to use electronic communication, they have to learn it from scratch, and this is naturally more difficult at such a late age (McCrindle, Fell, 2021).
- Generation X is very close to the BB generation (e.g. it celebrates direct communication and does not like changes). The form of communication developed by this generation is a telephone conversation via a mobile (mobile) phone.
- Millennials (because they entered the labor market after 2000), that is generation Y (1980-1994). In this generation, a computer (PC) and a portable computer (laptop) appeared in common access, which influences their preferences for e-mail communication, with reaching for the previous generation's tool, i.e. the telephone.
- The last generation is Z. The symbol of the communication device of this generation is a smartphone, which makes it possible to be online practically everywhere, so Y-s choose e-mail, SMS and instant messaging (Leńczuk, 2015).

Currently, the X and Y generations dominate the labor market in Poland, while the Z-you are just entering the market, and the BB's are retiring. The preferred method of communication resulting from the development of civilization during the youth / school period of a given generation may affect the way of communicating with the office, as well as the general attitude to the development of e-government solutions, therefore this issue will be analyzed in the context of the research carried out in the further part of this study (Report Newspoint, 2017).

## 2. Methods

5 large cities in Poland (Gdynia, Gliwice, Kielce, Rzeszów, Toruń) were selected for the survey, and then a survey questionnaire was created for the purposes of the survey, containing 10 closed or semi-open, scaling questions and birth certificate questions.

Due to sanitary restrictions and other pandemic requirements, as well as access to telephone databases, the research itself was commissioned to the market and public opinion research company "Market Research World" from Gliwice, which on December 15, 2021 conducted a quantitative study using the technique CATI (and supporting techniques) on issues related to the terminology of "Smart City".

For the purposes of the project only, dedicated two-way helplines have been created, with a prefix appropriate to each city covered by the study. Moreover, the following were also made: compilation of telephone databases; 8 main databases were developed, each with 10,000 mobile phone numbers (on average, 94% up-to-date) and 20,000 fixed-line numbers (15% up-to-date).

Before starting the research, both the databases and the research tool were piloted, and on this basis, the correctness of the survey scripting and the updating of the databases were determined.

The very process of obtaining data consisted in conducting telephone interviews supported by the Voice bot technology. It is a technology for automatic voice communication with telephone interlocutors (recording with information about the project and its goals, with a request for consent to participate in the survey). If the respondent expressed interest in participating in the survey, he was connected with a free consultant in a call center who conducted the survey on the basis of a survey questionnaire.

The use of the Voice bot technology meant that the interviewer did not encounter refusals (the recordings could be listened to, and the interviews could be conducted simultaneously), which made it possible to complete all 2,500 surveys in one day (with traditional interviewer-respondent contact, the survey would take 7 minutes and 56 seconds; in the case of technique used on average 4 minutes 15 seconds). Each call center interviewer made an average of 10 interviews/hour, and the response rate of people interested in participating in the survey, the so-called response rate was 4.7% (Market Research World, 2021).

A purposeful selection of the research sample was used based on the following parameters:

- the number of surveys conducted in: Gdynia, Gliwice, Kielce, Rzeszów and Toruń – 20% of the surveys from each city,
- gender of respondents – 50% of men and the same number of women.

The largest group of respondents (36.3%) had – secondary education; 25% each – basic vocational and higher education; just over 11% - basic; and in a trace (1.2%) there were representatives of lower secondary education.

The representatives were the most numerous age group 65+ (23.5%); 35-44 years accounted for about 20%; and the least numerous group of people were those in age 15-24 years of age about 10%; the remaining 5-year ranges ranged from 6.7% to 8.6%.

## 3. Results – social assessment of the need to expand (develop) remote handling of matters in the city hall and municipal units

When asked about the need for e-government development, the respondents answered as follows: on a 5-point scale, they assessed the need to extend the remote handling of matters in the office at an average of 3.84 (3.91 women and 3.77 men); this need is most noticed by people aged 35-54 (result 3.92); slightly weaker in the 25-34 and 55-64 age groups (3.85 and 3.86, respectively); they perceive the worst (but still very high, above 3.7) the need to extend remote handling of official matters in the 15-24 and 65+ age groups (3.71 and 3.76, respectively).

As for the relation of education to the need for e-administration development, the following were: it ranked highest on the scale of persons with primary and higher education (3.93); slightly lower with secondary education (3.84); and the lowest with basic vocational and lower secondary (3.72 and 3.68, respectively).

Taking into account the answers to the question in Chart 1 given in the examined cities, the following are: apparently this need to increase the scope of matters handled with the office is seen in Gliwice (3.96); slightly less in Kielce (3.87); and the worst in Rzeszów (3.79), Toruń and Gdynia (3.8 each).

On a 10-point scale, the respondents answered whether they saw official matters that cannot be settled via the Internet, and such a possibility should be created. The average assessment of the perception of such matters by the respondents is 7.4 / 10: the inhabitants of Gliwice see the most (9.4); then Gdynia (8,2); Toruń (7.0); Kielce (6.4); and the lowest in Rzeszów (5.8).

Such cases are most often identified by people with higher education (9.0); then medium (8.3); primary (8.0); and the least with basic vocational (4.3).

The correlation of answers to the same question with age and gender has shown that the fact that there are matters that cannot be settled via the Internet, and it should be possible, is most often noticed (indicator 8.0-8.3) by young people 15- 24 and older over 55 years of age; the remaining age ranges only scale the perception of the discussed issues slightly lower (index 6.4-6.9). The correlation of the question with the respondents' gender did not show any significant regularity.

## 4. Discussion

Based on the conducted research analyzes, it can be unequivocally stated that there is a need to expand (develop) remote handling of matters in city offices and municipal units. Taking into account the cities in which the survey was conducted, this need is noticed:

- the most in Gliwice 3.96/5; and the least in Rzeszów, Toruń and Gdynia 3.8/5,
- most by women 3.91/5; in the case of men, the ratio is 3.77/5,
- most in the age group 35-54 years (X and Y) 3.92/5; least among people aged 15-24 (Z) 3.71/5 and 65+ (Baby Boomers) 3.76/5,
- mostly by people with primary and higher education; the least with lower secondary and vocational,
- 3.84/5 on average.

The respondents' attitude to the possibility of indicating the types of matters that cannot be settled via the Internet, but it should be possible, was as follows:

- such matters were most often noticed in Gliwice (by 9.4% of respondents); least in Rzeszów (5.8%),
- similarly by men (7.4%) and women (7.3%),
- the most in the age group 55-64 (Baby Boomers) (8.3%); 15-24 (Z) (8.2); among 65+ (8%); least among people aged 35-44 (Y/X) (6.4%); 25-34 (6.6%),
- most by people with higher education (9%); the least with basic vocational (4.3%),
- on average 7.4%.

Despite the high result of the social need for e-government development (3.84 out of a maximum of 5), it should be noted that the least e-government is the generation Z (3.71) and BB (3.76).

"The types of matters that cannot be settled via the Internet and there should be such a possibility", are noticed by an average of 7.4% of respondents:

- most often in cities where the level of e-administration implementations is high (it proves a great public interest),
- most among the BB and Z generations, that is, "leaving" and "entering" the labor market. While the resistance to remote contact with the office is understandable among the oldest (Bylok, 1988) (e.g. problems with operating devices such as: PC/laptop/tablet/ smartphone), such a ratio among the youngest generation on the labor market must raise concern (resistance may result, for example, from with: problems with using the smartphone application – the size of the virtual buttons in relation to the screen and finger; this generation is the least numerous, hence the parents from generations X and Y relieve Z in many areas of life, including contacts with offices),
- The representatives of generations X and Y see the least shortcomings in the e-administration system (these generations are the most numerous in Polish society – which is currently conducive to the development of e-administration).

## 5. Summary

The conducted literature study and the analysis of data from empirical research allow for the formulation of the following final conclusions:

- not only in Poland, but in the countries of the entire European Union, there is a lot of pressure to adopt digital solutions (saving time and money, sealing systems, quick generation of reports, etc.) (Commission Comm. ..., 2006; Straus, Tuulik, 2007);

- current legal regulations in Poland leave the citizen free to choose the form of communication with the office – administrative proceedings may be conducted electronically on the initiative of a party or another participant in this procedure (Article 391 § 1 points 1-2 of the Code of Civil Procedure) or on the initiative of a public administration body, but with the consent of the party or another participant (Article 391 § 1 point 3 of the Code of Civil Procedure) (Wajda, 2015, pp. 275-278). On the other hand, the obligation to communicate by electronic means is when submitting the offer, application for admission to participate in the procedure and declaration. This communication takes place between the contractor and the contracting authority (Article 10a (5) of the Act of 29 January 2004 - Public Procurement Law, i.e. Journal of Laws of 2017, item 1579 as amended, hereinafter referred to as the Public Procurement Law) (Błażewski, 2018);
- Poland, despite the progress, is among the least developed countries e-government in the EU;
- development of digital skills of society, including those related to e-government (and the e-administration itself), allows for better coping with crisis situations of the covid_19 type (e.g. protective measures - the so-called shields, social support, etc.);
- by connecting ("seeing") many systems and reporting e-government, it is possible to project appropriate policies aimed at raising the functioning of the administration to a higher level and maintaining it;
- Polish citizens, residents of large cities, want to develop an electronic form of contact with the office (3.84 out of a maximum of 5); they are most often representatives of the X and Y generations;
- the BB and Z generations are the most resistant to e-administration; Due to the fact that Z-th are entering the labor market and will start their own families (hence the growing need to deal with official matters), it is necessary to more precisely diagnose the reasons for their resistance to remote contact with the administration and take remedial steps as soon as possible.

## References

1. Alzahrani, L., Al-Karaghouli, W., Weerakkody, V. (2017). Analyzing the critical factors influencing trust in e-government adoption from citizens' perspective: A systematic review and a conceptual framework. *International Business Review, Elsevier, vol. 26(1),* pp. 164-175.
2. Błażewski, M. (2018). Zasada powszechności elektronicznej administracji. *Folia Iuridica Universitatis Wratislaviensis, vol. 7(1),* pp. 229-242.

3. Bogucki, D. (2005). eGovernment w Unii Europejskiej. *Elektroniczna Administracja, nr 1*.
4. Brodnicki, K., Kubiszewska, K., Tymoszuk, E. (2012). E-administracja w ujęciu jakościowym i finansowym. *Zarządzanie i Finanse, R. 10, nr 3, cz. 3,* pp. 55-64.
5. Bylok, F. (1998). *Cechy lokalnego rynku pracy w świetle literatury przedmiotu. Funkcjonowanie lokalnych rynków pracy w aspekcie badań nad bezrobociem. Studium teoretyczno-empiryczne.* L. Milian (ed.). Częstochowa.
6. Communication from the Commission to the Council, the European Parliament, The European Economic and Social Committee and the Committee of the Regions. *The Role of eGovernment for Europe's Future*, Bruksela 2003, COM (2003) 567, p. 7.
7. *Cyfryzacja – Serwis Kancelarii Prezesa Rady Ministrów*, https://www.gov.pl/web/cyfryzacja/11-milionow-polakow-z-profilem-zaufanym.
8. Dziadkiewicz, M. (2014). Centre of Social Integration as a tool of professional reintegration of the permanently unemployed in Czestochowa. *Polish Journal of Management Studies, Vol. 9,* pp. 23-33.
9. Gov.pl (2022). *Serwis Rzeczypospolitej Polskiej*; https://www.gov.pl/web/gov/zalatwiaj-sprawy-urzedowe-przez-internet-na-epuap.
10. GUS (2021). *Społeczeństwo informacyjne w Polsce,* https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5497/2/11/1/spoleczenstwo_informacyjne_w_polsce_w_2021_r..pdf.
11. Kabus, J. (2017). External Stakeholders in Higher Education Governance. *Ekonomika i Organizacja Przedsiębiorstwa, nr 9(812)*, pp. 32-41.
12. Komunikat Komisji do Rady, Parlamentu Europejskiego, Europejskiego Komitetu Ekonomiczno-Społecznego oraz Komitetu Regionów (2006). *Plan działania na rzecz administracji elektronicznej w ramach inicjatywy i2010: przyspieszenie wprowadzenia elektronicznych usług administracji publicznej w Europie z korzyścią dla wszystkich*, COM 173 wersja ostateczna; https://eur-lex.europa.eu/legal-content/pl/ALL/?uri=CELEX%3A52006DC0173.
13. Kuzior, A., Mańka-Szulik, M., Krawczyk D. (2021), Changes in the management of electronic public services in the metropolis during the covid-19 pandemic. *Polish Journal of Management Studies [PJMS], Vol. 24, No. 2.*
14. Leńczuk, J. (2015). *Litery dzielące generacje – o różnicach między pokoleniem X, Y i Z,* https://stapler.pl/hydepark/litery-dzielace-generacje-o-roznicach-miedzy-pokoleniem-x-y.
15. Łesak, D. (2019 - publication, 2022 - update). *Profil zaufany a podpis elektroniczny. Czym się różnią?,* https://poradnikprzedsiebiorcy.pl/-profil-zaufany-a-podpis-elektroniczny-czym-sie-roznia.
16. Market Research World (2021). *Podsumowanie wyników badania. Badanie ilościowe technika CATI w tematyce zagadnień związanych ze terminologią Smart City*. Gliwice 15.12.2021.

17. McCrindle, M., Fell, A. (2021). *Generation ALPHA*; https://mccrindle.com.au/wp-content/uploads/infographics/Generation-Alpha-Infographic-2021.pdf.
18. Miłek, D., Nowak, P. (2021). Rozwój usług elektronicznej e-administracji publicznej w Polsce na tle Unii Europejskiej. *Nierówności Społeczne a Wzrost Gospodarczy, nr 65(1).*
19. Olejniczak-Szuster, K. (2021). *Przedsiębiorca społecznie odpowiedzialny: motywy strategie działania w dobie pandemii COVID-19.* Częstochowa: Wydawnictwo Politechniki Częstochowskiej.
20. Raport Capgemini (2021). *eGovernment-Benchmark 2021,* https://www.capgemini.com/wp-content/uploads/2021/10/eGovernment-Benchmark-2021-Insight-Report.pdf.
21. Raport Newspoint (2017). *Pokolenia w Polsce i potrzeba monitorowania ich rosnącej aktywności,* https://www.newspoint.pl/blog/raport-newspoint-pokolenia-w-polsce-i-potrzeba-monitorowania-ich-rosnacej-aktywnosci
22. Rzucidło, J. (2015). *Elektroniczny rząd.* Warszawa: Wydawnictwo Sejmowe.
23. Straus, I., Tuulik, T. (2007). *Establishing A Company Takes Only Two Hours In Estonia,* http://www.mondaq.com/article.asp?articleid=47610.
24. UNESCO (2018). *Umiejętności cyfrowe o kluczowym znaczeniu dla miejsc pracy i włączenia społecznego,* https://en.unesco.org/news/digital-skills-critical-jobs-and-social-inclusion, 30.09.2020, cyt. za: Kowalska-Chrzanowska, M., Krysiński, P., Karwowski, M.P. (2021). Kompetencje cyfrowe mieszkańców województwa kujawsko-pomorskiego w świetle polskiego projektu szkoleniowego „E-active". *Educ. Inf. Technol., 26,* 3427-3444, https://doi.org/10.1007/s10639-020-10411-0.
25. Wajda, P. (2015). *Komentarz do art. 391.* In: R. Hauser, M. Wierzbowski (eds.), *Kodeks postępowania administracyjnego. Komentarz.* Warszawa: C.H. Beck, pp. 275-278.

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# FROM SOCIAL DISTANCING TO THE FINANCIAL AND MEDICAL SERVICES DISINTERMEDIATION DURING THE COVID-19 PANDEMIC

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**Purpose of the article:** In one sentence, disintermediation, it is said, neutralized the negative effects of the lack of trust that accrue from the use of a trusted third party, the intermediary. Disintermediation it is new system allowing any two willing parties to transact directly with each other without the need for a trusted party. Its conceptual framework focuses on posing key cognitive questions. The first core question to ask here is: how can we in intermediation after Global Financial Crisis? The second core question to ask is: how can humans blend disintermediation with policy norms to sustain disintermediation when they know that a minority can violate pandemic norms? Institutional experiences of disintermediation to individual-level social distancing, can sharpe individual beliefs, risk attitudes, and choices for years to come. The aim of the article is to indicate the mechanisms of conscious exclusion from traditional financial intermediation. Indirectly, it is gaining momentum as a result of distrust of banks and health services. In the first part, we remind you how successive financial crises crushed the banks 'natural monopoly on direct contact with customers. Tin the second part, we show how artificial intelligence penetrates people and enforces self-confidence. Social distinctions is ubiquitous in times of trust in social media. In conclusion, we show that the COVID-19 pandemic did not cause, but only exposed the scale of the social distance to traditional banking.

**Research methods:** Narrative literature review of disintermediation discuss the state of the science of a specific theme from a theoretical and contextual point of view. We start with critical analysis of securitisation, switch to social distancing and transfer to telemedicine. Systematic literature review need replace disintermediation by digital transformation, social distancing by pandemic as catalyst of change, securitisation as equivalent of financial capital and telemedicine as equivalent of human capital. This is a conceptual article.

**Orginality/value:** The pandemic has become a catalyst for the disclosure of long-term changes in financial intermediation. The tendency to financial mediation emerged half a century ago during the crisis of small and medium-sized banks in the United States.

Collective memory has survived and has been used to advance digital non-banking intermediation. The barrier to its development was digital exclusion cantered around seniors and socially excluded people.

**Keywords:** social distance, financial disintermediation, medical services, COVID-19 pandemic.

**Category of the paper:** Conceptual paper.

## 1. Introduction

The COVID-19 pandemic caused not only a massive, global health crisis, but also a reconfiguration of the established forms of social life. The virus contributes to profound disruption in:

- Economy – global shortage in product supply and falls in services, production and stock markets.
- Society – possible occurrence of panic, restrictions on migration and participation in social events.
- Culture – restriction of freedoms and stringent mitigation measures (Jarynowski, 2020).

The narrative dimension of human life is focused on the difficult balance between human lives and economic loss. We need to have the conviction that life is going somewhere, that there is a horizon of meaning that makes this life worth living.

At the outset of the pandemic, it was crucial to determine to what extent that was a new phenomenon and to what extent it was one long forgotten. In monograph entitled *Holistic management of the COVID-19 pandemic* Edu-Libri, Kraków-Legionowo, 2021, autors adopted a working definition that COVID-19 is a manifestation of global systemic risk. Based on current experiences, one may seek a reporting definition of this phenomenon. The idea of an 'epidemic of epidemics' known as REIDs (emerging and re-emerging infectious diseases) seems to be the most helpful here. In the literature, the term syndemia (Horton, 2020) is used to describe the phenomenon caused by the SARS-Cov2 virus – i.e., a syndemic epidemic as an aggregation of two or more simultaneous or sequential epidemics or clusters of diseases in a population with biological interactions that worsen the prognosis and disease burden causing excess mortality not only as a result of the main virus, but of other untreated diseases due to limited access to medical services.

Four strategies have been mobilized in response to the pandemic:

1. Containment of transmission of the virus at the level of individuals, through testing, case isolation and contact tracing. The aim of this strategy is to stop cluster from breaking out.
2. Containment of transmission of the virus to a specific territory within a country, trough quarantine. The aim of this strategy is to keep infections from spreading out to adjacent areas within the country.

3. Suppression of transmission of the virus, within a given territory, realized principaly through "lockdown": an obligation to stay inside, close all "non-essential" places of education, work and leisure. The aim is to spare critical care capacity in hospitals from being overwhelmed.
4. Mitigation of the transmission of the virus, aims to protect vulnerable groups from spread of the virus through the population. In order to slow the spread of the virus, some physical distancing and partial closures of some places of education, work and leisure are put in place (Tessier, Stavrianakis, 2020, p. 2).

When we look at the diversity of national strategies to combat COVID-19, we recognise that it is an endogenous phenomenon. When we estimate the losses caused by COVID-19, we assume that it is an exogenous shock. We represent a holistic view of COVID-19 and acknowledge the pandemic as a hybrid phenomenon in which elements of exogenous shock are intertwined with an endogenous reluctance to announce a state of emergency.

When we describe the behaviour of the unvaccinated, we see an exogenous element in the pandemic. When we look at how the health system wants to maintain its ability to survive, we know that this is an endogenous phenomenon that may shape the quality of our lives over the coming decades.

An important element of the context of our further analysis of the structure of everyday life is the process of mass preventive vaccination of humanity. It is accompanied by a movement of people who consciously avoid vaccination. In economic theory, this can be defined as the deliberate replacement of public goods by private goods. In psychology, as a defence mechanism in the conditions of significant unmet basic psychological needs (Rudert et al., 2021).

The rational core of the anti-vaccine movement is the lack of knowledge about the long-term effects of SARS-CoV-2. Still the proportion between vaccinated and consciously avoiding vaccination does not allow for the development of herd immunity (Szmyd et al., 2021).

The attitude to vaccination against COVID-19 includes the attitude to remote work and defence mechanisms against the real threat of death (Bodner, Bergman, Ben-David, Palgi, 2021). We have to answer the cognitive question of what is virtual reality, is it fiction or everyday reality? (Chalmers, 2017). The modern world of finance has a hybrid character. The factor that binds the world together is physical and social time. It combines elements of virtual reality with the real circulation of goods and services. The real and virtual world are real, not imaginary beings. The practical and cognitive problem is finding a balance between these real beings in everyday life, a day still has 24 hours (Solarz, Waliszewski, 2022).

The alternation of endogenous and exogenous approaches to COVID-19 is perpetuated in the title of our study, which highlights the similarity of the process of transition from a natural monopoly in banking to social distancing in medical services. In the first part, we recall how successive financial crises crushed the banks' natural monopoly on direct contact with customers. The crisis of small banks in the 1970s meant that the client of a local bank stopped

trusting the local banker. The global financial crisis has taken away trust in systemically important financial institutions. In the second part, we demonstrate how artificial intelligence comes between people and forces them to abandon direct contact when asking for repeat medical prescriptions.

In conclusion, we indicate that the COVID-19 pandemic did not cause, but merely exposed, the scale of social distancing towards traditional banking. Street art likens bankers to the SARS-CoV-2 virus. We live in times of an epidemic of epidemics; the new normality does not assume a return to the old systemic equilibrium. This is not a shock, but the emergence of a new hybrid reality of the vaccinated and the unvaccinated.

## 2. Literature review

The language of social discourse about COVID-19 is indicative. To describe changes in the economic outlook under the influence of the pandemic, the entire alphabet is used: V, W, L, U, K. At the beginning of 2020, the World Health Organization acknowledged COVID-19 to be a pandemic – i.e., a global epidemic. In response, some governments introduced a state of natural disaster, a state of emergency, or one of the states of emergency on their territory.

Some researchers pointed out that COVID-19 is not a standard pandemic with significant spread, but one with a relatively low death rate. There is talk of an overlapping of the external costs of a pandemic – in the form of quarantine and lockdown – with age discrimination. The response to a pandemic is influenced by the degree of herd immunity, which largely depends on whether a given population group has been exposed to a given type of virus in the past and whether it has been previously subject to a compulsory vaccination program (Buesa, Perez, Santabarbara, 2021).

Over time, the pandemic came in waves – the first, second, third, fourth, and so on. The cyclical nature of the COVID-19 pandemic makes it difficult to present it as a shock, a temporary disruption to the normal run of things. We argue that the fluctuation of the COVID-19 pandemic makes it more U-shaped in nature – at first it was exogenous, now it is endogenous, and it will highlight its exogenous nature in the future. The hybrid nature of the pandemic means that its stakeholders are many and varied; first it was epidemiologists, and then representatives of life sciences had their say. It takes a decade for clinicians to make a judgment about a disease, whereas red zone doctors fight every day for people's lives in the here and now (Lewis, 2021).

The category of *oikos* has regained its former glory, the natural environment of man, the family and their household, material, the social and economic bond that allows the needs of individuals to be met (Olcoń-Kubicka et al., 2021). Currently, sociologists and political scientists have more and more say. The trauma of the COVID-19 pandemic (Długosz, 2021)

emerges as a key category of description. The social discourse about COVID-19 is packed with rumours, misinformation and conspiracy theories (Demczuk, 2021). Economists and financiers are being invited to rebuild the economy and society after the losses caused by the pandemic. The pandemic economy describes a supply shock caused by the disruption of global chains of added value (Economic, 2022). The sources of demand-pull inflation are recognised. Tremendous attention is devoted to state interventionism and the macroeconomic policy of central banks to absorb the shock. The overlapping of health, climate and economic shock leads to the collapse of empires (Bergeijk, 2021).

An intense search is underway for language with which to describe COVID-19 that matches the reality. The authors propose that this should be the language of systemic risk management. This proposal was understood; the COVID-19 pandemic is a systemic catastrophe. 'Systemic catastrophes are predictable in the sense that we know that, statistically speaking, they must happen one day, but we do not know exactly where it will lead and when it will happen' (Afeltowicz, Wróblewski 2021, p. 11).

To this day, we do not know the correct method for calculating the losses caused by COVID-19. 2019 Estimates of the statistical value of life differ in both the results and the methods used. Nevertheless, when it comes to the United States, the median is $7 million, with statistical deviations ranging from $2.4 and $11.2 million. The statistical value of a life depends on when it is interrupted. At 18, the value is $4.62 million, at 46 it is $10.62 million, and at 62 it is $6.94 million. (Banzhaf, 2021, p. 11).

COVID-19 mortality statistics are not reliable (figure 1). It is difficult to pinpoint a causal relationship between death and contraction of the coronavirus. Deaths after being put on a ventilator, in the absence of co-existing illnesses, represent hard data. In other cases, it is a question of speculation about 'excess deaths' (Cusmaiu, 2021).

Mortality among white US citizens increased by 15% during the COVID-19 pandemic, blacks by 25% and Hispanics by 39.5% (Alsan, Chandra, Simon, 2021).

One of the causes of excess deaths is the stay-at-home policy. Counterintuitively, it leads to an increase in mortality among self-isolating people (Agrawal, Cantor, Sood, and Whaley, 2021).

The lack of agreement on how to calculate the losses caused by COVID-19 makes it difficult to effectively limit them. In our monograph, we postulate that the fight against the pandemic should be acknowledged as a global public good.

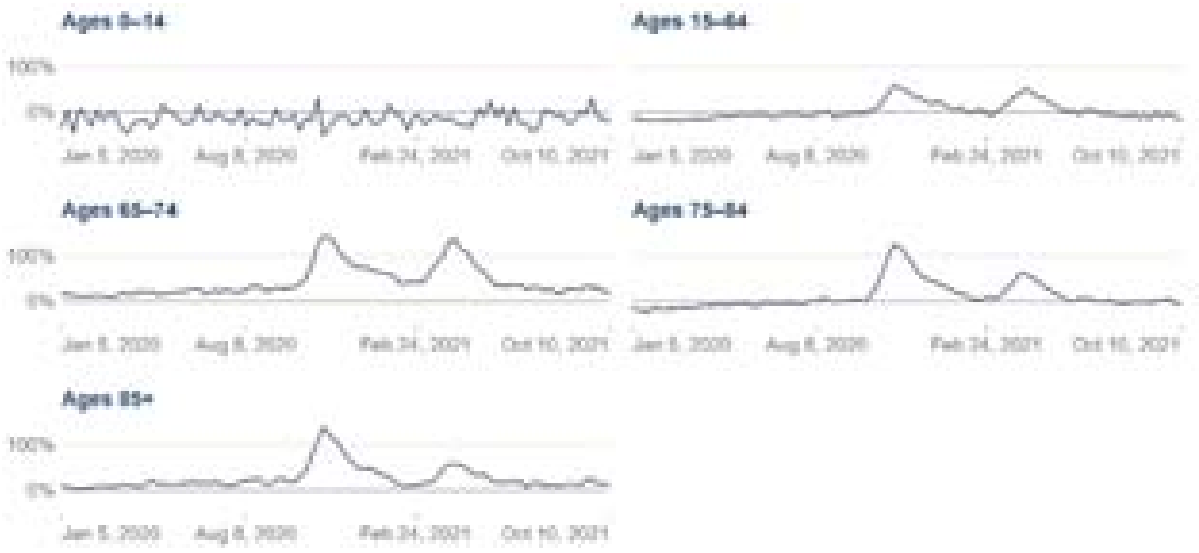


**Figure 1.** Excess mortality in Poland by age groups compared to the same period of the previous year. Source: https://github.com/akarlinsky/world mortality, 10.11.2021.

"The interconnection of individual welfare levels resulting from empathy makes a difference to the allocation of resources in the presence of externalities and public goods: in maximal form it leads to efficient outcomes and in weaker forms can lead to the partial internalization of external costs and benefits, and to a greater level of provision of public goods than would occur with non-empathetic preferences. In the case of public goods, an increase in empathy leads to a greater level of provision and an approach to the efficient level" (Heal, 2021, p. 20).

This approach focuses the attention of stakeholders on the scale of disability caused by the consequences of COVID-19 disease. The axis of the analysis is vaccinated vs unvaccinated, and the endogenous or exogenous nature of the pandemic. As a result of the overlap of these two dimensions, we obtain four fields for further analysis presented in Table 1.

**Table 1.**
*Conceptual framework of analysis for the COVID-19 pandemic*

| **Dimension of analysis** | **Vaccinated** | **Unvaccinated** |
|---|---|---|
| Endogenous model | Systemic risk management | Disintermediation of financial and medical services |
| Exogenous model | Crisis management,<br>Elimination of natural disaster. | Monitoring social distance and triple vaccinations<br>Organized isolation |

Source: own study.

In the national legal order, the COVID-19 pandemic is considered to be a natural disaster (The Economic, 2022). One of the important consequences of the COVID -19 crisis is that crisis management is directly related to fundamental rights and liberties.

The first organized isolation of healthy but potentially sick people took place in response to the Great Plague (also commonly known as Black Death) in 14th century in the independent trading city-state of Ragusa (now Dubrovnik, Croatia (Peters, Jandric, Mc Laren, 2020).

Due to the size restrictions on this publication, we shall focus on an identified gap in previous publications, which overlook the existence of a significant group of people who believe that their personal rights are being violated so severely that they do not agree to voluntary vaccination. Any statements by respondents about their plans to vaccinate against SARS-CoV-2 should be handled with caution. Attempts to nudge and guide people towards the decision to vaccinate are not effective unless made by heads of state (Chang, Jacobson, Shah, Pramanik, & Shah, 2021).

We remember that the method of overcoming a systemic crisis will determine the origins and course of a subsequent systemic crisis. The existing strategies for combating the virus can be conventionally divided into elimination – i.e., 10% of the world's countries, inhabited by 25% of its population – and controlling the degree to which a countries health system is overloaded for the remaining countries. At the end of May 2021, the cumulative death rate due to COVID-19 in the former was 4.3 while in the latter this figure stood at 69.3 per 100,000 inhabitants (Helliwell, Norton, Wang, Aknin, Huang, 2021, p. 25).

We are aware that in crisis management of natural disasters, material losses are not taken into account, but efforts are made to keep human losses to a minimum (Blanchot, 1986). How do these two philosophies of coping with the shock of the COVID-19 pandemic relate to deliberate refusal to vaccinate?

There are different types of misinformation about COVID-19 vaccine:

- Vaccines leading to infertility.
- Vaccines contain microchips.
- Vaccines cause one to be magnetic.
- Vaccines alerting one's DNA.
- Vaccines shed components.
- Vaccines are causing one to obtain a positive result when tested.
- Miss menstrual cycle (Chukwure, 2021).

**Table 2.**
*The myths versus true information about the virus SARS-CoV-2*

| **Myth** | **True information** |
|---|---|
| Mortality for SARS-CoV2 is similar to the influenza | Mortality for COVID19 is higher than for influenza |
| The increase of the temperature will eradicate the virus | There is no scientific proof that the temperature influences the activation of the virus |
| Drinking alcohol eradicates the virus and protect from the contamination | Consuming alcohol weakens the immune system and thus does not destroy the virus |
| The 5G technology is a possible source of the virus transmission | There is no confirmation of spreading SARS-CoV-2 by the 5G network |

Source: Cudy, Matuszczak, Donderska, Haczyńska, 2021, p. 56.

To answer this question, we shall draw on the experience of providing financial services. Historically, banking services have been the first to be licensed and regulated. The Venetian police used to monitor how bankers from the Jewish community executed the privilege of providing banking services to the townspeople. Half a century ago, government guarantees were introduced for bonds issued by venture capital funds purchased by small and medium-sized American banks. In the language of finance, refusal to cooperate in a crisis is called financial disintermediation or self-exclusion.

## 3. Financial service disintermediation (financial self-exclusion)

Financial exclusion is a range of processes that serve to restrict the access of specific social groups, mainly those with limited incomes, to the financial system (Leyshon, Thrift, 1995). Financial exclusion may take various forms depending on the causes that influence the occurrence of the phenomenon (types). The following types of financial exclusion should be mentioned: geographic (e.g., insufficient number of establishments, lack of infrastructure), accessibility (e.g., difficult access to products due to age, lack of creditworthiness), circumstantial (mismatch between products and services and customer needs), price (e.g., high fees and commissions), marketing (lack of information about current offers, no products for people with the lowest income) as well as self-exclusion (voluntary withdrawal from banking services).

It is useful to differentiate society into banked, unbanked and underbanked. The first group uses a wide range of banking products and services, thereby meeting their own needs. Members of the second group have no contact with financial institutions, and do not even have a basic bank account. On the other hand, the third group has limited access to services (e.g., they might not be eligible for a loan) or can use banking services, but do not do so (e.g., they have a personal account, but withdraw everything once a month and spend it on cash purchases) (Solarz, Swacha-Lech, 2011). Self-exclusion could be a life choice or a consequence of past folly. In the first case, there is a bias against using financial services, while in the second, the exclusion results from risky behaviour on the financial market, which temporarily excludes the perpetrator from the legal credit market. Financial self-exclusion may also have a psychological and behavioural basis – e.g., the repetition of well-worn patterns or negative perceptions, and may be caused by gaps in basic economic knowledge. Therefore, these are the reasons from the demand side of the financial market.

## 4. Narrative literature review on telemedicine, during and after the COVID-19 pandemic

Telemedicine is the provision of healthcare services at a distance with communication conducted between healthcare provider (provide to provider telemedicine) or conducted between remote healthcare users seeking health services and healthcare provider telemedicine (WHO, 2019).

Prior to the pandemic, several obstacles hindered the acceleration of telemedicine. The first was human nature. There was still a lack of training, support, and fully embedded telemedicine culture within all health organizations. For example, in the US, remote visits accounted for less than 1% of primary care visits before 2020.

The second obstacle was financial. For doctors, who are mainly paid on a fee-for- service basis, telemedicine consultation, expertise, and training were not, for some medical specialities, admissible practices reimbursed by health authorities. Challenges remained such as concerns in medical liability, and proof of the value of telemedicine on a wider scale was still limited.

Lastly, ethical obstacles such as privacy and confidentiality, as well as cybersecurity issues, technological barriers, and data availability to external actors al2021so hindered the spread of telemedicine (Brunet, 2021).

In 2020, countries reported on average, about half of essential health services were disrupted. Pursue telemedicine as alternative to disrupted face to face healthcare services was:

- Reduce unnecessary exposure to the COVID-19 pandemic.
- Help mitigate the spread of the virus.
- Reduce surges in hospitals and clinics.

Most importantly telemedicine can be used to ensure the healthcare resources are used in the most efficient and effective way during pandemics (Cassar, 2021).

Disparities with telemedicine use, which ultimately led patients with the highest risk of COVID-19 infection to use telemedicine the least (Qian, 2022).

Using a mobile health application is associated with increased ease of booking telemedicine appointments (Taha, 2022).

While telemedicine is not poised to replace in-person care, it is a useful adjunct when faced with disasters and public health emergencies by providing healthcare workers the flexibility to quickly transition care from clinics to homes seamlessly and without interruption. Barriers to access still exist, however, and are more pronounced in rural minority, and technologically unserved communities (Greiwe, 2021).

Patient experiences with inpatient telemedicine were largely favourable. Improvements in technical and a care team use may enhance acceptability (Vilendrer et al., 2022).

There remain many open questions about the role of supporting technologies, the design of optimal reimbursement politicies, and the optimal ways to combine telemedicine and inperson care for different conditions (Zeltzer, 2021).

To work toward this goal, payers could:

1. eliminate geographic and originating-site restrictions,
2. reimburse video telemedicine at the same rate as in–person services to encourage universal adoptions by clinicians,
3. eliminate reimbursement for audio-only telemedicine because of quality concerns,
4. cover only select services shown to be equivalent in quality, and
5. require an occasional inperson visit to offset some of the limitations of telemedicine (Uscher-Pines, 2021).

A number of social implication may arise with increasing use of telemedicine. The rapid progress of the digital age has already led to patient complaints about physicians spending more time looking at computer screens than their patients. As telemedicine replaces more in-person visits , the patient-physician interaction could be further jeopardised. Since not all systems offer telemedicine services at this time, a patient's utilisation at a telemedicine service could mean having to see a new provider, creating discontinuity of care (Kichloo, 2020).

Financial services cannot function without public trust. To what extent has the COVID-19 pandemic changed the level of trust in financiers? The results of research in the Netherlands and the United States showed no significant changes in the level of confidence in financial institutions (Cruijsen, Haan, Jonker, 2021).

Contrary to the global financial crisis (GFC) of 2007-2009, this time there was no wave of unemployment and bankruptcy. Banks wanted to, and did, grant loans so that people could adapt to the new economic circumstances caused by the pandemic. This was possible thanks to the banks' equity, which was higher than a decade ago (Ikeda et al., 2021).

Systemically important banks had more capital and better liquidity, which allowed them to absorb macroeconomic shocks rather than generate them. At the same time, the pandemic test showed that the resilience of non-bank financial intermediaries has room for improvement (Lessons, 2021). During the pandemic, payments and settlements became an area of particularly far-reaching shifts. ATM users avoided meeting with others and made fewer transactions but for larger amounts. This change in user habits entailed an overestimation of the scale of spending by 7% (Dahlhaus, Wlte, 2021).

COVID-19 has exposed the scale of digital illiteracy among the world's population. Young, well-paid and full-time employees switched to remote financial services. Women found it more difficult to switch to remote work due to the nature of their work. People over 65 had more difficulties than others when switching to remote work. The poor have disproportionally borne the external costs of the COVID-19 pandemic (Saka, Eichengreen, Aksoy, 2021).

Women in the United States are twice as likely as men to work in occupations exposed to automation and exposed to direct contact with people infected with coronavirus (Chernoff, Warman, 2021). In Poland, the concentration of this type of risk affects women working in banks.

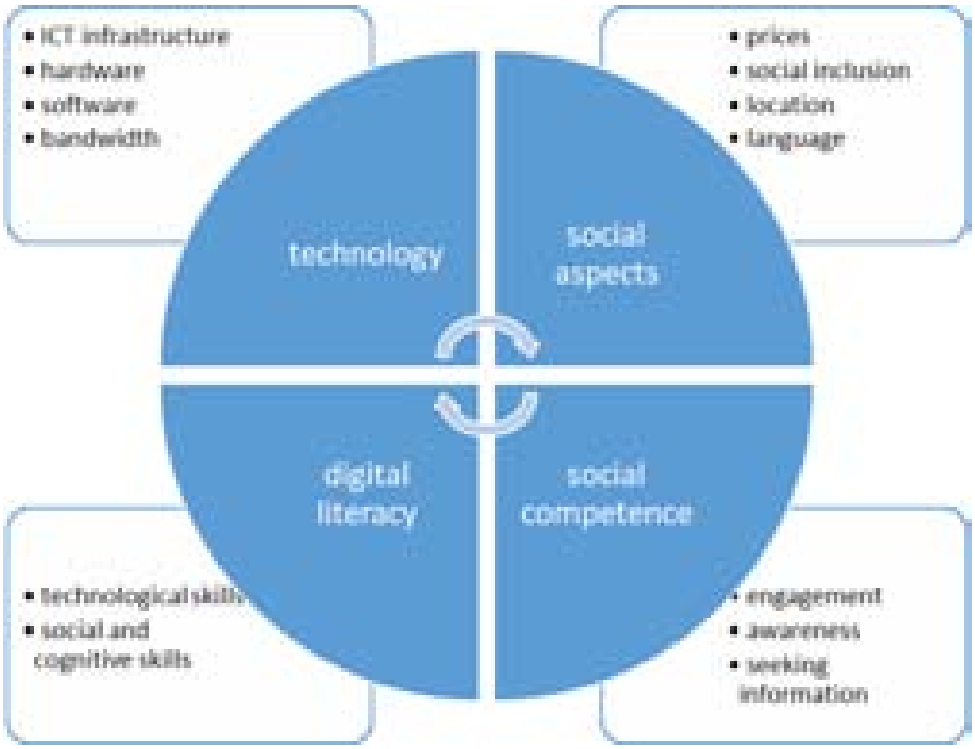


**Figure 2.** Framework of digital exclusion. Source: Folwarski, 2021, p. 131.

The framework of digital exclusion is presented on figure 2. The digitally excluded cannot take advantage of support from:

- Bank Tech – banking services.
- Big Tech – data collection services.
- InsurTech – insurance services.
- Lend Tech – loans.
- Pay Tech – payment services.
- Reg Tech – protection of sensitive data.
- Sup Tech – support for supervisory activities.
- Wealth Tech- wealth management (PayTech, 2020).

The supply of technological support for people in quarantine and those working remotely is clearly over-represented in contactless payments and loans on internet platforms with a clear lack of insurance support. A clear shift towards households is not a passing fad, but an appreciation of their economic significance (Lerner, Seru, Short, Sun, 2021).

There is a consensus that the COVID-19 pandemic has accelerated the digitisation of the economy and society by a decade. Neo-banks have appeared *en masse*, whose basis is an internet platform rather than a network of local branches. Transactions will be carried out by

numerous participants in the transaction; the data used to assess creditworthiness will be counted in thousands, not tens. Information technology improves the quality of lending (Pierri, Timmer 2021).

Access to broadband internet gives residents of small towns and villages access to financial services. Shunted from their habit of direct contact with service providers by the COVID-19 pandemic, they discover the advantages of access to the global financial market (Michelangeli, Viviano, 2021).

At the same time, the widespread use of artificial intelligence as a reliable intermediary between people raises well-founded fears that algorithms of conduct will perpetuate stereotypical perceptions about transaction participants (Armantier et al., 2021).

Synthetically recalled experiences of abandoning the natural monopoly of face-to-face contact in the provision of financial services may provide an indication of how the fate of remote medical services will unfold, one that does not involve listening to the patient. This type of medical service has a future and will develop no less rapidly than non-bank financial intermediation.

## 6. Conclusion

The gross world product decreased by 6.5% in 2020, and by the end of 2021 this gap is expected to have shrunk from pre-pandemic levels to 4.0% (Rungcharoenkitkul, 2021). The dilemma between life or economic activity is slowly weakening. The field for economic activity increases as the effectiveness of monitoring compliance with compulsory quarantine increases and the vaccination coverage of the population grows.

The dispute continues as to whether what we are observing is a temporary glitch in the global balance or if it is punishment for the sins of humanity. Who is the leper, the people who infect or those who do not get vaccinated against the coronavirus? Are the antivaxxers outcasts?

Pandemics occur as often as global financial crises: every 12-15 years. In this situation, routine and professional systemic risk management or crisis management should suffice. A new element is the emergence of an anti-vaccine movement outside the system, which draws its strength from bonds established in social networks on the Internet. They are manipulated via artificial intelligence. Artificial intelligence creates effective social distancing in the interests of service platform owners. A pandemic is no longer a natural process with a natural beginning and end. In financial services, the natural monopoly on their provision ceases to apply. he new fluid normality requires new language with which to describe it. Intermediary medical services are becoming a permanent feature of the new normality.

## References


1. Afeltowicz, Ł., Wróblewski, M. (2021). *Socjologia epidemii. Wyłaniające się choroby zakaźne w perspektywie nauk społecznych.* Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.
2. Agrawal, V., Cantor, J.H., Sood, N., Whaley, C.M. (2021). The Impact of the COVID-19 Pandemic and Policy resonses on excess mortality. *NBER Working Paper No. 28930.*
3. Alsan, M., Chandra, A., Simon, K.I. (2021). The great unequalizer: initial healt effects of COVID-19 in the United States. *NBER Working Paper No. 28958*.
4. Armantier, O., Doerr, S., Frost, J., Fuster, A., Shue, K. (2021). Whom do consumers trust with their data? Desrosiers US survey evidence. *BIS Bulletin, No 42*.
5. Banzhaf, H.S. (2021). The Value of Statistical Life: A Meta-analysis of Meta-Analyse. *NBER Working Paper, No 29185*.
6. Bergeijk, P.A.G. (2021). *Pandemic Economics.* Edward Elgar Publishing.
7. Blanchot, M. (1986). *The Writing of the Disaster.* University of Nebraska Press.
8. Bodner, E., Bergman, Y.S. Ben-David, B., Palgi, Y. (2021). Vaccination anxiety when vaccinations are available: The role of existential concerns. *Stress and Health, No. 8*.
9. Brunet, F., Malas, K., Desrosiers, M.E. (2021). Will telemedicine survive after COVID-19? *Healthcare Management Forum, Vol. 34, No. 5*.
10. Buesa, A., Perez, J.J., Santabarbara, D. (2021). Awareness of Pandemics and the Impact of COVID-19. *Documentos de Trabajo Banco de Espana, N 2123*.
11. Cassar, M.R., Borg, D., Camilleri, L., Schembri, A., Anastasi, E.A., Buhagiar, K., Callus, C., Grech, M. (2021). *International Journal of Infectious Diseases, Vol. 103*.
12. Chalmers, D.J. (2017). The Virtual and the Real. *Disputatio, Vol. IX, No. 46*.
13. Chang, T., Jacobson, M., Shah, M., Pramanik, R., Shah, S.B. (2021). Financial incetives and other nudges do not increase COVID-19 vaccinations among the Vaccine hesitant. *NBER Working Paper No 29403*.
14. Chernoff, A., Warman, C. (2021). COVID-19 and Implications for Automation. *Bank of Canada Staff Working Paper, No. 25*.
15. Chukwuere, G.C.J. (2021). COVID-19 vaccine misinformation and its effect on human psychology. *Academia Letters. Article 3469*. https://doi.org/10.20935/AL3469.
16. Cruijsen, C., Haan, J., Jonker, N. (2021). Has the COVID-19 pandemic affected public trust? Evidence for the US and the Netherlands. *DNB Working Paper, No.723*.
17. Cusmariu, A. (2021). Are COVID-19 Mortality Statistics Valid? *Academia Letters, Article 2932*.
18. Czudy, Z., Matuszczak, M., Donderska, M., Haczyńska, J. (2021). The Role of (Dis) information in Society During the COVID-19 Pandemic. *Problemy Zarządzania (Management Issues), 19(2),* 49-63. https://doi.org/107172/1644-9584.92.3.

*19.* Dahlhaus, T., Welte, A. (2021). Payment Habits During COVID-19: Evidence from High-Frequency Transaction Data. *Bank of Canada Staff Working paper, no. 43.*

*20.* Demczuk, A. (2021). *SARS-COV-2 I COVID-19. Plotki, dezinformacje I narracje spiskowe w polskim dyskursie publicznym.* Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej.

21. Długosz, P. (2021). *Trauma pandemii COVID-19 w polskim społeczeństwie.* CeDeWu.

22. *Economic policy and the COVID-19 crisis. The macroeconomic response in the US, Europe and East Asia, eds. Bernandette Andreosso-O'Callaghan. Woosik Moon, Wook Sohn* (2022). Routledge.

23. Folwarski, M. (2021). *Innowacje cyfrowe w bankowości a włączenie cyfrowe i finansowe społeczeństwa.* Wydawnictwa Uniwersytetu Jagiellońskiego.

24. Greiwe, J. (2022). Telemedicine Lessons Learned During the COVID-19 Pandemic. *Current Allergy and Asthma Reports, Vol. 22, No. 1.*

25. Heal, G. (2021). Empathy and the efficient provision of public goods. *NBER Working Paper, No. 29255*.

26. Helliwell, J.F., Norton, M.B., Akin, L.B., Huang, H. (2021). Well-being analysis favours a virus – elimination strategy for COVID-19. NBER Working Paper, No. 29092.

*27.* Horton, R. (2020). *COVID-19 is not a pandemic, Vol. 396, Iss. 10255*, p. 874.

28. https://github.com/akarlinsky/world_mortality, 10.11.2021.

29. Ikeda, Y., Kerry, W., Lewrick, U., Schmieder, C. (2021). Covid-19 and bank resilience: where do we stand? *BIS Bulletin, no. 44*.

30. Jarynowski, A., Wójta-Kempa, M., Płatek, D., Czopek, K. (2020). Attempt to understand public-health relevant social dimensions of Covid-19 outbreak in Poland. *Society Register, No. 3.*

31. Kichloo, A., Albosta, M., Dettloff, K., Wani, F., El-Amir, Z., Singh, J. Aljadah, M., Chakinala, R.C., Kanudula, A.K., Solanki, S., Chugh, S. (2020). Telemedicine, the current COVID-19 pandemmic and the future: a narrative review and perspectives moving forward in the USA. *Family Medicine and Community Health, no. 8*.

32. Lerner, J., Seru, A., Short, N., Sun, Y. (2021). Financial innovation in the 21st Century: Evidence from U.S.Patents. *NBER Working Paper, No. 28980*.

*33. Lessons Learnt from the COVID-19 Pandemic from a Financial Stability Perspective. Final report* (2021). Basel: Financial Stability Board.

34. *Lewis, B., Lewis, W. (2021). The COVID-19 Wars: Physician vs. Clinician. Academia Letters. Article 3085*. https://doi.org/10.20935/AL3085.

35. Leyshon, A., Thrift, N. (1996). Financial exclusion and the shifting boundaries of the financial system. *Environment and Planning, A28(7),* 1150-1156.

36. Michelangeli, V., Viviano, E. (2021). Can internet banking affect households' participation in financial markets and financial awareness? *Banca D'Italia Working Papers, No. 1329*.

37. Olcoń-Kubicka, M., Felczak, J., Posłuszny, Ł., Kubicki, P. (2021). *Przemiany praktyk konsumpcyjnych w gospodarstwach domowych w pierwszych miesiącach pandemii*

*COVID-19, w Zmiana społeczna pandemia, kryzys, konteksty empiryczne i teoretyczne*. Wydawnictwo IFiS PAN.

38. *PayTech-innowacyjne rozwiązania płatnicze na rynku polskim* (2020). NBP.
39. Peters, M.A., Jandric, P., Mc Laren, P. (2020). *Viral modernity? Epidemics, infodemics, and the "bioinforamtional" Paradigm.* Educational Philosophy and Theory. DOI: 10.1080/00131857.2020.1744226.
40. Pierri, N. Timmer, Y. (2021). *T*he importance of technology in banking during a crisis. *European Systemic Risk Board Working Paper, No. 117.*
41. Qian, A.S., Schiaffino, M.K., Nalawade, V., Aziz, L., Pacheco, F.V., Nguyen, B., Vu P., Patel, S.P., Martinez, M.E., Murphy, J.D. (2022). Disparities in telemedicine during COVID-19. *Cancer Medicine, No. 11*.
42. Rudert, S.C., Gleibs, I.H., Gollwitzer, M., Haefner, M., Hajek, K.V., Harth, N.S., Imhoff, R., Schneider, D. (2021). Us and the virus: Understanding the COVID-19 pandemic through a social psychological lens. *European Psychologist, No. 1*.
43. Rungcharoenkitkul, P. (2021). Macroeconomic effects of COVID-19: a mid-term review. *BIS Working Paper, No. 959*.
44. Saka, O., Eichengreen, B., Aksoy, C.G. (2021). Epidemic exposure, fintech adoption, and the digital divide. *NBER Working Paper, No. 29006*.
45. Solarz, J.K., Waliszewski, K. (2020). *Zarządzanie ryzykiem systemowym. Pandemia COVID-19.* Kraków-Legionowo: Edu-Libri.
46. Solarz, J.K., Waliszewski, K. (2022). Pandemia COVID-19 z perspektywy finansów – *integration of m Health technologies in telemedicine during the COVID-19 era: A cross-sectional study,* Plos one, https://doi. Org/10.1371/ journal.pone. 02644436.
47. Solarz, M., Swacha-Lech, M. (2011). Samowykluczenie bankowe w aspekcie finansów behawioralnych. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, nr 193*.
48. Szmyd, B., Karuga, F.F., Bartoszek, A., Staniecka, K., Simecka, N., Bartoszek, A., Błaszczyk, M., Radek, M. (2021). Attitude and Behaviors towards SARS-CoV-2 Vaccination among Healthcare Workers: A Cross-Sectional Study from Poland. *Vaccines, No. 9.*
49. Tessier, L., Stavrianakis, A.(2020). *Go Suppress Yourself. A Chronicle.* Somotospshere.
50. Menkes, J., Suska, M. (eds.) (2022). *The economic and leagal impact of COVID-19. The case of Poland.* Routledge.
51. Uscher-Pines, L., Martineau, M. (2021). *Telehealth After COVID-19. Clarifying Policy Golas for a Way Forward, Perspective.* RAND Corporation.
52. Vilendrer, S., Sackeyfio, S., Akimnbami, E., Gosh, R., Luu, J.H., Pathak, D., Shimada, M., Williamson, E.E., Shieh, L. (2022). Patient Perspectives of Inpatient Telemedicine During the COVID-19 Pandemic: Qualitative Assessment. *JMIRRorm Re, Vol. 6, No. 3, e 32933,* doi:10.2196/32933.

53. *WHO Guideline: Recommendations on Digital Interventions for Health System Strengthening* (2019). Geneva, https://apps. Who.int/ins/handle (10665311941).
54. Zaltzer, D., Einav, L., Rashba, J., Balicer, R. (2021). The Impact of Increased Access to Telemedicine. *NBER Working Paper, 28978*.

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# DIVERSIFICATION OF THE FINANCIAL SITUATION OF TERRITORIAL SELF-GOVERNMENT UNITS IN TERMS OF CHANGES IN THE NUMBER OF INHABITANTSS (EXAMPLE OF EASTERN AND WESTERN REGIONS OF POLAND)

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**Purpose:** The aim of the article is to identify and assess the differentiation of the financial situation of communes without cities with poviat status in terms of changes in the number of their inhabitants in the eastern and western regions of Poland.
**Design/methodology/approach**: Identification and evaluation of the diversification of the financial situation of communes without cities with poviat status in terms of changes in the number of their inhabitants in the eastern and western regions of Poland. The empirical material of the article consists of figures from the Local Data Bank of the Central Statistical Office in Warsaw for the years 1995 and 2018-2020. They apply both to the entire country and to all municipalities without cities with poviat rights, located in six voivodships of eastern and western Poland, i.e., Lubelskie, Podkarpackie and Podlaskie as well as Dolnośląskie, Lubuskie and Zachodniopomorskie. The collected and structured empirical material was developed in a descriptive, tabular, and graphic form, using the method of comparative analysis. Additionally, a score was made of all diagnostic features illustrating the financial situation of the analyzed local government units in the eastern and western regions of Poland against the background of the entire country for 2018-2020.
**Findings:** The analysis of statistical data showed that changes in the number of population (inhabitants) constitute essential demographic conditions for the economy and financial situation of municipalities without poviat status in the analyzed regions of Poland. It also confirmed the research hypothesis, which assumes that communes in western regions of Poland are in a better financial situation compared to eastern regions, especially those with an increase in the number of inhabitants.
**Originality/value:** The originality of the work is based on the author's approach to the analysis of the undertaken research issues and making a point evaluation of the financial situation of the examined local government units. The work is addressed primarily to local government officials responsible for local government public finances and the possibilities and directions of local socioeconomic development, as well as to decision-makers who implement regional development policy in Poland.

**Keywords:** local government units, financial situation, changes in the number of inhabitants, eastern and western regions of Poland.

**Category of the paper:** research paper.

## 1. Introduction

The essence of local self-government consists in the exercise of state authority with the use of administrative power in the field of shaping public life in a commune, poviat and voivodship, within the framework of the applicable legal order. Local self-government as a subject of public authority is the bearer of the subjective rights assigned to it, and its main function is to perform non-reserved public tasks for other public law entities, primarily for the state. The guarantee of the implementation of these tasks is, however, the appropriate economic potential of individual local government units, meaning all features, conditions, possibilities, and abilities to obtain funds and their rational and effective spending (Byjoch, Sulimierski, Tarno, 2000; Kotulski, 2000; Stanny, Strzelczyk, 2018).

One of the main aspects of the independence of a local government unit as an entity of a public authority is its financial independence i.e., the right to independently conduct financial management. The rule is that the greater the share of own income and the smaller the share of targeted subsidies in the total budget income the greater the financial independence of a local government unit. Similarly, in spending funds, the greater the share of expenditure on own tasks, and the smaller the share of commissioned tasks financed with earmarked income the greater the independence. Securing the financial independence of a local government unit depends not only on relying on own income, but also on independently shaping the expenses (Dębowska-Romanowska, 1995, 1997; Kornberger-Sokołowska, 2001; Gumińska-Pawlic, Sawicka, 2002; Jastrzębska, 2012).

The financial management of a local government unit comprises the accumulation of income and revenues as well as expenditures and including the ones to perform own and commissioned tasks. At the commune level, it determines its development and competitiveness and secures the fulfillment of the residents' needs. In assessing the income side of the commune's budget, it is important to study the changes in the amount of income, its dynamics, and structure as well as spatial differentiation. On the other hand, on the basis of the analysis of the expenditure side of the budget, it can be determined to what extent the funds are allocated to solving the current problems, and to what extent to the promotion and development of the commune, as well as the improvement and increase of its competitiveness. It should be added that the analysis of the spatial differentiation of the level of budget revenues shows that the high incomes of communes are not only the result of the resourcefulness of local authorities, but also, among others, of the location of capital and enterprises, changes in the number of people, the condition of infrastructure, neighborhood or presence of cities and tourist attractiveness (Podstawka, 2005; Hybel, 2010).

Due to the constantly growing social needs and the limited resources available, the management of public money resources by local government units should be rational. The need to apply mechanisms rationalizing the financial management of a local government

unit occurs in the income and expenditure area of the budget. This is due to the fact that the basis for determining the scope of the tasks performed is the amount of budget revenues. The main goal of rationalizing the income side is to increase the size of the budget of a local government unit. Its achievement depends on the use of economic and political instruments. On the expenditure side, the goal is to increase the efficiency of management and better use of municipal property. An expression of this is the rationalization of the costs of the services provided and the shaping of development on the basis of the desired proportions between current and investment expenditure. The possibilities of rationalizing the financial management of a local government unit are determined by four factors, i.e., the size and structure of the budget, municipal property, and the state of development, management strategy of local authorities and external conditions of financial management. To rationalize the financial management of a local government unit, priorities for the management of current funds and investment financing should be established. The determinant should be the adopted development strategy and the long-term financial forecast of the budget. When making a choice, one should consider social, economic, and political conditions (Zalewski, 1996; Owsiak, 1999; Gwoździcka-Piotrowska, 2012; Jastrzębska, 2012).

Investment expenditures in the financial management of local government units, apart from own income, are an important factor characterizing their development possibilities. The wealth of local government units clearly affects their investment opportunities. Local government units with higher budget revenues per capita usually also have greater investment opportunities. In addition, a greater share of own revenues in total budget revenues allows local governments to freely dispose of financial resources, and thus creates the possibility of allocating larger amounts for investments. The implementation of investments by local government units is one of their most important public tasks, as it satisfies the basic needs of local self-government communities and contributes to their development. In particular, it concerns, in particular, investments in the field of social and technical infrastructure, which create conditions for increasing the competitiveness of the local environment and improving the quantity and quality of public services provided. The aim of investments carried out by local government units should be primarily to meet the needs of the local community, and in assessing their purposefulness and calculating their effectiveness, not only economic, but also social and environmental aspects should be considered. It should be added that in investment processes carried out by local government units, there is a great difficulty in objectively assessing the effective allocation of resources, which results from the complexity of investment projects, the distribution of their effects and outlays over a long period of time, the multifaceted impact of the investment on the environment, the multitude of investment stakeholders and the presence of disagreements of interests. The specificity of this type of investment is their continuity, which means that the expenses for their implementation systematically burden the budget of a given local government unit, and the growing needs in this area create the necessity to look for sources of financing. Therefore, it is important that the investment effectively and

efficiently meets social expectations and needs, but also does not adversely affect the financial situation of a local government unit, which could reduce its potential for further investment. In this way, a kind of closed system is created in which the previously undertaken and completed investments largely determine the potential and possibility of implementing subsequent investments. Therefore, it is important that local government units, when implementing a specific investment policy, consider both its socio-economic and budgetary effects (Gołaszewska-Kaczan, 2005; Sobczyk, 2010; Filipiak, 2011; Błachut, et al., 2018).

The financial condition of a local government unit is its financial condition in a specific period of time, resulting from its income and its structure, expenses and its structure, the degree of use of repayable funds, activity, and effectiveness in obtaining extra-budgetary funds, as well as the efficiency of managing financial and material resources. Local authorities should care about the good financial condition of a given territorial unit, as it is an element of its competitiveness. In addition, it is evidenced by, among others, the ability to perform tasks, achieve budget balances, as well as to increase assets, and to implement and satisfy the needs of residents. Among a number of various conditions shaping the financial economy of a local government unit, and including its financial conditions, the most general are exogenous, endogenous, and mixed conditions. Moreover, certain common categories can be distinguished, including social, economic, environmental, institutional, and political conditions (Ossowska, Ziemińska, 2010; Bień, 2017; Standard, 2017; Stanny, Strzelczyk, 2018; Wójtowicz, 2018).

Thus, the effectiveness of financial management at the local government level is the resultant of many factors and conditions, and their proper identification and the ability to use them determine the efficiency of the functioning of a given local government unit. This is of particular importance in the case of communes which, having usually limited resources, perform many tasks that often exceed their financial capabilities (Świrska, 2016).

From the point of view of effective management of local government finances, the needs and expectations of residents should be carefully identified, which not only reduces waste, but also improves the efficiency of using public funds. The close links between the inhabitants and local authorities favors taking greater responsibility for decisions that are then taken with a large participation of the local population, who identify themselves more with the local environment. This type of approach is in line with the assumptions of the concept of public co-management, assuming the openness of local authorities to the needs of the local environment, active and constant participation of residents in deciding on the direction of local government activities and an effective system of accounting for local authorities. The decentralization of local government finances is not only the basic condition for the effective implementation of the concept of public co-management at the local level but should be the basis of local development policy. Decentralization of finance consisting, inter alia, in limiting local government revenues of a transfer nature and increasing the fiscal independence of local authorities is a prerequisite for effective management of local government finances. The main point here is that the largest possible part of the income of local

government units should come from tax income and fees, the amount of which is determined fully or partially by local government authorities. This is because such a solution imposes on the local government greater responsibility not only for the income policy, but also for the expenses incurred, the amount of which must in such circumstances be closely related to the scale of the residents' tax burden. Ensuring the financial stability of local government units is possible under the condition of coordinated and long-term actions of local government institutions and central authorities, because a significant group of factors influencing the financial stability of local governments is external to local governments and is shaped by economic conditions and political decisions. According to the research, a systemic reform of local government finances is necessary in Poland in terms of streamlining the processes of implementing modern and pro-effective financial management instruments, based on a managerial approach, and considering the principles of liberal democracy and standards of good public management, including the principles of partnership and civic participation. It is also necessary to improve the adaptability of local government units to changing external conditions (Baker, Van de Walle, Skelcher, 2011; Guziejewska, 2014; Sołtysiak, Suraj, 2016, 2018; Poniatowicz, Dziemianowicz, 2017; Sołtysiak 2017; Sztando, 2019).

The financial economy of a local government unit largely depends on social, including demographic, and conditions. These include, above all: the condition, structure and changes in the number of people (inhabitants), their preferences and needs as well as wealth, as well as population density, net migration, birth rate, situation of the labor market (e.g. unemployment rate, working) and others reflecting e.g. the quality of life or the scale of specific social problems occurring in a given local government unit (Berne, Schramm, 1986; Rodríguez Bolívar, Navarro Galera, Alcaide Muñoz, López Subirés, 2016; Wójtowicz, 2018; Grzebyk, Sołtysiak, Stec, Zając, 2020).

The number of people (inhabitants) determines the scale of needs, and therefore the size and structure of local government expenditure. Population growth causes an increase in local government budget revenues in the form of increased tax revenues, which, in turn, are the main element of the expenditure side of the budget. On the other hand, the decrease in the number of inhabitants may be a decisive factor in narrowing the local tax base. The number of inhabitants and the amount of income they earn are the key variables influencing the amount of local government income, the main source of which is the share of income from personal income tax. Inhabitants of communes with high personal income, paying high personal income tax, contribute a high share of this tax to the local budget, and this may, in turn, be an important factor in the development of a given local government unit. Thus, the amount of tax revenue to the municipal budget depends not only on the number of taxpayers living in a given territorial unit, but also on the degree of their creativity, entrepreneurship, and economic activity (Nollenberger, Groves, Valente, 2003; Kozłowski, Czaplicka-Kozłowska, 2010; Balatsky, Balatsky, Borysov, 2015; Stanny, Strzelczyk, 2018; Grzebyk et al., 2020).

Eastern regions of Poland are voivodeships with a low level of socio-economic development, characterized by low population density, low quality of human, social, and intellectual capital, low level of technical, social, and institutional infrastructure development, limited territorial accessibility and a low level of income of the population and local government units. Thus, these are voivodships that meet the definition criteria used for peripheral areas. On the other hand, the western regions of Poland, in the geographical and natural sense, are the Odra basin areas stretching between the Sudetes and the Baltic Sea, and in the economic sense, they are a more developed and prosperous part of the country, especially when compared to the eastern regions. The location of the western regions of Poland near Germany and the Czech Republic, as well as near the Scandinavian countries, creates an opportunity for their further socio-economic development, which can be accelerated primarily by establishing and using mutual relations and economic relations (cross-border cooperation) (Mogiła, Zaleski, Zathey, 2011; Kudełko, 2013; Balińska, 2015; Czudec, Majka, Zając, 2018; Grzebyk et al., 2019; Miś, Zając, 2020).

## 2. Research aim, empirical material, and research methods

The aim of the article is to identify and assess the differentiation of the financial situation of communes without cities with poviat status depending on changes in the number of their inhabitants in the eastern and western regions of Poland. The article presents a research hypothesis which assumes that communes in western regions of Poland present a better financial situation compared to eastern regions, especially those with an increase in the number of inhabitants. The empirical material of the article concerns the entire country as well as all communes without cities with poviat status located in six voivodeships of eastern and western Poland, i.e., Lubelskie, Podkarpackie and Podlaskie as well as Dolnośląskie, Lubuskie and Zachodniopomorskie[1]. The figures come from the Local Data Bank of the Central Statistical Office in Warsaw and concern the years 1995 and 2018-2020. The collected and structured empirical material was developed in tabular and graphical form, using the method of comparative analysis. To identify and assess the financial situation of communes without cities with poviat status in the eastern and western regions of Poland, the following diagnostic features illustrating it in 2018-2020 were analyzed:

- total revenue of communes' budgets per capita (PLN),
- own revenue of communes' budgets per capita (PLN),
- share of own revenue in total revenues of communes' budgets (%),
- total expenditure of municipalities' budgets per capita (PLN),

[1] One of the administrative borders of these provinces is the state border.

- capital expenditure of municipalities per capita (PLN),
- share of investment expenditures in total expenditures of communes' budgets (%).

The article provides a score for all diagnostic features illustrating the financial situation of municipalities without poviat status in the eastern and western regions of Poland against the background of the entire country for 2018-2020. Individual diagnostic features were compared with the average for the country, which was assumed as 100 points, and their advantage or underweight was assessed accordingly in all municipalities without cities with poviat status in the eastern and western regions of Poland together and in selected groups of municipalities depending on the dynamics of changes in their population in the years 1995-2020. All points were then summed up and the mean was calculated (Figure 1).

## 3. Results

When analyzing the demographic conditions of the economy and the financial situation of local government units, it was assumed that the leading features in this respect are changes in the number of the commune's population, i.e., a marked increase, stagnation, or a marked decrease in the number of people. Thus, in the analyzed eastern and western regions of Poland, communes without cities with poviat status were divided into three groups, i.e.: I – communes with an increase in population in 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020[2].

In the analyzed eastern and western regions of Poland, communes with a stagnant population are dominant, especially in the western regions, where the percentage of such units amounts to 60.3% of the total number of communes, while in the eastern regions it constitutes 48.1% of the total number of communes. On the other hand, a smaller percentage are units with a population decline, especially in the western regions, where it constitutes 26.5% of the total number of communes, while in the eastern regions it is higher and amounts to 42.5% of the total number of communes. In turn, the percentage of communes with an increase in population is definitely the smallest, which in the eastern regions constitutes only 9.4% of the total of communes, and in the western regions slightly more, 13.2% of the total of communes (Table 1).

On this basis, it can be concluded that in the western regions of Poland there are better demographic conditions for the economy and financial situation of communes without cities with poviat status compared to the eastern regions.

[2] Communes with an increase in the number of inhabitants - these are the units in which the dynamics of the population in the years 1995-2020, with the year 1995 = 100, is above 110.0; communes with a stagnant population - these are the units where the dynamics ranges from 90.0 to 110.0; communes with a decline in population - these are the units where the dynamics is below 90.0.

In Poland, there is a differentiation between municipalities without cities with poviat status in terms of the average value of total income in the budgets of municipalities per capita in 2018-2020. The average value of total revenues of communes' budgets per capita is slightly higher in the communes of the western regions of Poland compared to the eastern regions and the average for the country (PLN 5,240.81). In addition, the average value of total income in communes' budgets per capita varies depending on the dynamics of changes in the population of a commune, both in the eastern and western regions of Poland. It is the highest in the group of communes with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. In the group of communes with population stagnation, the average value of total incomes in communes' budgets per capita is lower, while it is the lowest in the group of communes with a population decline, especially in the eastern regions. In all separated groups of communes, depending on the dynamics of population changes, the differentiation of this characteristic between individual communes is small, so its variability is low, as in the case of all communes without cities with poviat status in the analyzed regions, especially in the eastern regions (Table 1).

**Table 1.**
*Total revenues of communes' budgets per capita depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in PLN)*

| Description | Overall | Group of municipalities *: | | |
|---|---|---|---|---|
| | | I | II | III |
| **Eastern regions of Poland** | | | | |
| Number of communes | 480 | 45 | 231 | 204 |
| Mean | 5176 | 5275.1 | 5216.7 | 5108 |
| Volatility coefficient *V* (%) | 12.3 | 15 | 12 | 11.8 |
| Minimum | 3970.2 | 4229 | 4092.2 | 3970.2 |
| Maximum | 9586.2 | 8883.4 | 9586.2 | 9.356.0 |
| **Western regions of Poland** | | | | |
| Number of communes | 355 | 47 | 214 | 94 |
| Mean | 5453.1 | 6108.5 | 5380.7 | 5290.3 |
| Volatility coefficient *V* (%) | 22 | 28.9 | 18 | 23.6 |
| Minimum | 3107.2 | 4593.9 | 4201.2 | 3107.2 |
| Maximum | 13823.5 | 13823.5 | 10430.5 | 11524.7 |

Explanation: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.

In Poland, there is a differentiation between communes without cities with poviat status in terms of the average value of the communes' own budgets per capita in 2018-2020. The average value of own revenues of communes' budgets per capita is clearly higher in communes in the western regions of Poland compared to eastern regions, and with the average for the country (PLN 2281.85). Additionally, the average value of municipal budgets' own incomes per capita varies depending on the dynamics of changes in the population of the commune, both in the eastern and western regions of Poland. It is definitely the highest in the group of communes

with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. On the other hand, both in the group of municipalities with population stagnation and in the group of municipalities with a population decline, the average value of municipal budgets' own income is clearly lower and similar, to the average for all municipalities without cities with poviat status in the analyzed regions. In all separated groups of communes, depending on the dynamics of changes in the number of the population, the differentiation of this characteristic between particular communes is quite high, i.e., its variability is average, as in the case of all communes without cities with poviat status in the analyzed regions (Table 2).

**Table 2.**
*Own revenues of communes' budgets per capita depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in PLN)*

| Description | Overall | Group of municipalities *: | | |
|---|---|---|---|---|
| | | I | II | III |
| **Eastern regions of Poland** | | | | |
| Number of communes | 1656.9 | 2039.5 | 1637.4 | 1594.4 |
| Volatility coefficient *V* (%) | 41.7 | 37.4 | 41.8 | 41.2 |
| Minimum | 752.8 | 917.8 | 752.8 | 799 |
| Maximum | 6846.4 | 5498.2 | 6359.6 | 6846.4 |
| **Western regions of Poland** | | | | |
| Number of communes | 2597.4 | 3456.8 | 2455.7 | 2490.1 |
| Volatility coefficient *V* (%) | 46.7 | 51.8 | 41.2 | 44.6 |
| Minimum | 1233.4 | 1953 | 1233.4 | 1272.2 |
| Maximum | 11535.4 | 11535.4 | 8142.1 | 8413.3 |

Explanation: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.

In Poland, there is a differentiation between municipalities without cities with poviat status in terms of the share of own income in the total income of municipal budgets in 2018-2020, and it is clearly higher in the municipalities of western regions of Poland compared to eastern regions, and with the average for the country (43.5%). Additionally, the share of own income in the total income of communes' budgets varies depending on the dynamics of changes in the population of a commune, both in the eastern and western regions of Poland. It is definitely the highest in the group of communes with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. However, both in the group of municipalities with population stagnation and in the group of municipalities with a population decline, the share of own income in the total income of municipal budgets is clearly lower and similar, as well as the closest to the average for all municipalities without cities with poviat status in the analyzed regions. In each group of communes, depending on the dynamics of changes in the number of population, the differentiation of this characteristic between individual communes is rather small, so its variability is low, as in the case of all communes without cities with poviat status in the analyzed regions, especially Western countries (Table 3).

**Table 3.**
*Share of own income in total income of municipalities' budgets depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in %)*

| Description | Overall | Group of municipalities *: | | |
|---|---|---|---|---|
| | | I | II | III |
| **Eastern regions of Poland** | | | | |
| Number of communes | 31.7 | 38.2 | 31.2 | 31 |
| Volatility coefficient *V* (%) | 31.7 | 25 | 31.5 | 32.2 |
| Minimum | 14.5 | 19.1 | 14.5 | 17.2 |
| Maximum | 73.2 | 61.9 | 71.6 | 73.2 |
| **Western regions of Poland** | | | | |
| Number of communes | 46.3 | 54.4 | 44.7 | 46.1 |
| Volatility coefficient *V* (%) | 22.2 | 17.4 | 21.7 | 22.1 |
| Minimum | 22.9 | 37 | 22.9 | 29.8 |
| Maximum | 83.4 | 83.4 | 78.1 | 77.1 |

Explanations of the table: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.

In Poland, there is a differentiation between communes without cities with poviat status in terms of the average value of total expenditure in communes' budgets per capita in 2018-2020. The average value of total expenditure in communes' budgets per capita is slightly higher in communes in the western regions of Poland compared to eastern regions and with the national average (5,247.05 PLN). Additionally, the average value of total expenditure in communes' budgets per capita varies depending on the dynamics of population changes in a commune, both in the eastern and western regions of Poland. It is the highest in the group of communes with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. In the group of communes with population stagnation, the average value of total expenditures in communes' budgets per capita is lower, while it is the lowest in the group of communes with a population decline, especially in the eastern regions. In all separated groups of communes, depending on the dynamics of changes in the number of the population, the differentiation of this characteristic between individual communes is small, so its variability is low, as in the case of all communes without cities with poviat status in the analyzed regions, especially in the eastern regions. (Table 4).

**Table 4.**
*Total expenditure of communes' budgets per capita depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in PLN)*

| Description | Overall | Group of municipalities *: | | |
|---|---|---|---|---|
| | | I | II | III |
| **Eastern regions of Poland** | | | | |
| Number of communes | 5118.6 | 5229.1 | 5167.4 | 5038.9 |
| Volatility coefficient *V* (%) | 12.9 | 14.8 | 12.4 | 13 |
| Minimum | 3940.8 | 4044.5 | 4030.2 | 3940.8 |
| Maximum | 10203.7 | 8171.6 | 9135.9 | 10203.7 |

Cont. table 4.

| | | | | |
|---|---|---|---|---|
| **Western regions of Poland** | | | | |
| Number of communes | 5388.1 | 6049.5 | 5310.0 | 5235.2 |
| Volatility coefficient *V* (%) | 22.5 | 27.5 | 19.2 | 23.9 |
| Minimum | 3043.7 | 4506.7 | 4108.5 | 3043.7 |
| Maximum | 11917.4 | 11917.4 | 10928.9 | 11851.7 |

Explanation: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.

In Poland, there is a differentiation between communes without cities with poviat status in terms of the average value of investment expenditure in communes' budgets per capita in 2018-2020. The average value of investment expenditure of municipalities' budgets per capita is slightly higher in the municipalities of the eastern regions of Poland compared to the western regions and the average for the country (PLN 909.30). In addition, the average value of investment expenditure in communes' budgets per capita varies depending on the dynamics of changes in the population of a commune, both in the eastern and western regions of Poland. It is the highest in the group of communes with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. On the other hand, both in the group of municipalities with population stagnation and in the group of municipalities with a population decline, the average value of investment expenditure of municipalities' budgets per capita is clearly lower and most similar to the average for all municipalities without cities with county rights in the analyzed regions, and by far It is the lowest in the group of communes with a population stagnation in the western regions of Poland (Table 5).

**Table 5.**
*Investment expenditure of communes' budgets per capita depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in PLN)*

| **Description** | **Overall** | **Group of municipalities *:** | | |
|---|---|---|---|---|
| | | **I** | **II** | **III** |
| **Eastern regions of Poland** | | | | |
| Number of communes | 979.9 | 1113.5 | 980.3 | 949.9 |
| Volatility coefficient *V* (%) | 44.8 | 44.4 | 45.3 | 43.7 |
| Minimum | 222.6 | 322.5 | 260.3 | 222.6 |
| Maximum | 3745.1 | 2569.7 | 3745.1 | 2850 |
| **Western regions of Poland** | | | | |
| Number of communes | 942 | 1372.8 | 840.1 | 958.8 |
| Volatility coefficient *V* (%) | 67.9 | 54.8 | 62.1 | 76.1 |
| Minimum | 121.5 | 170.6 | 127.8 | 121.5 |
| Maximum | 4874.6 | 4254.7 | 3846.5 | 4874.6 |

Explanation: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.

In eastern regions, in all separated groups of communes, depending on the dynamics of changes in the number of the population, the differentiation of this characteristic between individual communes is, in turn, quite large and very similar, so its variability is average,

the same as in the case of all communes without cities with the right of county. On the other hand, in the western regions, in all separated groups of communes, depending on the dynamics of changes in the number of the population, the differentiation of this characteristic between individual communes is large, i.e., its variability is also large, especially in the case of the group of communes with a decrease in the number of inhabitants (Table 5).

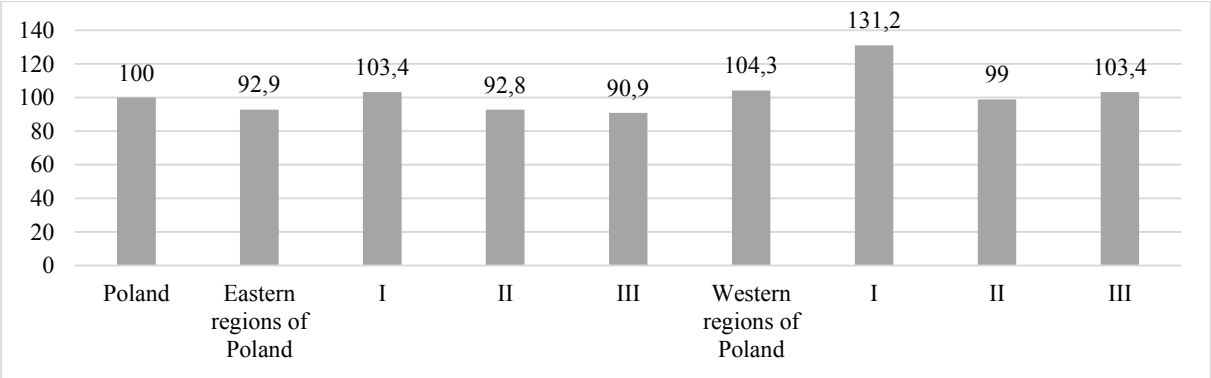
In Poland, there is a differentiation between municipalities without cities with poviat status in terms of the share of investment expenditure in the total expenditure of municipal budgets in 2018-2020, and it is slightly higher in the municipalities of the eastern regions of Poland compared to the western regions and the average for the country (17.3%). Additionally, the share of investment expenditures in the total expenditures of communes' budgets varies depending on the dynamics of changes in the population of the commune, both in the eastern and western regions of Poland. It is definitely the highest in the group of communes with an increase in population, where it exceeds the average for all communes without cities with poviat status in the analyzed regions, especially in the western regions. On the other hand, both in the group of municipalities with population stagnation and in the group of municipalities with a population decline, the share of investment expenditure in the total expenditure of municipalities' budgets is lower and similar, as well as the closest to the average for all municipalities without poviat status in the analyzed regions. In each group of communes, depending on the dynamics of changes in the number of the population, the differentiation of this characteristic between particular communes is quite large, i.e., its variability is average, as in the case of all communes without cities with poviat status in the analyzed regions, especially in the western regions. and in the group of communes with a population decline in these regions (Table 6).

**Table 6.**
*Share of investment expenditures in total expenditures of communes' budgets depending on the dynamics of population changes in the eastern and western regions of Poland in 2018-2020 (in %)*

| Description | Overall | Group of municipalities *: | | |
|---|---|---|---|---|
| | | I | II | III |
| **Eastern regions of Poland** | | | | |
| Number of communes | 18.7 | 20.8 | 18.6 | 18.4 |
| Volatility coefficient *V* (%) | 35.1 | 35.4 | 35.4 | 34.5 |
| Minimum | 4.9 | 7.1 | 5 | 4.9 |
| Maximum | 42.3 | 36.6 | 42.3 | 35.4 |
| **Western regions of Poland** | | | | |
| Number of communes | 16.5 | 22.1 | 15.1 | 17.1 |
| Volatility coefficient *V* (%) | 46.2 | 33.9 | 44.4 | 49.5 |
| Minimum | 2.6 | 3.5 | 3 | 2.6 |
| Maximum | 42.1 | 39.2 | 40 | 42.1 |

Explanation: * I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

Source: Bank Danych Lokalnych, GUS w Warszawie.




Explanation: I – communes with an increase in the number of inhabitants in the years 1995-2020; II – communes with population stagnation in 1995-2020; III – communes with a population decline in 1995-2020.

**Figure 1.** Scoring of the financial situation of municipalities depending on the dynamics of changes in the number of their population in the eastern and western regions of Poland compared to the country for 2018-2020 (Poland = 100.0 points). Source: Bank Danych Lokalnych, GUS w Warszawie.

Figure 1 shows the results of the scoring on the financial situation of municipalities without cities with poviat status, distinguished according to the dynamics of changes in the number of their population in the eastern and western regions of Poland against the background of the entire country for 2018-2020. It should be noted that the results unequivocally confirm the research hypothesis presented in the article, which assumes that communes in the western regions of Poland have a better financial situation compared to eastern regions, especially those with an increase in the number of inhabitants.

## 4. Summary and conclusions

The analysis of statistical data carried out in the article showed that communes without cities with poviat status dominate both in the eastern and western regions of Poland with a stagnant population, while the percentage of communes with an increase in the number of inhabitants is by far the smallest, while in the western regions there are better demographic conditions the economy and financial situation of communes in comparison to eastern regions.

In Poland, there is a differentiation between communes without cities with poviat status in terms of the average value of total income and the communes' own income per capita budget, but they are higher in communes in western regions of Poland compared to eastern regions and with the average for the country. Additionally, both of these income values differ depending on the dynamics of changes in the population of the commune, both in the eastern and western regions of Poland, and they are the highest in the group of communes with an increase in population, especially in the western regions.

In Poland, there is a differentiation between municipalities without poviat status cities in terms of the share of own income in the total income of municipal budgets, and it is higher in municipalities in western regions than in eastern regions, and on the average for the country.

Additionally, it varies depending on the dynamics of changes in the population in a commune, both in the eastern and western regions of Poland, but it is the highest in the group of communes with an increase in population, especially in the western regions.

In Poland, there is a differentiation between municipalities without poviat cities in terms of the average value of total expenditure and capital expenditure per capita budgets of municipalities, but the average value of total expenditure per capita is higher in municipalities in western regions, and the average value of investment expenditure per capita in communes of eastern regions. In addition, both of these expenditure values vary depending on the dynamics of changes in the population of a commune, both in the eastern and western regions of Poland, and are the highest in the group of communes with an increase in the number of inhabitants, and especially in the western regions.

In Poland, there is a differentiation between communes without cities with poviat status in terms of the share of investment expenditure in the total expenditure of communes' budgets, and it is higher in communes of eastern regions of Poland compared to western regions and to the country's average. Additionally, it varies depending on the dynamics of changes in the population of a commune, both in the eastern and western regions of Poland, but it is the highest in the group of communes with an increase in population, especially in the western regions.

The analysis of statistical data carried out in the article showed that changes in the number of population (inhabitants) constitute essential demographic conditions for the economy and financial situation of municipalities without poviat status in the analyzed regions of Poland. It also confirmed the research hypothesis, which assumes that the communes in the western regions of Poland are in a better financial situation compared to the eastern regions, especially those with an increase in the number of inhabitants.

## References

1. Baker, K., Van de Walie, S., Skelcher, Ch. (2011). Citizen Support for Increasing the Responsibilities of Local Government in European Countries: A Comparative Analysis. *Lex Localis – Journal of Local Self-Government, vol. 9, no. 1*, pp. 1-21.
2. Balatsky, A., Balatsky, G., Borysov, S. (2015). Resource demand growth and sustainability due to increased world consumption. *Sustainability, vol. 7*, pp. 3430-3440.
3. Balińska, A. (2015). Czynniki rozwoju terenów peryferyjnych Polski Wschodniej. *Journal of Agribusiness and Rural Development, nr 2(36)*, pp. 153-160.
4. Berne, R.I., Schramm, R. (1986). *The financial analysis of governments*. Englewood Cliffs: Prentice Hall.
5. Bień, W. (2017). Ocena kondycji finansowej gmin województwa małopolskiego w latach 2007-2016. *ZN UE w Katowicach. Współczesne Finanse, 1, nr 345*, pp. 45-62.

6. Błachut, B., Cierpiał-Wolan, M., Czudec, A., Kata, R. (2018). *Wydatki inwestycyjne jednostek samorządu terytorialnego a rozwój przedsiębiorczości w regionie Polski południowo-wschodniej*. Rzeszów: Urząd Statystyczny w Rzeszowie.
7. Byjoch, K., Sulimierski, J., Tarno, J.P. (2000). *Samorząd terytorialny po reformie ustrojowej państwa*. Warszawa: PWN.
8. Czudec, A., Majka, A., Zając, D. (2018). Impact of European Union Cohesion Policy at Local Level (Rural Areas of Eastern Poland Case Study). *Lex localis – Journal of Local Self-Government, Vol. 16, No. 4*, pp. 785-803.
9. Dębowska-Romanowska, T. (1995). *Komentarz do prawa budżetowego państwa i samorządu terytorialnego wraz z częścią ogólną prawa finansowego*. Warszawa: Municypium.
10. Dębowska-Romanowska, T. (1997). Budżet gminy. In: W. Wójtowicz (ed.), *Prawo finansowe*. Warszawa: PWN.
11. Filipiak, B. (2011). *Finanse samorządowe. Nowe wyzwania bieżące i perspektywiczne*. Warszawa: Difin.
12. Gołaszewska-Kaczan, U. (2005). Partnerstwo publiczno-prywatne a atrakcyjność regionu. In: A. Kopczyk, M. Proniewski (eds.), *Atrakcyjność inwestycyjna regionu*. Białystok: Wyższa Szkoła Finansów i Zarządzania.
13. Grzebyk, M., Miś, T., Stec, M., Zając, D. (2019). *Skala, kierunki i dynamika zmian społeczno-gospodarczych na obszarach wiejskich wschodniej Polski po przystąpieniu do Unii Europejskiej*. Poznań: Bogucki Wydawnictwo Naukowe.
14. Grzebyk, M., Sołtysiak, M., Stec, M., Zając, D. (2020). *Społeczne, ekonomiczne i środowiskowe uwarunkowania gospodarki finansowej samorządu lokalnego (przykład województwa podkarpackiego)*. Poznań: Bogucki Wydawnictwo Naukowe.
15. Gumińska-Pawlic, J., Sawicka, K. (2002). *Budżet jednostki samorządu terytorialnego*. Zielona Góra: ZCO.
16. Guziejewska, B. (2014). Polityka kształtowania dochodów samorządu terytorialnego w świetle wybranych koncepcji teoretycznych. *Research Papers of Wrocław University of Economics, nr 326*, pp. 60-70.
17. Gwoździcka-Piotrowska, M. (2012). Budżet gminy jako element zarządzania jednostką samorządu terytorialnego. *Studia Ekonomiczne i Regionalne, Tom V, Nr 2*, pp. 100-106.
18. Hybel, J. (2010). Regionalne zróżnicowanie sytuacji finansowej gmin w Polsce w latach 2005-2009. *Zeszyty Naukowe SGGW w Warszawie, Ekonomika i organizacja gospodarki żywnościowej, nr 86*, pp. 29-39.
19. Jastrzębska, M. (2012). *Finanse jednostek samorządu terytorialnego*. Warszawa: Lex a Wolters Kluwer business.
20. Kornberger-Sokołowska, E. (2001). *Decentralizacja finansów publicznych a samodzielność finansowa jednostek samorządu terytorialnego*. Warszawa: Liber.

21. Kotulski, M. (2000). Pojęcie i istota samorządu terytorialnego. *Samorząd Terytorialny, n r 1-2*, pp. 85-86.
22. Kozłowski, A.J., Czaplicka-Kozłowska, I.Z. (2010). *Samorząd terytorialny w systemie zarządzania państwem. Wybrane zagadnienia*. Olsztyn: Pracownia Wydawnicza Elset.
23. Kudełko, J. (2013). *Uwarunkowania i kierunki rozwoju województw Polski Wschodniej jako regionów słabo rozwiniętych*. Warszawa: Studia KPZK PAN, t. CLI.
24. Miś, T., Zając, D. (2020). Results of European Union Cohesion Policy in Terms of Quality of Life Improvement on a Regional Level (as Exemplified by Eastern Poland). *Lex localis – Journal of Local Self-Government, Vol. 18, No. 1*, pp. 53-69.
25. Mogiła, Z., Zaleski, J., Zathey, M. (2011). *Wykorzystanie przygranicznego położenia terenów znajdujących się w zachodniej części Polski dla rozwoju społeczno-gospodarczego*. Wrocław.
26. Nollenberger, K., Groves, S.M., Valente, M.G. (2003). *Evaluating Financial Condition: A Hand-book for Local Government.* Washington, DC: International City/County Management Association.
27. Ossowska, L., Ziemińska, A. (2010). Kondycja finansowa gmin wiejskich i miejsko-wiejskich województwa pomorskiego. *Journal of Agribusiness and Rural Development, nr 4(18)*, pp. 73-85.
28. Owsiak, S. (1999). *Finanse publiczne. Teoria i praktyka*. Warszawa: PWN.
29. Podstawka, M. (2005). *Podstawy finansów. Teoria i praktyka*. Warszawa: Wydawnictwo SGGW.
30. Poniatowicz, M., Dziemianowicz, R. (2017). Efektywne zarządzanie finansami jednostek samorządu terytorialnego – postulaty doktryny ekonomicznej i instrumentalnej. *Problemy Zarządzania, nr 2(67)*, pp. 126-146.
31. Rodríguez-Bolívar, M.P., Navarro-Galera, A., Alcaide-Muñoz, L., López-Subirés, M.D. (2016). Risk factors and drivers of financial sustainability in local government: An empirical study. *Local Government Studies, 42(1)*, pp. 29-51.
32. Sobczyk, A. (2010). Rozwój lokalny – wybrane problemy finansowania. *Zeszyty Naukowe SGGW w Warszawie, Ekonomika i Organizacja Gospodarki Żywnościowej, nr 81*, pp. 125-136.
33. Sołtysiak M. (2017). Budżet jednostki samorządu terytorialnego a wiedza i aktywność lokalnej społeczności. *Humanities and Social Sciences – Quarterly, Vol. XXII. Research Journal, 24(4),* pp. 181-193.
34. Sołtysiak, M. (2017). Wiedza i aktywność mężczyzn w zakresie budżetu partycypacyjnego. In: Z. Głodek, A. Kuciński (eds.), *Wybrane aspekty z finansów* (pp. 103-105). Gorzów Wielkopolski: Wydawnictwo Akademii im. Jakuba z Paradyża.
35. Sołtysiak, M., Suraj, M. (2016). *Engagement of local community members in terms of participatory budgeting based on municipality of Rzeszów*. Proceedings 14thInternational

Scientific Conference *Economic Policy in the European Union Member Countries*. Silesian University, Karvina, t. II, pp. 629-637.

36. Sołtysiak, M., Suraj, M. (2018). *Budget of local government unit versus state of art and engagement of young generation of Poles.* Proceedings 16thInternational Scientific Conference *Economic Policy in the European Union Member Countries*. I. Majerova (ed.). Silesian University, pp. 327-336.
37. Standar, A. (2017). Ocena kondycji finansowej gmin oraz jej wybranych uwarunkowań na przykładzie województwa wielkopolskiego przy wykorzystaniu metody TOPSIS. *Wieś i Rolnictwo, nr 2(175)*, pp. 69-92.
38. Stanny, M., Strzelczyk, W. (2018). *Kondycja finansowa samorządów lokalnych a rozwój społeczno-gospodarczy obszarów wiejskich. Ujęcie przestrzenne*. Warszawa: Scholar.
39. Świrska, A. (2016). Czynniki determinujące efektywne zarządzanie finansami samorządowymi (na przykładzie gmin powiatu siedleckiego). *Polityki Europejskie, Finanse i Marketing, 16(65)*, pp. 88-99.
40. Sztando, A. (2019). Contemporary expectations of polish smalltown authorities towards the state policy of local development. *Research Papers of Wrocław University of Economics, vol. 63, no. 5*, pp. 187-200.
41. Wójtowicz, K. (2018). Znaczenie wybranych czynników ekonomiczno-społecznych dla kształtowania stabilności fiskalnej gmin miejskich w Polsce. *Acta Universitatis Lodziensis. Folia Oeconomica, vol. 334(2)*, pp. 213-234.
42. Zalewski, A. (1996). Efektywność gospodarowania samorządu terytorialnego w Polsce i możliwość jej poprawy. In: *Aktualne problemy gospodarki lokalnej*. Warszawa: SGH.

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# MOBILE HEALTH APPLICATION EVALUATION POSSIBILITIES

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**Purpose:** Nowadays smart phone users can choose between millions of mhealth applications, but the huge selection raises an important question: how should the user choose? The information that is most readily available to the users, such as the star rating in app stores, reviews left by previous users, short descriptions and attractive screenshots, do not address many points which are important during use. How do users know that the application they are downloading is reliable, professionally relevant, and living up to its promise, for example? Several studies have already tried to answer this question and come up with models to help evaluating health applications. It is important to note that while applications focusing on more serious health areas are subject to more complex regulations, there are fewer rules for lighter topics such as weight-loss, fitness, smoking cessation, or drinking water. Thus, evaluation frameworks, usually created for serious health topic related apps, that are easy to use and understand for users, can play an important role for the less serious applications as well. The purpose of this article is to find and compare these models, to identify commonalities and any missing elements. In the second part of the article, the number one free application in the health and fitness category (considering in-app purchase revenue), MyFitnessPal is evaluated with the selected models. It will also be determined how these evaluating systems can be utilized from the users' point of view for hobby type mhealth apps, and if the suggested criteria are available for the average user at all.
**Design/methodology/approach**: After a literature review was conducted, four evaluation models were selected. With those, one of the most popular apps in the health and fitness category was assessed. This approach enabled the evaluation of the usability of the models from end user point of view. At the end of the article a common set of criteria is presented based on the models that were introduced and the usability of the evaluation criteria in them.
**Findings:** The paper points out the many possible angles that can be considered during an assessment of an application. Although not all the systems were created for end users, all are beneficial to them. Each model has criteria that is unique for them and that was not mentioned in other models, but there also were similarities. Although the authors were familiar with the application that is assessed with the models, before the evaluation was started, with the various questions from the models, lot of new useful information was found. At the end of the article a possible, useful blend of the assessment aspects is also presented.

**Research limitations/implications**: The authors of this paper selected various models for investigation, but the final selection was based on personal preferences to fit the aim of the article precisely.
**Practical implications:** Understanding the possible aspects of evaluating a mobile application is crucial for end users, especially if the app they are going to use is for health topics. Getting familiar with the models and assessing the application with a critical approach will help users to find more reliable, research based, secure applications.
**Social implications:** The secondary aim of the article is to raise awareness of the several aspects of using a mobile application. A lot has to be considered from end user point of view but also from app provider view, to make sure that users have the right information to trust the app.
**Originality/value:** The value of this paper is that it compares and describes the various methods for application evaluation, then it shows a possible blend for end users that would like to use applications more carefully. It points out that although there are end user focused models that help assessing an application, several other details can be checked that help deciding about an application, which are just as important for developers as for end users.

**Keywords:** MobileHealth, Application evaluation.

**Category of the paper:** General review.

## 1. Introduction

Nowadays smart phone users can choose between millions of applications, aiming for the biggest possible reach of users (Druć, Jóźwiak, Jóźwiak, Nowak, 2021) Although reports vary, it seems that the correct number was around 6 million by the end of 2020. About 8-10% of these apps are in the category of health and lifestyle in the two main app stores, Google Play, and Apple App Store. (Curry, Business of Apps, 2021) (Anthony, 2021) Together they are called mobile health or mHealth apps, which link healthcare and infocommunication technologies, including health-related services and prevention apps as well. (Buttarelli & EDPS, 2015) However, the huge selection raises an important question: how should the user choose? The information that is most readily available to the users, such as the star rating in app stores, reviews left by previous users (who are known to be easily influenced), short descriptions and attractive screenshots, do not address many points which are important during use. What aspects might be worth considering at all? For example, how do users know that the application they are downloading is reliable, professionally relevant, and living up to its promise? Several studies have already tried to answer this question. The purpose of this article is to locate and compare these studies, to identify commonalities and any missing elements. In the second part of the article, the number one free application in the health and fitness category (considering in-app purchase revenue), MyFitnessPal is also evaluated, and it will be determined how these models can be utilized from the users' point of view.

It is important to note that while applications focusing on more serious health areas are subject to more complex regulations, there are fewer rules for lighter topics such as weight-loss, smoking cessation, or drinking water. Thus, evaluation frameworks, usually created for serious health topic related apps, that are easy to use and understand for users can play an important role for the less serious applications as well. This article does not detail the regulations, it focuses on user evaluation. However, because these applications work with personal data, even applications for hobby topics are subject to strict regulations. As the market for applications is complex and cross-border, regulation and compliance is a difficult task. However, with user awareness, the risks can always be reduced.

## 2. Mobile app evaluation models

During the literature review, works aimed at creating a unified, practical health app evaluation system were selected (these include systematic research summaries on the topic that ensure quality content). The final selection was made based on personal opinion; the theories best suited for the purpose have been included in this paper. The articles are in English and were written after 2015. Although some of the below models are not made for end users' evaluation, because of the important aspects they raised, they are cited. It is important to note however, that selecting the correct mobile app is only part of the success, the user needs to be health conscious and motivated in order to achieve their goals with these kinds of apps (Birkmeyer, Wirtz, Langer, 2021).

### 2.1. MARS – Mobile App Rating Scale

The creators of the scale divide the identified rating criteria into five major categories. These are engagement, functionality, aesthetics, information quality and subjective quality. In a further 23 subcategories, the aspects can be evaluated on a scale from 1 to 5, for which descriptions are also available for the sake of objectivity. Engagement, for example, examines how well the app supports the user's entertainment, interest, and customization. The functionality analyses the app's performance, ease of use, and interactions. Aesthetics help judging the graphics, layout and display of the app's content. The quality of information is looking at data in and about the application as well, i.e. it also takes into account authenticity, validity, credibility and evidence base. The last aspect is the subjective quality, i.e. whether the user would recommend the application to others or pay for its services, but also includes the aforementioned star rating (Stoyanov et al., 2015).

### 2.2. Mobile Health App Trustworthiness Checklist (MHAT)

The creators of the list have identified five factors that affect users' confidence that the app is trustworthy. This analysis is more privacy and security focused than the scale presented earlier. These, as mentioned earlier, are also important aspects of the application usage, because of the amounts of personal data apps handle. Although made for application developers, this model is listed because end users could also benefit from it. The first aspect is the information content, which examines, among other things, the comprehensibility of the privacy policy and terms of service that accompany the application, the amount of personal data collected, the availability of regular updates, and that the app is based on reliable research. Organizational characteristics include aspects about the company that publishes the application, such as a history of data management and data leakage, compliance with data protection regulations, and the company's reputation. The social influence factor examines whether the user would recommend the app to others, whether the app is in the top results of the download lists, or whether it can keep its good ratings. Technology-related features analyse function, aesthetics, notifications, and data encryption. The last consideration is user control, which evaluates users 'disposition of their own data, whether they can simply delete their data, whether their data can be shared with a third party with their consent, whether they have influence over it (van Haasteren, Gille, Fadda, & Vayena) (van Haasteren, Vayena, & Powell, The Mobile Health App Trustworthiness Checklist: Usability Assessment, 2020).

### 2.3. Standards for Mobile Health–Related Apps

The authors aimed to create a standard set of criteria for health applications, which, as above, considered not only their literature review but also the perspectives of the stakeholders. Eight categories have been identified: usability, privacy, security, appropriateness and suitability, transparency and content, safety, technical support and upgrades, and technology. In addition to ease of use, usability examines, for example, whether the app has been tested before publication, whether assistance is available in case of problems, or whether the application is properly designed and fast. From a privacy point of view, it shall take into account, among others, appropriate information, information on the data collected, confidentiality, protection of minors and anonymisation. In terms of security, it analyses encryption mechanisms, cloud services and related security measures, authorization and authentication mechanisms, vulnerabilities and threats, and their risks. In terms of appropriateness and suitability, it examines whether the app has a well-defined target audience, whether the benefits of the app are understandable, and whether it was created with the help of experts. Transparency and content are the presentation of professional authors, the identification of the operator of the application, ethical conflicts of interest and the indication of sources of information. From safety point of view, the possible risks and dangers affecting the users are examined. The technical support and updates category includes how

often updates are performed, whether they affect performance and data collection, whether the content of the application is reviewed during the update, and what technical support the operator can provide to users. The last consideration is technology that examines, among others, whether the application is working properly, whether it is wasting resources (e.g., battery, CPU, memory), or whether it is working without data traffic (Llorens-Vernet & Miró , 2020).

### 2.4. Transparency for Trust (T4T)

The last model is a bit different than the ones above. The purpose of including it in the list, however, is that it could be a great addition to some other evaluation systems because of the criteria it queries. In the model, the authors name four areas that they think should be communicated to potential users in app stores to help making the best possible decision, and that developers consider while creating applications. These aspects can be grouped into privacy and security, development characteristics, feasibility data, and health benefits. In terms of privacy and security, it is necessary to examine where the data of the application is stored, what data leaves the user's device and who has access to it. Good development practice is scientifically sound, involving all stakeholders (including users) and then evaluates usability. The feasibility assessment analyses the usability, user experience, commitment, and potential adverse effects of the application. Finally, the health benefits include questions about the health effects of the application, such as the results of the application usage in clinical trials, and the opportunity cost, as using the app may even delay seeing a doctor, which may affect the success of a later treatment (Wykes & Schueller, 2019).

From the above list, it is visible that diverse criteria can be considered before downloading an application as well as when using it. Unfortunately, while all of them are valuable to the user, in many cases this information is not available, as it will be explained later. Sometimes apps are not transparent enough, which is a deficiency that can also be expressive to the user. People can already be more mindful application users, if aware that these aspects exist and may be worth looking for. Although the regulations already mentioned provide a great deal of protection for users, their own responsibility to protect themselves cannot be neglected.

**Table 1.**
*Summary of the evaluation models, authors' own edition based on the cited sources*

| MARS | MHAT | STANDARDS | T4T |
|---|---|---|---|
| Engagement | Informational content – Information accuracy, Understandability, Transparency | Usability | Privacy and security |
| Functionality | Organizational attributes – Brand familiarity, Reputation | Privacy | Development characteristics |
| Aesthetics | Societal influences – Recommendations, External factor | Security | Feasibility |
| Information | Technology-related features – Usability, Privacy | Appropriateness and suitability | Benefits |

Cont. table 1.

| App subjective quality | User control – Autnomy, Empowerment | Transparency and content | |
|---|---|---|---|
| App-specific | | Safety | |
| | | Technical support and updates | |
| | | Technology | |

The above table summarizes the criteria of the selected evaluation models. To show the similarities, the same topics are highlighted in different colours. It is visible that each evaluation system has criteria which is unique to them (uncoloured cells), so it could be a good idea to combine them in order to achieve a complex assessment. Although the quality of the information for a hobby type application is not always considered the most important point, all these models mention it as one of the criteria (highlighted in orange). It is also noticeable that MARS is more focused on users' point of view, as it lists more usage-centred aspects. All other models address security and privacy in some way too (highlighted in green). MARS and MHAT also recognizes that societal influencers can play a role in selecting and using an application (highlighted in blue).

## 3. Putting models in practice

To test these models from users' point of view, the number one health and fitness application was selected based on its in-app purchase (IAP) revenue in 2020. IAP revenue was chosen as basis because in our opinion this metric shows real usage of the application from users. Once an app is downloaded, it is not necessarily used, but IAPs mean long-term usage and engagement with it. There are thousands of applications in this topic, but this one is popular which might be familiar to readers of this article as well. MyFitnessPal (with $43 million IAP revenue) is analysed below with the models described above. (Curry, Fitness App Revenue and Usage Statistics (2022), 2022)

MyFitnessPal is one of the most popular diet tracking app. It allows the user to track the calorie content of the foods they consume as well as the change of their own weight. When the user starts using the app, they can define their purpose: losing, maintaining, or gaining weight. Considering personal data, goals and activity levels, the application calculates the amount of appropriate energy intake. The user can then log their meals and the app will indicate the status compared to the recommended amount. Users can choose from millions of food records from a data base which is co-created by MyFitnessPal and its users. The app also provides possibility to connect with other smart devices and apps to track activity, water intake, or sleep, for example, which can improve users' understanding of the processes that affect the body and help to achieve goals. Articles on the topic and recipes, which are also available either in the application or on supporting website, can help to raise awareness. Friends in the app, reminders

and challenges help users to stay committed. Opinions about effectiveness of such apps are divided. According to a researcher group who ran a randomized controlled trial with MyFitnessPal, it is not likely to help patients to achieve significant weight change compared to traditional health care methods, but it might be useful if they are already self-monitoring. Interestingly that article also mentions that they experienced a sharp drop in usage after the first month, signalling that one of the biggest challenges for an app is to keep users' interest over time (Yoshio Laing et al., 2014). According to another study, MyFitnessPal helped users to make healthier choices, therefore reduce sugary food intake. It also highlights that benefits from app usage are dependent on the original intent of the user when they start to use the application (Slazus, Ebrahim, & Koen, 2022). A third study suggests that mobile applications were more successful in changing dietary behaviour than conventional methods (Ipjian, Johnston, 2017). In connection to usage, the other big challenge is to keep the user motivated, so they can take advantage of the application. The type of motivation, as other functions of the app, in the future could be tailored to the users' preferences what could help people achieve their best performance (Pendick, 2014). At the same time, in order to achieve the best results the app can bring, it might be a good idea to use it with a professional, because of for example a more accurate estimation of proportions could be reached with their help (Chen, Berkman, Bardouh, Yan Kammy, & Allman-Farinelli, 2019). To summarize, as already mentioned, users' attitude is just as important as selecting the correct application to help them on their health journey.

For the purpose of testing the evaluation models, the authors of this article downloaded MyFitnessPal and set up a new account, however they were familiar with the app already.

The evaluation was started with the MARS criteria (Stoyanov et al., 2015). This evaluation sheet has a header, asking information about the application, for example app name, developer, version, cost of basic version and cost of premium services, age group, etc. Then the questions are divided into sections. During the evaluation the criteria felt a bit subjective, although authors tried to describe the different ratings in detail to reduce subjectivity. It seems that the assessor has to be familiar with the app to be able to evaluate it, which criteria will be applicable to the other systems as well (Additionally for the other models, further research of the questions might also be required). Generally, the application got very good scores on each point because it is a well known app that is developed for a long period of time now with lot of user feedback. The total number of points that can be given during the evaluation is 115 (with section A-E). MyFitnessPal got 98 points (as for a research related question we gave non applicable as answer, that worth 0 and subjectively we marked no when the questionnaire asked if we would be willing to pay for the app, which worth 1), which is an 85% score. These scores are visible on the below figure. The summary points are also good for comparing applications. The information required for this rating is available for users, and can be easily found, which makes this model easy to use and practical. This might be also a good framework for creating new applications as all its points are needed for a good user experience.

**Table 2.**
*MARS Evaluation Total Scores for MyFitnessPal, own edition*

| | TOTAL POINTS | MAXIMUM POSSIBLE |
|---|---|---|
| A: Engagement – fun, interesting, customisable, interactive, well-targeted to audience – Mean Score | 22 | 25 |
| B: Functionality – app functioning, easy to learn, navigation, flow logic, and gestural design of app – Mean Score | 20 | 20 |
| C: Aesthetics – graphic design, overall visual appeal, colour scheme, and stylistic consistency – Mean Score | 14 | 15 |
| D: Information – Contains high quality information from a credible source – Mean Score | 28 | 35 |
| App subjective quality Score | 14 | 20 |
| Total | 98 | 115 |

Source: Stoyanov et al., 2015.

The second model that was tried was MHAT (van Haasteren, Vayena, & Powell, 2020). In this model the questions are also divided into categories, but instead of points the evaluator can select: Yes, No, Not Applicable or In progress (since it is originally for developers). Considering that this assessment was carried out by users' point of view, a fifth possibility was added called 'Information is not available for end users' to cover all scenarios. Overall, it was hard to find the requested information about the application, even if it has an additional website and blog as well. The available information in the app is more usage-focused and concentrates less on the actual scientific background or research that backs up the logic of the app, although, it could be mentioned in one of the blogposts or in FAQ, as an idea for the future. This evaluation system is useful because it makes the assessor try to discover information, which is relevant for users, but is not easy to find at a first glance. To answer the questions evaluators have to read the terms and conditions (MyFitnessPal, 2020), the privacy policy (MyFitnessPal, 2020), and disclaimers on the blog (MyFitnessPal, n.d.) or in the app too. This can lead to a well-informed and security/privacy-aware usage. The below figure shows part of the evaluation, where transparency was assessed. For the purpose of readability, the below screen shot does not contain the options 'Not applicable', 'In progress' and 'Information is not available for end users', because they were not selected for this particular criterion. The whole criteria was assessed this way, and every question was carefully researched and commented in the background for this article.

**Table 3.**
*MHAT, Transparency evaluation, own edition*

| | YES | NO | COMMENTS |
|---|---|---|---|
| Does the app highlight potential risks or side-effects resulting from its use? | x | | Yes, can be found in the terms and conditions- if the user reads it. |
| Are the 'terms of service' concise and easy to read? | x | | The language is clear, there are smaller summaries for each point to help users understand the most important points of the chapters. Important details are also either highlighted in capital letters or written in bold. Bulleted lists are also easier to read. |
| Does the app require only minimal personal data of end-users?* | | x | Reading the privacy policy, I think data collection is not on a minimal level. |
| Are the privacy policies concise, clear and easy to understand? | x | | Yes, privacy policy is clear and easy to understand. It is devided into chapters, lists and bullet points. The language is also clear and easy to understand. |

Source: van Haasteren, Vayena, & Powell, 2020.

Compared to the previous model, this one also makes users think about scientific background, which should be relevant for health and wellness type apps, and interestingly is not referenced in one of the most well-known applications in this field (However, it will be visible on figure 5 that National Institutes of Health (NIH) is referenced in one of the warning screens, suggesting that research was probably used). The information accuracy part questions the quality of the information provided in the application. Upon researching this, the app itself did not provide details, but papers were found examining for example the accuracy of nutrient calculations, which showed assuring results (Evenepoel et al., 2020; Lin et al., 2022). This system queries if users are aware of the production company of the app, and its reputation for data handling. These are also good indicators of security and could protect the users if they are aware of this information. MyFitnessPal had a famously unfortunate incident where they experienced a massive data breach, where 150 million accounts were compromised (Bradley, 2018). Directly trying to find this kind of information could be useful for a user, because understandably this is not advertised by providers. When authors tried to look this information up on the MyFitnessPal site, there was no result, but a Google search helped to find the result on the actual MFP site afterwards (MyFitnessPal, 2018). Although it must be noted that despite company's best efforts these can happen. While many users might not be interested in technical details about how their data is stored and processed, testing this questionnaire also points out that this information is not readily available to users generally. In summary, although this system was created for developers, many of the answers were obtainable for end users too. This is good news, because it would allow users to be more in control of their own data and responsible usage considering these criteria when using an app. There were 44 questions in total, to which 24 times the answer was yes (55%). This means that a lot of information was available for users as well for a developers' checklist. We answered no 9 times (20%). The mentioned 'Information is not available for end users' category was selected 11 times (25%). The missing points are concerning company background, research, and privacy details.

This shows how application information is presented and what is considered to be important (While personally for the authors these are important details, we can accept that these might not be important factors for an average user).

The third tested system was the Standards for Mobile Health–Related Apps questionnaire (Llorens-Vernet & Miró, 2020). The questions are also grouped into categories that can be evaluated. 'Not available' was added as an extra option, because although the developers might be aware of the answers, the average user might not find the queried information. This was the first questionnaire (of the selected ones) that asked about language setting possibilities, which signals that the most common languages for the apps are English and any local language if the app is created for or in a certain country. MyFitnessPal allows users to select one of 15 available languages, which shows that this is a mature application with a serious past already (MyFitnessPal, 2019). This system also urged the examiner to read the privacy policy (MyFitnessPal, 2020) and the terms (MyFitnessPal, 2020) with its questions, even in more detail than the previous one. The privacy policy felt a bit vague after reading the evaluation criteria, it was not too specific about the data collection and right to access for example. GDPR is specifically addressed in the privacy policy, special rights related to it can be exercised by contacting the support services of the app (MyFitnessPal, 2020). While researching this topic, authors were also able to find an article for GDPR on the MyFitnessPal support page, that contains a great amount of useful information for users for various topics (MyFitnessPal, 2021). After reading the terms and privacy policy thoroughly for these models, authors of this article appreciated that users usually agree to a lot of things when they just click on mandatory consents, but maybe upon detailed reading, they would be more selective of the apps they are using or the data they share. Some of the data usage felt ok and valid for using the app but for some in my opinion some users would opt out if they had the chance to do so. Thus, there is an ‘all-in approach’ to these documents, either the user accepts and can use the app or does not consent but cannot use the app at all. The below table shows the privacy section of the evaluation. It details questions and the authors’ opinion and reasoning why the answers were selected. The highlighted questions were marked as two of the most important points by the stakeholders that the original article of the evaluation criteria researched.

**Table 4.**
*Standards for Mobile Health–Related Apps questionnaire, Privacy section evaluation, own edition*

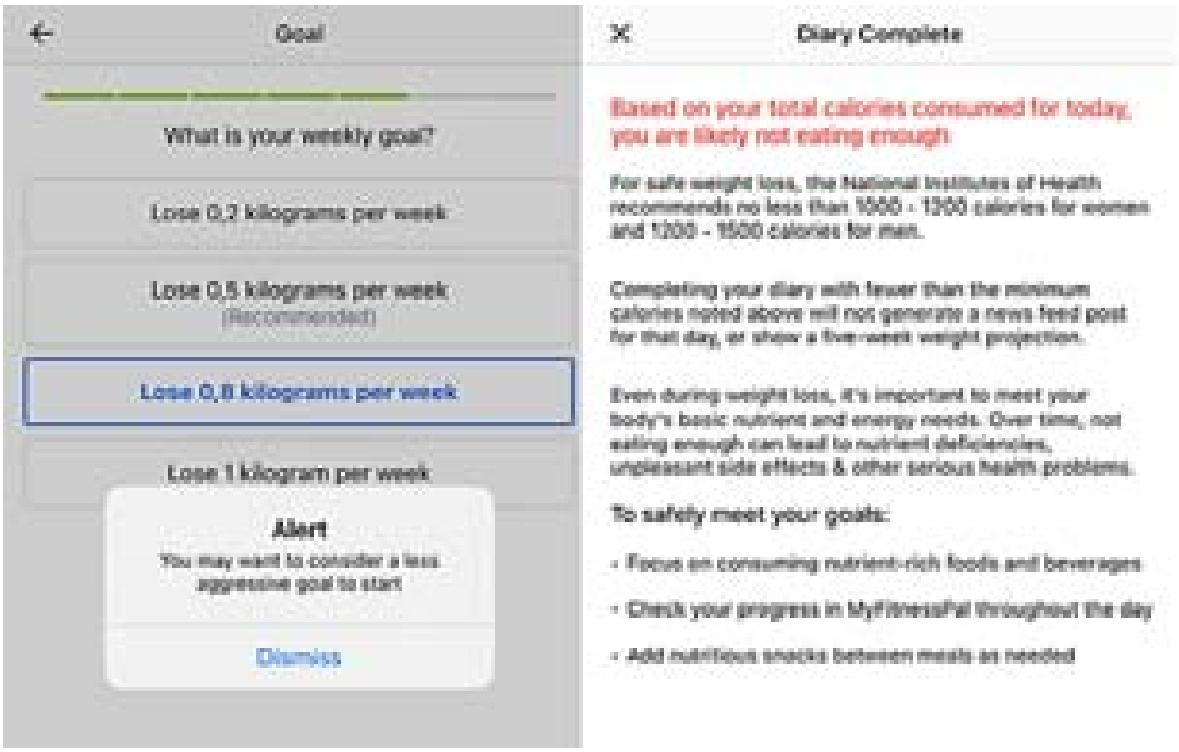
| | YES/NO/ N/A FOR MyFitnessPal | COMMENTS |
|---|---|---|
| The app gives information about the terms and conditions of purchases in the app and personal data recorded. | Yes | Terms and privacy policy are requested to be approved upon registration, but they are also available for reading during app usage, and they can be found from the webpage and blog as well. |
| It gives information about the kind of user data to be collected and the reason (the app must only ask for user data that is essential for the app to operate). It gives information about access policies and data treatment and ensures the right of access to recorded information. It describes the maintenance policy and the data erasure procedure. It gives information about possible commercial agreements with third parties. | Yes | Privacy policy contains this information, however I have the feeling that it could be more specific- GDPR is addressed, special rights can be exercised by contacting support services of MFP |
| It guarantees the privacy of the information recorded. It requires users to give their express consent. It warns of the risks of using the app. | No | Although privacy policy has a lot of information about this, there is no warning of risks and consent is requested for the whole terms and privacy policy documents. So user can't opt out if they disagree with certain points of them. |
| It tells users when it accesses other resources of the device, such as their accounts or their social network profile. | Yes | This has to be initiated by the user |
| It takes measures to protect minors in accordance with the current legislation. | Yes | You have to be of age to be able to register |
| Confidential user data are protected and anonymized, and there is a privacy mechanism so that users can control their data. | Yes | MFP is trying to apply the GDPR rules for all of its users, however specific description of data protection done by the company is not available |

Source: Llorens-Vernet & Miró, 2020.

In the model some of the criteria are too complex, they contain two or more sentences, of which one can be true and one can be false, making the evaluation harder in one line. Security related points were not clearly accessible for users, although a company and app of this size must have the mentioned measures in place. Technical support is not cited in the previous evaluation systems, however that is a useful and important point too that would be relevant for end users. Technical details, such as flight mode usage and resource usage are also valuable criteria, however presumably they are not in the other ones because hopefully these issues are addressed during a testing phase already. Finding the authors of the app was a difficult task, generally a page about authors, research and provider company would be useful for the average user considering the above evaluation systems and the value of this information. The total number of criteria was 36, of which 23 were answered with yes (64%). This also means that a lot of information was available from the checklist. No was selected 4 times (11%). 9 criteria were answered with 'Not available' concerning development details, security details, validation, and research (25%).

This model, among many other topics, asked about the possible safety of the app, namely if it is warning the users of possible risks of using the app and potential effects of bad usage (Llorens-Vernet & Miró, 2020). The following two screen shots are example from MyFitnessPal, taken by the authors, highlighting possible risks. On the first screen shot we tried to set a challenging weight loss goal during the app setup. On the second picture we tried to complete the daily food diary with very little food intake saved for the day. In relation to the possible risks, it is worth noting that according to a study there might be a relationship between using weight-related self-monitoring applications and disordered eating (Hahn et al., 2022), however there was no reference for MyFitnessPal of such risks.

**Table 5.**
*Safety warnings in MyFitnessPal, screen shots taken by the authors*




The last model that was tested was T4T (Wykes & Schueller, 2019). It is slightly different, as it focuses on trustworthiness of the app. This evaluation model is the shortest of the ones that were selected, so it was relatively quick to fill. The questions are data-aware, they helped to direct attention while reading the privacy policy, for example asking about the collected data and the 3rd party sharing details (MyFitnessPal, 2020), as the below screen shot shows. It contains one of the four criteria, privacy and security and the authors' comments after researching the questions.

**Table 6.**
*T4T evaluation criteria and authors' comment, own edition*

| PRIVACY AND SECURITY | COMMENTS |
|---|---|
| 1) What data leave the device? | The app collects personal data about the user- contact details, address, weight, hight, weight and fitness goals, activity, possibly sleep data, other health data if the app is connected to another device (heart rate, etc), photos |
| 2) How are those data stored? | According to the privacy policy the data is stored on the company's server in the US |
| 3) Who will have access to those data? | According to the privacy policy:<br>Service providers and vendors "With business partners, marketing partners, and vendors to provide, improve, and personalize the Services.",<br>Social network providers "With social network providers when we use social network widgets, buttons, or plug-ins in our Services."<br>Other MFP users "With other users of the Services in the context of specific features that are social in nature. Additionally, any information you post or disclose in our community forums (e.g., Facebook, sponsored pages on the MyFitnessPal Blog) is public."<br>Advertisers and marketing services "With advertising and marketing partners for advertising and marketing purposes on MyFitnessPal's behalf and on behalf of third parties, including but not limited to Facebook."<br>Analytics and improvements "With certain companies for purposes of analytics and improvement of the Services."<br>For personalized advertising<br>For Legal Compliance, Law Enforcement, and Public Safety Purposes<br>In the event of an actual or contemplated sale- with other companies/ investors |

Sources: (MyFitnessPal, 2020), (Wykes & Schueller, 2019).

The model also highlights the importance of clinical research, for which details are not available for the average users. It was thought-provoking to think about the possibility that there are certain users that received no benefit from the app or even deteriorated due to the usage of the app. This data would be very significant too for users. In my opinion revealing how testing and evaluation of an app is done when it is already operational would help improving trust towards the app. The model asked about the proportion of users that use the app after two weeks, which is referring back to the previously mentioned challenge that users stop utilizing the application after a while. Although the precise answer to this question was not found, the already cited research (Yoshio Laing et al., 2014), and the statistics (Curry, Business of Apps, 2021) could give the assessor some insight. There were 12 questions in this system, but the answers to these were complex ones, so a total of points cannot be provided. Overall, this evaluation criteria could be a great addition to some of the other models because it asks important questions which should be considered for a health and fitness app but are not mentioned in the general evaluations.

## 4. Conclusion

Using these four evaluation criteria for a single app was an eye-opening exercise. It pointed out the many possible angles that can be considered during an assessment of an application. Although not all the systems were created for end users, in my opinion all are beneficial to them. Each model had criteria that was unique for them and that was not mentioned in other models, but there also were similarities. It would be a great habit to read the privacy policies and terms and conditions, because they provide valuable information for the users, which answer a lot of important questions. It also felt useful to research the scientific background and the organizational background of the application. Although the authors were familiar with the application already before we started the evaluations, we learned a lot about it with the various questions from the models.

In summary, as a possible blend of these models, the following areas have to be evaluated to establish if an app is good enough to be used.

- Usability, including function, engagement, aesthetics. In this category the aim could be to examine if the app is easily usable, intuitive, fun to use, visually appealing, customisable and fit for its purpose and target audience, etc.
- Content, including quality of the information provided, benefits, research, appropriateness, and suitability. This category could contain questions about measurements, research that backs up the contents of the app, the benefits of the app, etc.
- Security, privacy, safety, transparency. This could show potential risks of using the app, security measures that are taken to protect users, and privacy related questions about data handling, how the privacy policy is written, how the app is protecting user data, etc.
- Publishers: it could be beneficial for users to have more information about the app provider organization, its reputation, brand, and about the app's authors, possibly development characteristics.
- Technical support and updates: it is important to provide technical support for health and fitness related apps, and in general regular updates to improve the app's many aspects are also vital.
- Technology: the app should work well, should not waste resources, etc.

Using the models, the last factor could be societal influencers, but the authors of this article think that this is not needed as a criteria as other aspects feel more important. However, generally it is accepted that users are influenced by each other when selecting an app to download.

Although using a kind of combination of the evaluating systems or any individual evaluating system might give users a great knowledge and awareness of the app's quality, realistically usually not this many aspects are considered before a user downloads an app. Perhaps because this is health related, they could be more prudent. The more realistic approach could be that these assessments could be carried out by providers, for which results would be shown when an app is presented to the users (for example on the informational pages or supporting sites). Another solution could be that the medical personnel who recommends these types of apps does the evaluation and gives out recommendations based on the results. Even if these applications are not very serious health apps, their evaluation with more serious criteria gives valuable information to their users and enhances trustworthiness if provided.

## References


1. Bradley, T. (2018). Security Experts Weigh In On Massive Data Breach Of 150 Million MyFitnessPal Accounts. Retrieved from https://www.forbes.com/sites/tonybradley/2018/03/30/security-experts-weigh-in-on-massive-data-breach-of-150-million-myfitnesspal-accounts/?sh=15fb97b23bba, 04.17.2022.
2. Ipjian, L.M., Johnston, S.C. (2017). Smartphone technology facilitates dietary change in healthy adults. *Nutrition, 33,* 343-347. doi:https://doi.org/10.1016/j.nut.2016.08.003.
3. Stoyanov, S., Hides, L., Kavanagh, D., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile App Rating Scale: A New Tool for Assessing the Quality of Health Mobile Apps. *JMIR mHealth and uHealth, 3(1).* doi:10.2196/mhealth.3422.
4. van Haasteren, A., Vayena, E., & Powell, J. (2020). The Mobile Health App Trustworthiness Checklist: Usability Assessment. *JMIR mHealth and uHealth, 8(7).* doi:10.2196/16844.
5. Anthony, J. (2021). Finances Online. Retrieved from Number of Apps in Leading App Stores in 2021/2022: Demographics, Facts, and Predictions: https://financesonline.com/number-of-apps-in-leading-app-stores/, 12.01.2021.
6. Birkmeyer, S., Wirtz, W.B., & Langer, F.P. (2021). Determinants of mHealth success: An empirical investigation of the user perspective. *International Journal of Information Management, 59.* doi: https://doi.org/10.1016/j.ijinfomgt.2021.102351.
7. Buttarelli, G., & EDPS (2015). Opinion 1/2015 Mobile Health, Reconciling technological innovation with data protection. Brussels: European Data Protection Supervisor, EDPS.
8. Chen, J., Berkman, W., Bardouh, M., Yan Kammy, C., & Allman-Farinelli, M. (2019). The use of a food logging app in the naturalistic setting fails to provide accurate measurements of nutrients and poses usability challenges. *Nutrition, 57,* 208-216. doi: https://doi.org/10.1016/j.nut.2018.05.003.

9. Curry, D. (2021). Business of Apps. Retrieved from App Store Data (2021): https://www.businessofapps.com/data/app-stores/, 11.15.2021.
10. Curry, D. (2022). Fitness App Revenue and Usage Statistics (2022). *Business of Apps*. Retrieved from https://www.businessofapps.com/data/fitness-app-market/, 03.01.2022.
11. Druć, M., Jóźwiak, J.I., Jóźwiak, M.A., Nowak, M.W. (2021). Scientific Papers Of Silesian University Of Technology - Organization And Management Series, No. 153. Retrieved from https://managementpapers.polsl.pl/wp-content/uploads/2021/09/ZN153_Dru%C4%87-J%C3%B3%C5%BAwiak-J%C3%B3%C5%BAwiak-Nowak.pdf.
12. Evenepoel, C., Clevers, E., Deroover, L., Van Loo, W., Matthys, C., & Verbeke, K. (2020). Accuracy of Nutrient Calculations Using the Consumer-Focused Online App MyFitnessPal: Validation Study. *J. Med. Internet Research*, doi:10.2196/18237.
13. Hahn, L.S., Hazzard, M.V., Loth, A.K., Larson, N., Klein, L., & Neumark-Sztainer, D. (2022). Using apps to self-monitor diet and physical activity is linked to greater use of disordered eating behaviors among emerging adults. *Preventive Medicine, 155*. doi: https://doi.org/10.1016/j.ypmed.2022.106967.
14. Llorens-Vernet, P., & Miró, J. (2020). Standards for Mobile Health–Related Apps: Systematic Review and Development of a Guide. *JMIR mHealth and uHealth, 8(3)*. doi: 10.2196/13057.
15. MyFitnessPal (2018). MyFitnessPal Account Security Issue: Frequently Asked Questions (MyFitnessPal). Retrieved from https://content.myfitnesspal.com/security-information/FAQ.html, 04.17.2022.
16. MyFitnessPal (2019). How do I change my preferred language? (MyFitnessPal). Retrieved from https://support.myfitnesspal.com/hc/en-us/articles/360032623951-How-do-I-change-my-preferred-language-, 04.11.2022.
17. MyFitnessPal (2020a). MyFitnessPal Privacy Policy. Retrieved from https://www.myfitnesspal.com/privacy-policy, 04.15.2022.
18. MyFitnessPal (2020b). MyFitnessPal Terms and Conditions of Use. Retrieved from https://www.myfitnesspal.com/terms-of-service, 04.15.2022.
19. MyFitnessPal (2021). What is the GDPR? (MyFitnessPal). Retrieved from https://support.myfitnesspal.com/hc/en-us/articles/360032622811-What-is-the-GDPR-, 04.19.2022.
20. MyFitnessPal (n.d.). MyFitnessPal Blog (MyFitnessPal Inc.). Retrieved from https://blog.myfitnesspal.com/, 04.05.2022.
21. Pendick, D. (2014). Can an app help you lose weight? (Harvard Health Blog). Retrieved from https://www.health.harvard.edu/blog/can-app-help-lose-weight-201411207537, 05.01.2021.
22. Slazus, C., Ebrahim, Z., & Koen, N. (2022). Mobile Health Apps: An Assessment of Needs, Perceptions, Usability, and Efficacy in Changing Dietary Choices (Nutrition). doi: https://doi.org/10.1016/j.nut.2022.111690.

23. van Haasteren, A., Gille, F., Fadda, M., & Vayena, E. (n.d.). Development of the mHealth App Trustworthiness checklist. *Digital Health,* p. 01. doi:10.1177/2055207619886463.
24. Lin, W.A., Morgan, N., Ward, D., Tangney, C., Alshurafa, N., Van Horn, L., & Spring, B. (2022). Comparative Validity of Mostly Unprocessed and Minimally Processed Food Items Differs Among Popular Commercial Nutrition Apps Compared with a Research Food Database. *Journal of the Academy of Nutrition and Dietetics, 122(4)*, 825-832. doi: https://doi.org/10.1016/j.jand.2021.10.015.
25. Wykes, T., & Schueller, S. (2019). Why Reviewing Apps Is Not Enough: Transparency for Trust (T4T) Principles of Responsible Health App Marketplaces. *Journal of Medical Internet Research, 21(5).* doi: 10.2196/12390.
26. Yoshio Laing, B., Mangione, M.C., Tseng, C.-H., Leng, M., Vaisberg, E., Mahida, M., … Bell, S.D. (2014). Effectiveness of a smartphone application for weight loss compared to usual care in overweight primary care patients: a randomized controlled trial. *Annals of Internal Medicine*. doi: https://doi.org/10.7326/M13-3005.

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# THE IMPORTANCE OF TEACHERS' CULTURAL INTELLIGENCE FOR THE INTERNATIONALIZATION PROCESS OF HIGHER EDUCATION

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**Purpose:** The main purpose of this article is to diagnose the level of cultural intelligence of academic teachers of public economic universities in Poland and identify factors related to this kind of intelligence.
**Design/methodology/approach**: The tests carried out were quantitative. The following methods were used: analysis of the subject literature, surveys, and analysis of organizational documentation.
**Findings:** The study showed that the level of cultural intelligence of teachers of economic universities in Poland is relatively high and slightly different between the surveyed universities. There was no correlation between the cultural intelligence level and such variables as gender and a scientific degree. On the other hand, the number of languages known at the communicative level and the number of countries in which the employee has stayed under international cooperation programs are positively correlated with the level of cultural intelligence.
**Research limitations/implications**: The original plan was to carry out the survey at all five public universities of economics in Poland. Eventually, due to a small number of completed questionnaires, teachers from three public universities of economics were included in the study.
**Practical implications:** This study may contribute to revealing the factors influencing the cultural intelligence level of academics and, consequently, the intercultural work environment and the wider internationalisation process of universities.
**Originality/value:** This is pioneering research on the level of cultural intelligence of employees at Polish economic universities. Some of the findings are novel, such as the diagnosed correlation between a lecturer's academic degree and the level of cultural intelligence. The authors believe that their study may inspire researchers from other countries to conduct more in-depth research in the area of cultural intelligence of lecturers.

**Keywords:** Cultural intelligence; academic teachers; higher education institutes; internationalization; skills.

**Category of the paper:** Research paper.

## 1. Introduction

Global changes of a social, economic, political, and technological nature, which we observed in past decades, have had a significant impact on the way enterprises, non-governmental organizations, as well as universities operate. Contemporary universities are now facing dynamically changing conditions and numerous claims made towards them. They are expected to participate in the development of the local community as well as the development of innovation and shaping human capital (Chirileasa, 2013). The necessity of shaping human capital by universities is indicated by Boucher, Conway, Meer (Boucher, Conway, & Van Der Meer, 2003). As multiculturalism has become a sign of times, next to work at the junction between cultures and the need to have excellent communication skills, universities must enter the path of gradual internationalization. It means the process of including international, intercultural and global dimensions into the process of providing educational services at the academic level (Chan, 2013). Its effect is expected to be appropriate preparation of the academic community for successful participation in the increasingly interdependent world (Francis, 1993).

The internationalization of higher education requires continuous adjustment to a dynamically changing global environment, responding to challenges and use of emerging capabilities (Hudzik, 2013). Its significance changes depending on the premises, stimuli and political and economic circumstances in which it takes place (Callan, 2000). According to the program for the internationalisation of Polish higher education, developed by the Ministry of Science and Higher Education in Poland in 2015 (MNISW, 2015), the development of cultural competences has great importance for the success of the internationalization process among both students and university staff. These competences, also called cultural intelligence (in short CQ), facilitate the understanding of beliefs, standards, and values relevant to various national cultures. Consequently, they enable adaptation and efficient functioning in a multicultural environment. The need for developing and strengthening the cultural intelligence of academic teachers as part of their professional development has also been pointed out by Upton and Butters (Upton & Butters, 2019).

Cultural intelligence is defined as the ability to adapt to different cultural realities (Earley & Ang, 2003), or the ability to effectively interact with people from various cultural environments, which is strengthened by any new cultural experience (Bobanovic and Grzinic 2019; Thomas and Inkson 2009). Cultural intelligence refers to the features and skills thanks to which people quickly, and with minimal stress, adapt to interaction in cultures other than the one in which they were socialized. According to Le, Jiang and Nielsen (2018), cultural intelligence helps people to adapt to a multicultural environment and deal with stress, cultural barriers and difficulties in communication and intercultural interactions. People with a high CQ more often relate to culturally determined situations, and at the same time, those who have

a deeper and more frequent contact with other cultures show a more developed cultural intelligence (Kolano & Olszewski, 2011). Thomas and Inkson (2009) emphasize that cultural intelligence is not a subset of emotional intelligence but a separate ability. It is about the "ability to effectively interact with people from various cultural circles". People with high emotional intelligence can sense the emotions, desires and needs of others, while people with high cultural intelligence are sensitive to the values, beliefs, attitudes and body language of people from different cultures, and they use this knowledge in interactions based on empathy and understanding (Suharti, Handoko, & Huruta, 2019).

According to the concept of Ng, Van Dyone, And Ang, cultural intelligence consists of four dimensions/components (Ng, Van Dyne, & Ang, 2012): meta-cognitive, cognitive, motivational and behavioural. The meta-cognitive dimension of CQ reflects the thought processes that individuals use to acquire and understand cultural knowledge, including knowledge about individual thought processes related to culture and control over them. It includes planning, monitoring and revision of mental models and cultural standards. The cognitive dimension of CQ reflects the knowledge about standards, practices and conventions prevailing in different cultures, obtained both in the education process and through individual experiences. The motivational dimension of CQ reflects the ability to focus attention and energy on learning and functioning in situations characterized by cultural differences. Last but not least, the behavioural dimension of CQ reflects the ability to take appropriate verbal and non-verbal actions when interacting with people from various cultures.

## 2. Theoretical foundation and development of hypotheses

According to Kim and Locke (Locke & Kim, 2010), the impact of globalization on higher education is usually discussed in relation to students and their mobility, the financing of higher education institutions, research and knowledge transfer and labour markets for graduates. Little attention has been paid to academic teachers so far. Meanwhile, Qiang (2003) notes that to equip students with the desirable labour market competences, universities must have staff with high cultural competences. The cultural intelligence of teachers is perceived as an important factor of effective responsibility for the educational requirements of heterogeneous student groups (Ramis, Krastiņa, and Ramis Salas, 2010; Teekens, 2003; Zelenková and Hanesová, 2019; Sá and Serpa, 2020) and involvement in the implementation of international research projects, often under Interdisciplinary teams (Suharli et al., 2019; Plum, 2007). Ryan believes that teachers' cultural intelligence can contribute to the students' development, such as the openness of the mind, openness to the world, tolerance and respect for others (Ryan, 2005).

The internationalization of Polish universities is rather low compared to other European Union countries. One of the reasons is the cultural differences between Poles and foreigners. Lack of knowledge with respect to values, standards, customs, and attitudes typical of diverse cultures hinders intercultural adaptation, often causing a cultural shock. That is why it is so important that employees of Polish universities develop their cultural competences, enabling effective interaction in intercultural situations.

Empirical research, which analyses the cultural intelligence of academic teachers and its importance in the context of the internationalization of universities, is relatively new and not very ample. M. Tharapos (Tharapos, 2015) studied the level of CQ of Australian researchers dealing with accounting, as well as demographic factors that may affect the CQ results. In turn, Mahasneh, A.M., Gazo, A.M., and O.A. Al-Adamat (2019) compared the level of cultural intelligence of teachers and students of the University of Haszymid. Clearly prevailing in Polish literature are works on the internationalization of universities omitting the issue of cultural intelligence (Domański, 2017; Popowska, 2016; Piwowarczyk, 2016; Maliszewski, 2015; Golubieva, Tutko, and Tutko, 2016; Przytuła, 2019b, 2019a). The work of A. Pabian and B. Pabian should be considered particularly interesting from the perspective of the subject matter of this article. A. Pabian and B. Pabian focus on the internationalization of Polish universities in the aspect of cultural differences (Pabian and Pabian, 2012, 2019).

These studies are a response to the research gap observed. Their main objective was to diagnose the level of cultural intelligence of academic teachers at public economic universities in Poland and to identify factors related to this type of intelligence. The research questions were formulated as follows: How is the level of four dimensions of employees' cultural intelligence shaped? Are there any significant differences in this respect between universities? Is there a relationship between the level of CQ and factors such as gender, scientific degree, knowledge of foreign languages and the number of countries visited by the employee for at least 5 days under international cooperation initiatives?

Polish public universities that participated in the research are predominantly located in large cities, have the same (economic) profile and a similar size and offer similar opportunities to acquire experiences and develop cultural competences by teachers (e.g., through exchange programmes, internships, foreign placements, lectures for visiting professors, participation in international organizations, international scientific projects, etc.). That is why it was assumed that teachers of these universities are characterized by a similar level of cultural intelligence. H1: There are no significant differences with respect to the individual four dimensions of cultural intelligence (meta-cognitive, cognitive, motivational and behavioural) between employees of the researched universities.

Previous studies on CQ and gender relations are ambiguous. Research by Bobanovic & Grzinic (2019) and MacNab & Brent (2012) showed that women and men differ in the level of cultural intelligence. In their study women were characterized by a higher level of the behavioral dimension of CQ. On the other hand, Brancu, Munteanu, Golet (2016) (Brancu

et al., 2016) indicated the existence of statistically significant differences in cultural intelligence due to gender, but in favour of men. At the same time, they could concern one component. In Mahasneh's research (Mahasneh et al., 2019), it was a CQ motivational dimension. Engle and Nehrt (2012) and Ward, Festcher (2008) research did not state any statistically significant differences in cultural intelligence due to gender variables. Noticing the need for further research in this respect, in this study it was decided to verify the following hypothesis H2: Women, regardless of the researched university, have higher cultural intelligence than men.

In Poland, the professional promotion of scientific staff means the need to enter a defined professional path, which in turn requires time. The Law on Higher Education and Science (Sejm, 2018) provides for two scientific steps: Doctor and habilitated Doctor. The title of Professor should be distinguished from the scientific degrees. The title is given by the President of the Republic of Poland to a person holding a degree of Habilitated Doctor for outstanding scientific or artistic achievements. In exceptional cases, the title of Professor may be given to a person with a doctoral degree if it is justified by the highest quality of their scientific or artistic achievements. Progressing to further stages of one's career means involvement in research and publishing work not only in the country but also abroad. Therefore, it seems that people who have the title of Professor, due to their richer international, personal, and professional experience, will have a higher level CQ than people with a degree of Doctor and Habilitated Doctor. Hence, the hypothesis: H3: The scientific degree affects the level of cultural intelligence.

There are studies indicating that while learning a foreign language, one learns the culture of the country of its origin (Alon & Higgins, 2005). Ang et al. (2011) stated that individual language skills are positively related to the level of cultural intelligence. One can come across similar conclusions in the works of N. Harrison (2012). M. Tharapos noticed that academic teachers who communicate in more than one language have higher total CQ (Tharapos, 2015). It was decided to check if the said conclusions of the researchers can be confirmed in Polish conditions. The following hypothesis was formulated: H4: Knowledge of foreign languages affects the level of cultural intelligence.

According to K.A. Crowne, cultural exhibition in all forms affects Cultural Intelligence (Crowne, 2013). It can therefore be expected that experiences in the form of foreign trips are positively related to CQ. Engle and Crowne (2014) studies have shown that participation in a short-term international research programme lasting from 7 to 12 days causes a significant increase in the level of each of the four dimensions of CQ. It is hard to disagree with Ang et al. (2011) that not all international experiences are the same and that international experience must be significant enough to bring the effect. According to J. Eisenberg et al. (2013), significant international experience requires a stay abroad lasting at least 6 months. In these studies, considering a relatively low level of Polish teachers' participation in official foreign trips, it was assumed that in the assessment of cultural exhibition, even short, five-day foreign visits will be considered. The hypothesis regarding the dependence between the CQ level and

the number of countries in which the employee has been involved in international cooperation was formulated as follows: H5: There is a relationship between the CQ level and the number of countries in which an employee has stayed under international cooperation programs for at least 5 days

## 3. Methods

The empirical research carried out was quantitative. Methods such as surveys and analysis of organizational documentation were used. In May 2020, the consent of the authors of the scale measuring cultural intelligence (CQS) was obtained to use it in research and publications in scientific journals. This consent obliged the authors of the survey to place the following copyright information in the electronic copy of the survey and its subsequent publications:
*© Cultural Intelligence Center 2005. Used by Permission of Cultural Intelligence Center.Note. Use of this Scale Granted to Academic Researchers for Research Purposes Only. For Information on Using The Scale For Purposes Other Than Academic Research (E.G., Consultants and Non-Academic Organizations), Please send an email to info@culturalq.com.*

This copyright information was directly translated into Polish and used in an electronic CQS copy. CAWI (ang. Computer-Assisted Web Interview) type surveys were carried out in the period September – October 2020 to determine the teachers' CQ. A quantitative approach was decided upon, as it enables the collection of descriptive information and examines the relationship between variables. It also allows replication, generalization of results and comparison between groups (Creswell, Klassen, Clark, & Smith, 2013). Scientific staff of public economic universities in Poland constituted the group of respondents. No incentive was proposed to participate in the study. The relevant study was preceded by a pilot study, which resulted in the improvement of the research tool. Before collecting data, an email consent was obtained for the research from the rectors of all five public economic universities in Poland. Surveys were directed to internal mail to all academic teachers.

Due to the small number of completed surveys at Katowice University of Economics (7 replies) and Poznan University of Economics (2 replies), it was decided that these two universities would not be considered in the statistical analysis. Finally, teachers from three public economic universities were considered in the studies: Warsaw School of Economics (in short – SGH) (81 people), Krakow University of Economics (in short – EU Krakow) (64 people) and the Wroclaw University of Economics and Business (in short – EU Wroclaw) (61 people). Warsaw School of Economics is the oldest economic university in Poland and the biggest one (in terms of the number of employees and students). According to higher education rankings in Poland, it is also considered the best economic university in the country (Perspektywy, 2021).

Year by year, employees of the researched universities are becoming increasingly involved in international cooperation. Table 1 includes basic information on foreign mobility in the academic year 2018/2019. It can be clearly seen that SGH boasts the highest foreign mobility of their teachers – 695 people have travelled abroad, which is about 87% of all teachers. At the same time, the university analysed has been visited by just 32 visiting professors. The University of Economics in Wroclaw is the worst in the summary. Less than 17% of teachers have taken foreign trips, with the number of visiting professors (48) higher than in SGH.

**Table1**.
*Foreign mobility in the academic year 2018/2019*

| Specification | Warsaw School of Economics | Wroclaw University of Economics and Business | Krakow University of Economics |
|---|---|---|---|
| Number of teachers going abroad[a]/Total number of academics | 695/800* | 97/581* | 616/748* |
| Number of visiting professors[b] | 32 | 48 | 85 |

*approximate figures
Legend:
[a]Staff departures include conferences, teaching, research, and training placements, Other (organisational, queries etc.), Erasmus Plus mobility; [b]Arrivals include visiting professors under the teaching and Erasmus Plus programmes and research placements.

A total of 206 people took part in the study, representing approximately 10% of the total teacher population of each university. A detailed description of the sample is included in Table 2. The research was dedicated to Polish nationality teachers only, with women (57.8%) prevailing. The largest percentage of the people surveyed ranged in their age from 36-45 years old (36.4%), with a Doctor's scientific degree (46.1%). The smallest number of responses came from people 55+ years old (16%), with the scientific degree of Professor or Habilitated Doctor (8.3%).

**Table 2**.
*Description of the sample (N = 206)*

| Specification | | Number | Percentage of N in column |
|---|---|---|---|
| Sex | Female | 119 | 57.8% |
| | Male | 87 | 42.2% |
| Nationality | Polish | 206 | 100.0% |
| University | SGH | 81 | 39.3% |
| | UE Krakow | 64 | 31.1% |
| | UE Wroclaw | 61 | 29.6% |
| Age | up to 35 years | 28 | 13.6% |
| | 36-45 years | 75 | 36.4% |
| | 46-55 years | 70 | 34.0% |
| | +55 years | 33 | 16.0% |
| Scientific degree | Master of Science, engineer | 34 | 16.5% |
| | Doctor | 95 | 46.1% |
| | Habilitated Doctor | 60 | 29.1% |
| | Professor, Doctor habilitated | 17 | 8.3% |

## 4. Results

In the statistical analyses carried out to measure the reliability of the research questionnaire, the Alfa Cronbach coefficient was calculated. Credibility tests were needed because the survey was translated into Polish and was used in a different culture and in a different period than the previously taken tests. The value of the scale in the educational measurement was adopted at 0.9 for the main scale for the acceptable resolution limit. Alpha Cronbach for the entire CQ scale of the translated questionnaire was 0.93.

**Verification of research hypothesis**

H1: There are no significant differences at the level of particular 4 dimensions of cultural intelligence (meta-cognitive, cognitive, motivational and behavioural) between the teachers of the university respondents.

In order to test the hypothesis regarding the lack of differences between the teachers of the universities, i.e. SGH Warsaw, the EU Krakow and the EU Wroclaw, in terms of the level of individual dimensions making up cultural intelligence, i.e. a meta-cognitive, cognitive, motivational and behavioural dimension, a single-factory analysis of variance was carried out for independent groups. The analysis showed the following:

- a statistically significant variable effect. University in a meta-cognitive dimension $F(2, 202) = 3.3473$, $p < 0.04$, $ETA2 = 0.03$. The comparisons of post hoc with the help of the Bonferroni test revealed differences between two universities, i.e. SGH Warsaw and the EU Wroclaw ($p < 0.04$), which means that SGH Warsaw employees are characterized by a higher level of cultural intelligence at a meta-cognitive level ($M = 23.48$; $SD = 4.03$) than EU employees Wroclaw ($M = 21.64$; $SD = 4.36$);
- statistically significant variable effect. University in cognitive dimension $F(2, 202) = 6{,}6955$, $p < 0.002$, $ETA2 = 0.06$. The comparisons of post HOC with the help of the Bonferroni test revealed differences between two universities, i.e., SGH Warsaw and the EU Wroclaw ($p < 0.001$), which means that SGH Warsaw employees are characterized by a higher level of cultural intelligence in the cognitive dimension ($M= 30.03$; $SD = 6.69$) than EU Wroclaw employees ($M = 25.89$; $SD = 7.04$);
- statistically significant variable effect. University in the motivational dimension $F(2, 202) = 6.9451$, $p < 001$, $ETA2 = 0.06$. The comparisons of post hoc with the help of the Bonferroni test revealed differences between two universities: SGH Warsaw and the EU Wroclaw ($p < 0.001$), which means that SGH Warsaw employees are characterized by a higher level of cultural intelligence in the motivational dimension ($M = 28.26$; $SD = 5.44$) than EU Wroclaw employees ($M = 24.56$; $SD = 5.74$);

- effect at the level of a trend ($p < 0.06$). University in behavioural dimension $F(2, 202) = 2.9151$, $p < 0.06$, ETA2 = 0.03. Post hoc comparisons with the help of the Bonferroni test revealed differences, but also at a trend level, between SGH Warsaw and the EU Wroclaw ($p < 0.07$), which means that SGH Warsaw employees are characterized by a higher level of cultural intelligence at a behavioural level ($M = 27.24$; $SD = 6.89$) than EU employees Wroclaw ($M = 24.66$; $SD = 6.29$). However, one needs to remember that this is a trend.

To check whether teachers of individual universities differ in the IC level, a single analysis of the variance was performed, which showed a variable effect of the University $F(2, 202) = 7.6$, $p < 0.001$, ETA2= 0.07. Comparisons of post hoc with a Bonferroni test showed a statistically significant difference between SGH Warsaw and the EU employees ($p < 0.001$) and the difference at a trend level ($p < 0.06$) between SGH Warsaw and EU employees (SGH Warsaw: $M = 108.96$; $SD = 19.28$, EU Krakow: $M = 101.48$; $SD = 18.72$, EU Wroclaw: $M = 96.74$; $SD = 18.28$). To test the hypothesis concerning a higher level of cultural intelligence of women compared to men, an analysis was carried out using a T test for independent tests. The results of this analysis did not show the gender effect and thus differences between women ($M = 103$; $SD = 19.3$) and men ($M = 103$; $SD = 19.7$) in terms of cultural intelligence $T(204) = 0.31$, COHEN'S $D = 0.04$. Women and men do not differ in terms of cultural intelligence. To test the hypothesis on the impact of the scientific degree on the level of cultural intelligence, a single analysis of the variance was performed, which showed a statistically significant effect of the variable "Scientific stage" $F(3, 201) = 1.2573$. There are no differences in the level of cultural intelligence between the groups distinguished on the basis of the scientific degree: Master's degree ($M = 102.79$; $SD = 16.69$), Doctor ($M = 102.31$; $SD = 18.71$), Habilitated Doctor $M = 101.72$; $SD = 21.96$), Professor Habilitated Doctor ($M = 111.65$; $SD = 17.99$). Respondents with varying scientific degrees are characterized by a similar level of cultural intelligence.

**Table 3.**
*Data on the knowledge of foreign languages and the number of countries visited by employees under international cooperation programs (N = 206)*

| Specification | | Number | Percentage of N in column |
|---|---|---|---|
| Number of foreign languages known (communicative level) | 1 | 63 | 30.6% |
| | 2 | 106 | 51.5% |
| | 3 and more | 37 | 18.0% |
| Number of countries visited within international cooperation for at least 5 days so far (student classes, training, or research project implementation) | 0 | 46 | 22.3% |
| | 1 | 36 | 17.5% |
| | 2 | 32 | 15.5% |
| | 3 and more | 92 | 44.7% |

Table 3 contains data on the knowledge of foreign languages and the number of countries visited by employees under international cooperation programs. In the study, people who can communicate in 2 foreign languages (51.5%) and people who have spent at least 5 days in three or more countries (44.7%) constituted the largest percentage. A scarce number of people declared knowledge of three or more foreign languages (18%) and a stay in two countries under international cooperation programs (15.5%). To test the hypothesis on the influence of foreign language skills on the level of cultural intelligence, a single analysis of the variance was made, which showed the effect of a variable knowledge of languages $F(2, 202) = 22.92$, $p < 0.001$, $ETA2 = 0.18$. Comparisons post hoc with Bonferroni test showed statistically significant differences between individual groups ($p < 0.02$), i.e. people using one foreign language are characterized by a lower level of cultural intelligence ($M = 91.7$; $SD = 17.79$) than those who know two languages ($M = 105.45$; $SD = 18.68$), and yet those who know two languages are characterized by a lower level of cultural intelligence than those who know 3 and more languages ($M = 115.24$, $SD = 13.68$). The number of languages known at the communicative level varies the level of cultural intelligence; the more languages one knows the greater cultural intelligence they represent.

To investigate the relationship between the number of countries which the employee has visited under international cooperation programs for at least 5 days and the level of cultural intelligence, a single analysis of the variance was performed, which showed a statistically significant effect of the variable effect "Number of countries" $F(3, 201) = 13.08$, $p < 0.001$, $ETA2 = 0.16$. Comparisons post hoc with Bonferroni test showed statistically significant differences between individual groups ($p < 0.01$), i.e. people who have not been to any country under international cooperation programs are characterized by a lower level of cultural intelligence ($M = 91.24$; $SD = 17.56$) than those who have visited one country ($M = 96,86$; $SD = 17.23$), and a lower level than those who have visited two countries ($M = 106.47$; $SD = 18.49$), and respectively, lower than those who have visited three and more countries ($M = 109.99$; $SD = 18.03$). The greater the number of countries visited by the respondents, the higher the level of their cultural intelligence.

## 5. Discussion

The choice of Polish public economic universities for the study was not accidental. These universities did not survey for cultural intelligence. Meanwhile, the literature emphasises that business schools should be sensitive to cross-cultural differences (Caporarello & Manzoni, 2020), as they are responsible for educating ethical and entrepreneurial leaders who think globally and also understand the systemic implications of business decisions (Business Education Jam, 2015). R. MacIntosh, Chairman of the Chartered ABS writing about the

contribution of business schools to the public good, stated: "The world faces big challenges on climate and social inclusion, the answers to which don't just lie in technological innovation. Scientific breakthroughs are important but not enough on their own - they need an interface with business research to ensure their transition to viable products and services for the benefit of society" (Chartered ABS and ITN Launch "Business Schools for Good" film, Chartered Association of Business Schools, n.d.).

The main purpose of the research was to diagnose the level of cultural intelligence of academic teachers of public economic universities in Poland. It was assumed in the research that teachers of three Polish universities are characterized by a similar level of cultural intelligence: H1: There are no significant differences with respect to the individual four dimensions of cultural intelligence (meta-cognitive, cognitive, motivational and behavioural) between employees of the universities (Krakow, Warsaw, Wroclaw).

The studies conducted have shown a difference in terms of the level of individual dimensions making up cultural intelligence, i.e., a meta-cognitive, cognitive, motivational and behavioural dimension, between the employees of SGH Warsaw and the EU Wroclaw and the difference at a trend level between SGH Warsaw and EU employees. The analysis showed that at each of the four dimensions, SGH Warsaw employees are characterized by a higher level of cultural intelligence components than employees of EU Wroclaw. On the other hand, employees of EU Krakow do not differ from the employees of SGH Warsaw and the EU Wroclaw. Further research and analysis should be carried out to determine what specific factors affect these differences, but it seems that it can be such factors as the mobility of academic staff or – more generally – the degree of the university's internationalization.

It is difficult to find research that would allow a comparison between the level of cultural intelligence of employees of Polish economic universities with employees of economic universities from other countries. Among the few researchers who have dealt with the CQ analysis of academic teachers are M. Tharapos (2015), who studied the level of CQ of Australian researchers dealing with accounting, as well as demographic factors that can affect CQ; and also the team A.M. Mahasneh, A.M. Gazo and O.A. Al-Adamat (2019), who compared the level of cultural intelligence of teachers and students of the University of Haszymid. Due to significant differences in the method and the scope of research, one can only make a very general comparison of the level of cultural intelligence of Polish academic teachers with the level of intelligence of the teachers from the University of Haszymid (Jordan). The results of the Jordanian teachers with respect to three dimensions: meta-cognitive, cognitive, and motivational are within the range between the result of teachers from SGH Warsaw and the EU Wroclaw, while the result concerning the behavioural dimension is higher in the case of teachers of the Haszymid University. This relatively better result in behavioural dimension may result from cultural conditions – Arab countries are characterized by different behaviour standards. Perhaps this is also the cause of differences in the level of CQ by gender, which will be mentioned in the next paragraph. H2: Women, regardless of the university researched, have higher cultural intelligence than men.

The results of the analysis carried out at economic universities in Poland did not show the gender effect and thus, no differences between women and men in terms of cultural intelligence were observed. These results are consistent with the results of Engle and Nehrt (2012) and Ward and Festcher (2008), who have not stated any statistically significant differences in cultural intelligence due to the gender variable. They differ from the results of Mahasneh et al. (2019), M. Bobanovic, J. Grzinic and MacNaba (2019), which showed differences between the level of cultural intelligence of women and men. The existing research on the relationship between gender and the level of CQ is ambiguous, hence further, in-depth tests in this respect are justified. H3: The scientific degree affects the level of cultural intelligence.

The studies conducted showed a statistically significant effect of the "Scientific Degree" variable in relation to the level of cultural intelligence. Researchers with various scientific degrees were characterized by a similar level of cultural intelligence. However, it can be assumed that the support of research on a larger test sample with equally distributed numbers of employee groups with certain scientific degrees would reveal some differences, as usually employees with a higher scientific degree have greater opportunities to participate in various forms of activities under international cooperation programs, and research confirms the positive influence of any type of cultural exposure on Cultural Intelligence (Crowne, 2013). H4: Knowledge of foreign languages affects the level of cultural intelligence.

The results of research carried out into Polish economic universities confirmed the hypothesis that knowledge of foreign languages at a communicative level varies the level of cultural intelligence; the more known languages declared, the greater cultural intelligence. These results are consistent with the findings of other researchers, including S. Ang et al. (2011), N. Harrison (2012) or M. Tharapos (2015). H5: There is a relationship between the IC level and the number of countries in which the employee has stayed under international cooperation programs for at least 5 days.

Research carried out into Polish economic universities revealed that their employees' CQ increases with the number of stays of an employee under international cooperation programs. There were significant differences between individual groups, i.e., people who have not visited any country under international cooperation programs are characterized by a lower level of cultural intelligence than those who have visited one country. Respectively, the people who have visited one country are characterised by a lower level than those who have visited two countries, and in turn, the people who have visited two countries are characterised by a lower level than those who have visited three or more countries. To some extent, these results are consistent with the findings of K. Crowne, who observed that the cultural exhibition in all forms had an impact on cultural intelligence (Crowne, 2013) and Engle and Crowne (2014), who observed that participation in a short-term international research program lasting from 7 to 12 days caused a significant increase in each of the four CQ components. A relatively low level of participation of Polish teachers in official foreign trips resulted in the fact that in the assessment of cultural exhibition all, even short, five-day foreign visits were considered,

without any differentiation. This fact, therefore, does not make it possible to refer to the proposition by Ang et al. (2011) that not all international experiences are the same and that international experience must be significant enough to bring the effect.

## 6. Conclusion

As it was observed in the introduction, there is no research regarding academic teachers, therefore, in this study, an attempt was made, at least to some extent, to fill in this research gap. The research showed that the level of cultural intelligence of teachers of economic universities in Poland is relatively high and slightly different between the three universities studied. In each of the four dimensions of CQ, SGH Warsaw employees are characterized by a higher level of cultural intelligence than EU Wroclaw employees. On the other hand, EU Krakow employees do not differ significantly from SGH Warsaw and EU Wroclaw employees. There was no correlation between two variables, i.e. gender and academic degree of lecturer and the CQ level. On the other hand, the number of languages known at a communicative level and the number of countries visited by the employee under international cooperation programs for at least 5 days is positively correlated with the level of cultural intelligence. It should be noted that some of the conclusions that have been described in detail in the article coincide with the results of international research carried out by other authors. Some of the conclusions are of a relatively innovative nature, such as the diagnosed correlation between the academic degree of lecturer and CQ. The authors believe that their research may inspire researchers from other countries to conduct more in-depth research to reveal organizational and individual mechanisms that affect the CQ level of academics and, consequently, the intercultural work environment, and the broadly understood internationalization process of universities. The conducted research does not entitle one to generalise conclusions to all types of universities. Further research among different kinds of universities, i.e. art, technical, military, medical, agricultural, theological and pedagogical universities, seems advisable to determine whether their teachers' level of cultural intelligence is similar or significantly different.

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## References


1. Alon, I., & Higgins, J.M. (2005). Global leadership success through emotional and cultural intelligences. *Business Horizons*, *48*(6), 501-512. https://doi.org/10.1016/j.bushor.2005.04.003.
2. Ang, S., Van Dyne, L., & Ling Tan, M. (2011). Cultural intelligence. In: S.B. Kaufman & R.J. Sternberg (Eds.), *The Cambridge Handbook of Intelligence* (pp. 582-602). New York: Cambridge University Press. Retrieved from https://culturalq.com/wp-content/uploads/2019/03/Ang_Van-Dyne_Tan-2011-Sternberg.pdf.
3. Bobanovic, M.K., & Grzinic, J. (2019). Teaching Tourism Students With Cultural Intelligence. *UTMS Journal of Economics*, *10*(1), 85-95.
4. Boucher, G., Conway, C., & Van Der Meer, E. (2003). Tiers of engagement by universities in their region's development. *Regional Studies*, *37*(9), 887-897. https://doi.org/10.1080/0034340032000143896.
5. Brancu, L., Munteanu, V., & Golet, I. (2016). Comparative Evidences of Cultural Intelligence Profile for Management and Non-Management Students. *Revista De Management Comparat International/Review Of International Comparative Management, Faculty of Management, Academy of Economic Studies*, *17*(4), 308-319. Retrieved from https://ideas.repec.org/a/rom/rmcimn/v17y2016i4p308-319.html.
6. Business Education Jam (2015). *Reimagining Business Education. A World of Ideas*. Retrieved from https://efmdglobal.org/wp-content/uploads/Reimagining_Business_Education.pdf.
7. Callan, H. (2000). Higher Education Internationalization Strategies: Of Marginal Significance or All-Pervasive? The International Vision in Practice: A Decade of Evolution. *Higher Education in Europe*, *25*(1), 15-23. https://doi.org/10.1080/03797720050002161.
8. Caporarello, L., & Manzoni, B. (2020). The Role of Business Schools and Their Challenges in Educating Future Leaders: Looking Back to Move Forward. In: N. Pfeffermann (Ed.), *New Leadership in Strategy and Communication* (pp. 209-226). Cham: Springer, https://doi.org/10.1007/978-3-030-19681-3_15.
9. Chan, S.J. (2013). Internationalising higher education sectors: Explaining the approaches in four Asian countries. *Journal of Higher Education Policy and Management*, *35*(3), 316-329. https://doi.org/10.1080/1360080X.2013.786854.
10. Chartered ABS and ITN launch "Business Schools for Good" film - Chartered Association of Business Schools (n.d.). Retrieved from https://charteredabs.org/chartered-abs-and-itn-launch-business-schools-for-good-film/. 17.02.2022.
11. Chirileasa, I.C. (2013). University and insertion environment – progresses in the knowledge of relationship between the two entities. *Analele Universitatii Din Oradea – Seria Geografie*, *2*, 321-332.

12. Creswell, J.W., Klassen, A.C., Clark, V.L.P., & Smith, K.C. (2013). Best Practices for Mixed Methods Research in the Health Sciences. *Qualitative Social Work.*, *12*(4), 541-545.
13. Crowne, K. A. (2013). Cultural exposure, emotional intelligence, and cultural intelligence: An exploratory study. *International Journal of Cross Cultural Management*, *13*(1), 5-22. https://doi.org/10.1177/1470595812452633.
14. Domański, T. (2017). Internacjonalizacja polskich uczelni wyższych Wprowadzenie. In: A. Stępień-Kuczyńska, A. Włodarska-Frykowska, & T. Domański (Eds.), *Internacjonalizacja polskich ośrodków politologicznych*. Wydawnictwo Uniwersytetu Łódzkiego. https://doi.org/10.18778/8088-741-1.05.
15. Earley, C., & Ang, S. (2003). *Cultural Intelligence: Individual Interactions Across Cultures*. Stanford: Stanford University Press.
16. Eisenberg, J., Lee, H.J., Brück, F., Brenner, B., Claes, M.T., Mironski, J., & Bell, R. (2013). Can business schools make students culturally competent? Effects of cross-cultural management courses on cultural intelligence. *Academy of Management Learning and Education*, *12*(4), 603-621. https://doi.org/10.5465/amle.2012.0022.
17. Engle, R.L., & Crowne, K.A. (2014). The impact of international experience on cultural intelligence: an application of contact theory in a structured short-term programme. *Human Resource Development International*, *17*(1), 30-46. https://doi.org/10.1080/13678868.2013.856206.
18. Engle, R.L., & Nehrt, C.C. (2012). Antecedents of Cultural Intelligence: The Role of Risk, Control, and Openness in France and the United States. *Journal of Management Policy and Practice*, *13*(5), 35-47.
19. Francis, A. (1993). *Facing the Future: The Internationalization of Post-Secondary Institutions in British Columbia. Task Force Report.* Vancouver. Retrieved from https://eric.ed.gov/?id=ED377759.
20. Golubieva, T., Tutko, M., & Tutko, M. (2016). Internationalization in Polish and Ukrainian higher education : a comparative analysis. *Studia Ekonomiczne*, *269*, 87-98.
21. Harrison, N. (2012). Investigating the impact of personality and early life experiences on intercultural interaction in internationalised universities. *International Journal of Intercultural Relations*, *36*, 224-237. https://doi.org/10.1016/j.ijintrel.2011.03.007.
22. Hudzik, J.K. (2013). Changing paradigm and practice for higher education internationalisation. In: H. de Wit (Ed.), *An Introduction to Higher Education Internationalisation* (pp. 47-60). Milan: Vita e Pensiero. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.905.8413&rep=rep1&type=pdf.
23. Kolano, A., & Olszewski, J. (2011). Poziom inteligencji kulturowej a jego związek z doświadczeniem międzynarodowym oraz oceną doświadczeń z innymi kulturami. *Przedsiębiorczość i Zarządzanie*, *12, (z. 4*, Studia z zarządzania międzykulturowego), 52-69.
24. Le, H., Jiang, Z., & Nielsen, I. (2018). Cognitive Cultural Intelligence and Life Satisfaction

of Migrant Workers: The Roles of Career Engagement and Social Injustice. *Social Indicators Research*, *139*(1), 237-257. https://doi.org/10.1007/s11205-016-1393-3.

25. Locke, W., & Kim, T. (2010). *Transnational academic mobility and the academic profession.* Retrieved from Centre for Higher Education Research and Information. London: The Open University, https://oro.open.ac.uk/.
26. MacNab, B.R. (2012). An experiential approach to cultural intelligence education. *Journal of Management Education*, *36*(1), 66-94. https://doi.org/10.1177/1052562911412587.
27. Mahasneh, A.M., Gazo, A.M., & Al-Adamat, O.A. (2019). Cultural intelligence of the Jordan teachers and university students from the Hashemite University: Comparative study. *European Journal of Contemporary Education*, *8*(2), 303-314. https://doi.org/10.13187/ejced.2019.2.303.
28. Maliszewski, T. (2015). *Jak wykreować sukces uczelni. Budowanie przewagi konkurencyjnej na rynku edukacyjnym*. Warszawa: Oficyna a Wolters Kluwer business.
29. MNISW. (2015). Program Umiędzynarodowienia Szkolnictwa Wyższego. Retrieved from https://www.bip.nauka.gov.pl/komunikaty-rzecznika-prasowego-mnisw/program-umiedzynarodowienia-szkolnictwa-wyzszego.html, 15.04.2021.
30. Ng, K.-Y., Van Dyne, L., & Ang, S. (2012). Cultural intelligence: A review, reflections, and recommendations for future research. *Conducting Multinational Research: Applying Organizational Psychology in the Workplace*, *October*, 29-58. https://doi.org/10.1037/13743-002.
31. Pabian, A., & Pabian, B. (2019). *Wielokulturowość w szkolnictwie wyższym. Zarządzanie i komunikacja z cudzoziemcami z perspektywy różnic kulturowych*. Warszawa: PWN SA.
32. Pabian, A., & Pabian, B. (2012). Internacjonalizacja polskich uczelni w aspekcie różnic kulturowych. *Nauka i Szkolnictwo Wyższe*, *2(40),* 117-124. Retrieved from https://pressto.amu.edu.pl/index.php/nsw/article/view/3295.
33. Perspektywy (2021). Ranking Szkół Wyższych Perspektywy 2020. Retrieved from https://ranking.perspektywy.pl/2020/ranking/ranking-uczelni-akademickich/types/uczelnie-ekonomiczne, 12.05.2021.
34. Piwowarczyk, A.J. (2016). Istota i znaczenie inteligencji kulturowej w kontekście kształcenia uniwersyteckiego. *E-Mentor*, *1*(63), 1-14. https://doi.org/https://doi.org/10.15219/em63.1225.
35. Plum, E. (2007). Cultural Intelligence - A concept for bridging and benefiting from cultural differences. Retrieved from https://kulturelintelligens.dk/Cultural_Intelligence_Plum.pdf, 28.03.2021.
36. Popowska, M. (2016). Internacjonalizacja szkolnictwa wyższego – uwarunkowania i przejawy w świetle faktów i liczb. *Horyzonty Wychowania*, *15*(35), 131-154. https://doi.org/10.17399/HW.2016.153507.
37. Przytuła, S. (2019a). Ekspatriacja akademicka jako przejaw internacjonalizacji uczelni. *Przegląd Organizacji*, *10*, 18-24. Retrieved from https://www.researchgate.net/publication/

339441201_Ekspatriacja_akademicka_jako_przejaw_internacjonalizacji_uczelni.

38. Przytuła, S. (2019b). Internacjonalizacja szkolnictwa wyższego - implikacje dla polskiej nauki. In: Ł. Sułkowski & R. Seliga (Eds.), *Internacjonalizacja i marketing Uniwersytetów* (pp. 295-321). Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
39. Qiang, Z. (2003). Internationalization of Higher Education: towards a conceptual framework. *Policy Futures in Education, vol. 1*. Retrieved from https://www.researchgate.net/publication/225083424_Internationalization_of_Higher_Education_Towards_a_Conceptual_Framework.
40. Ramis, M., Krastiņa, L., & Ramis Salas, M. (2010). *Cultural Intelligence in the School*. *15*(2), 239-252. Retrieved from www.ehu.es/revista-psicodidactica.
41. Ryan, J.M. (2005). Improving teaching and learning practices for international students: implications for curriculum, pedagogy and assessment. In: J. Carroll & J. Ryan (Eds.), *Teaching International Students: Improving Learning For All* (pp. 92-100). London: Routledge. Retrieved from https://research.monash.edu/en/publications/improving-teaching-and-learning-practices-for-international-stude.
42. Sá, M.J., & Serpa, S. (2020). Cultural dimension in internationalization of the curriculum in higher education. *Education Sciences*, *10*(12), 1-11. https://doi.org/10.3390/educsci10120375.
43. Sejm (2018). Ustawa z dnia 20 lipca 2018 r. Prawo o szkolnictwie wyższym i nauce. Retrieved from http://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20180001668/U/D20181668Lj.pdf, 10.04.2021.
44. Suharli, Supriatna, N., Maryani, E., & Komalasari, K. (2019). *Profile Of Teacher's Strategy In Improving Student's Cultural Intelligence*. *323* (ICoSSCE 2018), 95-99. https://doi.org/10.2991/icossce-icsmc-18.2019.18.
45. Suharti, L., Handoko, Y.A., & Huruta, A.D. (2019). Linking Cultural Intelligence and Adaptive Performance: Do Intercultural Interactions and Host University Support™ Play Important Roles? *Business, Management and Education*, *17*(0), 36-48. https://doi.org/10.3846/bme.2019.8831.
46. Teekens, H. (2003). The Requirement to Develop Specific Skills for Teaching in an Intercultural Setting. *Journal of Studies in International Education*, *7*(1), 108-119. https://doi.org/10.1177/1028315302250192.
47. Tharapos, M.A. (2015). *Cultural intelligence in the transnational education classroom: The case of Australian accounting academics*. School of Accounting at RMIT University.
48. Thomas, D.C., & Inkson, K. (2009). *Cultural Intelligence: Living and Working Globally*. San Francisco: Berrett-Koehler Publishers.
49. Upton, S., & Butters, L. (2019). The importance of developing cultural intelligence. Retrieved from https://www.universityworldnews.com/post.php?story=20191017135800899, 30.03.2021.

50. Ward, C., & Fischer, R. (2008). Personality, cultural intelligence & cross-cultural adaptation: A test of the mediation hypothesis. In: S Ang & L. Van Dyne (Eds.), *Handbook of Cultural Intelligence: Theory, Measurement, and Applications* (pp. 159-173). Armonk: M.E. Sharpe, Inc.
51. Zelenková, A., & Hanesová, D. (2019). Intercultural competence of university teachers: a challenge of internationalization. *Journal of Language and Cultural Education*, *7*(1), 1-18. https://doi.org/10.2478/jolace-2019-0001.

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# WELDING OF 690 QL STEEL FOR THE CONSTRUCTION OF VEHICLES AND ANTENNA ELEMENTS

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**Purpose:** The novelty and the aim of the article is to check the possibility of welding high-strength steels with a mixture containing 7000 ppm of nitrogen.
**Design/methodology/approach**: A new welding material and method have been developed in order to obtain a high-quality joint for automotive industry and for antenna holders and towers. The properties of the joint were checked by NDT (Non Destructive test) tests and the strength and fatigue were tested.
**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 MIG/MAG welding process.
**Practical implications:** The proposed innovation will not cause problems in the production process. Only the innovate shielding gas with micro additives will be modified without affecting the technological process, management and economic aspects.
**Social implications:** Modifying the welding method will not affect the environment and production management methods.
**Originality/value:** It is to propose a new solution with its scientific justification. The article is addressed to manufacturers of high-strength steel for automotive industry and to manufacturers of antenna components and instrumentation.

**Keywords:** welding, S690 QL, automotive, antenna, shielding gas mixtures.

**Category of the paper:** Research paper.

## 1. Introduction

The paper presents the results of tests leading to the selection of the correct MIG/MAG welding parameters of a thin-walled structure made of S690 QL high-strength steel (HSS). These steels are treated as a new material in the construction of means of transport. The HSS and AHSS (advanced high-strength steel) steels can be used for car bodies, truck frames,

and for elements of mobile platforms (Fig. 1). Other applications in the automotive and other industrial sectors are also possible.

**Figure1.** Tanker truck with elements of HHS steel (own study).

HSS steels are especially very suitable for antenna holders and towers due to their very high strength (Jaewson et al., 2011; Darabi et al., 2016; Hadryś, 2015). The weldability of this steel is still not well recognized (Golański et al., 2018, pp. 53-63; Skowrońska et al., 2017, pp. 104-111).

A major difficulty when welding 690 QL steel is the presence of a martensitic structure, which clearly makes it difficult to make the correct joint.

In order to get good weld, it is necessary to carefully determine all welding parameters.

The most important of them are (Silva et al., 2019; Krupicz et al., 2020):

- welding current,
- arc voltage,
- welding speed,
- beveling method,
- type of electrode wires,
- composition of gas mixtures,
- pre-heating temperature.

Welding of S690 QL steel is even more complicated compared to low-alloy steel due to the higher carbon and titanium content to strengthen the base material (Fydrych, Łabanowski et al., 2013); Shwachko et al., 2000). Preheating is recommended for good welding of HSS and AHSS steels (Szymczak, 2020). Recently, a method of producing gas mixtures with a very low content of the second component, even up to 2000 ppm, has been developed. The novelty and the aim of the article is to check the possibility of welding high-strength steels with a mixture containing 7000 ppm of nitrogen. It can be assumed that such a mixture will provide greater strength of

the welded joint due to the increase in nitrogen content in the weld metal, which will translate into increased nitride and carbon-nitride precipitates.

## 2. Materials

For MAG welding of S690 QL steel with a thickness of 1.8 mm, the UNION X90 wire (EN ISO 16834-AG 89 6 M21 Mn4Ni2CrMo) was used and a mixture argon and oxygen. In the welding process, it was decided to check the need for drying preheating to a temperature of 90°C.

**Table 1.**
*Tensile strength of steel S690 QL*

| YS MPa | UTS, MPa | A5, % |
|---|---|---|
| 690 | 970 | 14 |

Table 1 shows the mechanical properties of the S690 QL steel used in the construction of various means of transport.

These good mechanical properties result from an interestingly selected chemical composition, where the very high content of titanium and boron deserves attention, which clearly strengthens the material (Table 2).

**Table 2.**
*Chemical composition of S690 QL [6]*

| Steel | C | Si | Mn | P | S | Al | Cr | Cu | Mo | Nb | Ni | Ti | V | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S690 QL | 0,21 | 0,8 | 1,7 | 0,025 | 0,015 | 0,009 | 1,55 | 0,5 | 0,7 | 0,06 | 2,1 | 0,05 | 0,12 | 0,005 |

Chemical composition of steel is rather similar with electrode wire composition (Table 3).

**Table 3.**
*Wire UNION X90 – chemical composition [10]*

| UNION | C% | Si% | Mn% | P% | Cr% | Mo% | Ni% | Ti% |
|---|---|---|---|---|---|---|---|---|
| X90 | 0,10 | 0,8 | 1,8 | 0,010 | 0,35 | 0.6 | 2.3 | 0,005 |

Before starting to make joints from sheets with a thickness of t = 1.8 mm, no chamfering was performed. The distance between the sheets and the threshold was 0.5 mm.

The welding parameters were as follows:

- diameter of the electrode wire: 1 mm,
- arc voltage: 19.5 V,
- welding current: 114 A,
- welding speed: was 335 mm/min,

- shielding gas flow: 14 l/min
- the nature of the weld: single-pass.

The workshop is presented in Fig. 2.

**Figure 2.** View on the MAG welding workshop (own study).

The joints were made with a drying pre-heating to the temperature of 90° C and without pre-heating. The shielding gas was changed twice in the MIG / MAG welding process.

## 3. Methods

After MAG welding, standard non-destructive testing (NDT) and destructive tests of the joints was carried out.

NDT tests were based on:

- VT – visual examination with an eye armed with a magnifying glass at 3 × magnification – the tests were carried out in accordance with the requirements of PN-EN ISO 17638, evaluation criteria according to EN ISO 5817.
- MT – magnetic particle testing – the tests were carried out in accordance with the PN-EN ISO 17638 standard, the tests were assessed in accordance with EN ISO 5817, with a magnetic flaw detector test device type REM-230.

The analysis of the obtained results of non-destructive tests allowed to select joints for destructive tests, which consisted of the temporary tensile strength tests. The samples were also structurally examined using a light microscope (LM). The tests were carried out in accordance with the PN-EN ISO 9016 2021 standard. Amount of nitrogen content in the weld metal was performed on the LECO ONH836 analyzer. A bending test was performed in accordance with PN-EN ISO 7438 standard.

## 4. Results and discussion

The joints were made using two different shielding gases with slightly different chemical compositions. The first shielding gas was argon and the second was an argon mixture containing only 7,000 ppm nitrogen. The joints were made in two ways: without preheating and with preheating to the temperature of 90° C. The results of macroscopic visual tests carried out with the naked eye and the magnetic-powder tests of the joints made with the use of various sheath mixtures are presented in Table 4. It was found that for proper welding of 1.8 mm thick sheets of S690 QL steel, preheating before welding is recommended.

**Table 4.**
*NDT results*

| Type of shielding gas (mixture) | Welding without pre-heating | Welding without pre-heating up to 90°C |
|---|---|---|
| Ar | Cracks in weld | No cracks |
| Ar + 7,000 ppm $N_2$ | Cracs in weld | No cracks |

The preheating temperature at the level of 90°C was treated to be correct, as no welding defects and incompatibilities were observed in joints. It was additionally noted that the shielding gas mixture Ar +7,000 ppm $N_2$ allows for obtaining a correct joint, comparable to a joint made in a pure argon shield.

The next stage of the research was to compare the nitrogen content in the weld metal, which was performed on the LECO ONH836 analyzer. The test results are presented in Table 5.

The table data shows that after welding the joint made of S690 QL steel in a pure argon shield, the weld metal was obtained with a lower nitrogen content, at the level of 55 ppm. On the other hand, the use of a shielding gas containing 7,000 ppm of nitrogen allowed for a slight increase in the nitrogen content in the weld metal to the level of 60 ppm. This translated into the metallographic structure of the weld, which was analyzed in the next stage.

For further destructive tests (structure and mechanical properties), only joints made with preheating of 90°C were taken into account. The dominant structure was martensite, small amount of ferrite and non-metallic inclusions.

**Table 5.**
*Nitrogen in weld metal deposit (WMD)*

| Type of shielding gas (mixture) | Nitrogen in WMD, ppm |
|---|---|
| Ar | 55 |
| Ar + 7,000 ppm $N_2$ | 60 |

Main observed precipitations included mainly oxides (especially MnO and TiO), carbides (mainly TiC, NbC) carbonitrides and nitrides (mainly TiN). In a joint containing 60 ppm nitrogen (table 5), more amount of TiN nitrides were observed than in a joint containing 55 ppm nitrogen. It is very important, because nitrides strengthens the joint. The next stage of the research was to check the mechanical properties. Table 6 shows the immediate tensile strength of joints (UTS) made in various sheathing compounds.

**Table 6.**
*Tensile strength of joints*

| Type of shielding gas (mixture) | UTS [MPa] |
|---|---|
| Ar | 567 |
| Ar + 7,000 ppm $N_2$ | 612 |

The table data shows that it is possible to obtain high tensile strength of the joint (at the level of 600 MPa). This result was obtained in only one case when 7000 ppm $N_2$ was added to argon. The strength of the joint made in the argon shield is significantly lower. A blend containing 7,000 ppm nitrogen was found to be more preferable. This fact can be explained by the fact that nitrogen has a high affinity for titanium and forms TiN nitrides, as well as other non-metallic inclusions such as Ti (N, C) carbonitrides, the size and distribution of which is strongly related to the nitrogen content in the weld metal and determines the strengthening weld metal.

The last stage of the research was the performance of bending tests of the examined joints, which were made from the side of the ridge and from the side of the face. The test results are presented in Table 7.

**Table 7.**
*Bending test results*

| Type of shielding gas (mixture) | Face side | Ridge side |
|---|---|---|
| Ar | No cracks | No cracks |
| Ar + 7,000 ppm $N_2$ | No cracks | No cracks |

It was not possible to ensure continuity in the joint, both from the side and the face, so now they are getting the benefits of having good plastic properties.

## 5. Summary

In the paper, it was decided to test in an innovative way the influence of the micro nitrogen content added to the argon shielding mixture in the MIG / MAG process when welding high-strength S690 QL steel. For this purpose, joints were made in an argon shield and in a gas mixture containing argon and 7,000 ppm $N_2$. At the same time, the influence of the application of preheating at the level of 90°C was checked. In further tests, joints made only with the use of preheating were tested. Tensile strength and bending tests were performer.

The metallographic structure and nitrogen content in the tested welds were assessed. It has been shown that the gas mixture containing the micro nitrogen content allows to increase the mechanical properties of the joint. Making gas mixtures with micro-additives may contribute to revolutionizing the current knowledge of welding, which can be used in the construction of many means of transport and various antenna holders and towers.

The following conclusions were made:

1. Preheat (90°C) is recommended prior to MIG/MAG welding of S690 QL.
2. It is possible to obtain the tensile strength of a joint made of S690 QL steel at the level of 600 MPa.
3. In the tested welds, it was observed that the dominant phase is martensite, which is not conducive to good weldability.
4. On the basis of all the tests performed, it can be concluded that the Ar + 7,000 ppm $N_2$ gas mixture is more appropriate for the welding of S690 QL steel in the MIG/MAG process.

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## 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. Fydrych, D., Łabanowski, J., Rogalski, G. (2013). Weldability of high strength steels in wet welding conditions. *Polish Maritime Research*, *Vol. 20, no 2/78,* 67-73. https://doi.org/10.2478/pomr-2013-0018.
3. 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.
4. 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.
5. Jaewson, L., Kamran, A., Jwo, P. (2011). Modeling of failure mode of laser welds in lap-shear speciments of HSLA steel sheets. *Engineering Fracture Mechanics*, *Vol. 1,* pp 347-396.
6. 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
7. Shwachko, V. (2000). Cold cracking of structural steel weldments as reversible hydrogen embrittlement effect. *International Journal of Hydrogen Energy, no. 25.*
8. 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, Nr 3,* PL ISSN 0033-2364, 23-30.
9. 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.
10. 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 (Basel), Vol. 13, 22*, pp. 5249-5259. doi: 10.3390/ma13225249. PMID: 33233651; PMCID: PMC7699769.

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# PROJECT MANAGEMENT STANDARDS

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**Purpose:** The aim of the paper is to analyze the main project management standards and topics connected with quality management in projects.
**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 considerations presented in the publication made it possible to analyses the most important aspects of project management in the context of quality management. The publication concentrate on problems connected with various aspects of project management. The paper says about ISO and non ISO related projects trying to characterize and compare various types of standards and approaches. There is a spatial attention towards analysis of quality management in projects. Especially problems connected with risk in process which are important part of quality management and also play important role in ISO 9001 quality management standards. Paper also contains some analysis connected with the impact of COVID-19 pandemic on the project management and try to conclude main methods how to manage teams in project management in virtual environment.
**Originality/value**: Detailed analysis of all subjects related to the problems connected with project management in the conext of standards and quality management.

**Keywords:** project management, industrial management, ISO standards, quality management, project, Industry 4.0.

**Category of the paper:** literature review.

## 1. Introduction

In the times of Industry 4.0 implementation project management plays important role in improving the processes and effectiveness of the organizations (Drizd and Wolniak, 2021; Gajdzik and Wolniak, 2021, 2022; Grabowska et al., 2019, 2020, 2021). Consisting project goals they can be classified into two groups: industrial projects and developmental projects (Sułkowski and Wolniak, 2016, 2018; Tuthill, 2014; Wolniak and Sułkowski, 2015; Wolniak and Skotnicka-Zasadzień, 2014; Wolniak, 2011). The differences between them are

characterized in table 1. Industrial projects are also characterized as commercial projects are undertaken to provide goods and services for meeting the growing needs of the customer and providing attractive return to the stake holders. Development projects are undertaken to facilitate the promotion and acceleration of overall economic development (Introduction, 2021).

**Table 1.**
*Differences between industrial projects and developmental projects*

| Dimension | Industrial project | Developmental project |
|---|---|---|
| Scale of project | Limited | Large |
| Promoters | Entrepreneurs or corporates | Government, Public Sectors, NGOs |
| Investment | - | High |
| Gestation period | - | High |
| Profitability | High, Considered on IRR (Internal Rate of Return) | Modest, Considered on ERR (Economic Rate of Return) |
| Finance | Stringent debt equity norms | Operates on higher debt-equity norms |
| Source of fund | National stock markets and from domestic financial institutions | International organizations like World Bank, IMF,ADB,DFID and others mostly as loan, yet times providing for some grants |
| Interest rate and repayment period | Market rate and the repayment period is generally 7 to 10 years | Very low for borrowed funds and the repayment period extends up to 25 years and even beyond |

Source: (Introduction, 2021).

There are many project management standards on the market (Wolniak, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2022). The aim of the paper is to analyze the main project management standards and topics connected with quality management in projects.

## 2. ISO related standards

To manage help in the process of managing project there are some special ISO standards (ISO 21500:2020; ISO 21504:2015):

- ISO 21500:2020 Guidance on project management.
- ISO 21504:2015 Project, programme and portfolio management – Guidance on portfolio management.

ISO 21500:2012 provides guidance for project management and can be used by any type of organization, including public, private or community organizations, and for any type of project, irrespective of complexity, size or duration. ISO 21500:2020 provides high-level description of concepts and processes that are considered to form good practice in project management (Billows, 2014; Gębczynska and Wolniak, 2018). Projects are placed in the context of programmes and project portfolios, however, ISO 21500:2012 does not provide detailed guidance on the management of programmes and project portfolios (Lewis, 2011; Stawiarska

et al., 2020; Stawiarska et al., 2021). Topics pertaining to general management are addressed only within the context of project management (ISO 21500:2020).

ISO 21504:2015 provides guidance on the principles of project and programme portfolio management. ISO 21504:2015 is relevant to any type of organization including public or private and any size organization or sector (Czerwinska-Lubszczyk et al., 2022). The guidance presented in ISO 21504:2015 is intended to be adapted to suit the specific environment of the project and programme portfolio.

Also there are some others additional ISO standards and documents in progress:

- ISO/CD 21503 Guidance on programme management.
- ISO/DIS 21505.2 Project, programme and portfolio management – Guidance on governance.
- ISO/AWI TR 21506 Vocabulary for Project, Programme and Portfolio Management.
- ISO/AWI 21508 Earned Value Management.
- ISO/AWI 21510 Project manager competencies.
- ISO/AWI 21511 Work Breakdown Structure (WBS).

## 3. Non ISO related standards

Also in project management there are many non ISO standard which are very widespread and removed:

- ANSI/PMI Standard PMBOK® Guide.
- PRINCE2 ™ Project Management Methodology.
- IPMA Competence Baseline ICB.

In table 2 there is a short characteristic of mentioned standards.

**Table 2.**
*Non ISO related project management standard*

| Standard | Characteristic |
|---|---|
| ANSI/PMI Standard PMBOK® | The PMBOK Guide is intended to be a "subset of the project management body of knowledge that is generally recognized as a good practice. 'Generally recognized' means the knowledge and practices described are applicable to most projects most of the time and there is a consensus about their value and usefulness. 'Good practice' means there is a general agreement that the application of the knowledge, skills, tools, and techniques can enhance the chance of success over many projects."<br>A Guide to the Project Management Body of Knowledge — Sixth Edition provides guidelines for managing individual projects and defines project management related concepts. It also describes the project management life cycle and its related processes, as well as the project life cycle. and for the first time it includes an "Agile Practice Guide". |

Cont. table 2.

| | |
|---|---|
| PRINCE2 ™ Project Management Methodology | PRINCE2 provides an integrated framework of processes with activities and referenced tools and techniques to be performed for the proper management of a project from its start to the end. It details what needs to be done, by whom , and when. Also, it includes an integrated and inter-linked set of practical templates as the documented support for project management deliverable products. A methodology is generally prescriptive, and it deals with all project management organization roles but does not cover interpersonal skills. |
| IPMA Competence Baseline ICB | The IPMA Individual Competence Baseline (IPMA ICB®) is the global standard for individual competence in project, programme and portfolio management. The IPMA ICB supports the development of individual competence through the presentation of a complete inventory of competence elements across projects, programmes and portfolios. IPMA's goals with IPMA ICB are simple – to enrich and improve the individual's competence in project, portfolio and programme management and to provide an inventory of competences that, if fully realized, represent complete mastery of these management domains. Projects, programmes and portfolios are at the forefront of change in the world today. Projects drive the development of new products and services, investments and expansion, capabilities, the implementation of new strategies and a new generation of infrastructure. We recognise that projects begin and end with people and that competent execution is at the heart of every successful project. |

Source: Own work based on: (Virtual hires, 2014; Project Management, 2013).

## 4. Quality management in projects

Very important part of the project is it's quality management. There is a special ISO specification (ISO 10006:2018) dedicated to quality management on projects (Kordel and Wolniak, 2021; Kwiotkowska et al., 2021, 2022; Orzeł and Wolniak, 2022; Ponomarenko et al., 2016). It is applicable to organizations working on projects of varying complexity, small or large, of short or long duration, being an individual project to being part of a programme or portfolio of projects, in different environments, and irrespective of the kind of product/service or process involved, with the intention of satisfying project interested parties by introducing quality management in projects (Juran, 1992; Kerzner, 2019; Wolniak, 2021). This can necessitate some tailoring of the guidance to suit a particular project. This document addresses the concepts of both "quality management in projects" and "quality management systems in projects" (ISO 10006:2018; Wolniak and Sułkowski, 2015; Wolniak and Grebski, 2018; Wolniak et al., 2019; Wolniak and Hąbek, 2015, 2016; Wolniak and Jonek-Kowalska, 2021, 2022; Wolniak et al., 2020).

In every project we should use risk management methods to analyses and prioritize risk. We can define risk as following (We, 2020):

- A risk is a potentiality that, if it materializes, can have an impact on one or multiple objectives in a negative or positive manner, in the form of resources, performance, quality, or timeline. This differs from a problem or issue, which is something that has already occurred and is already having an impact.

- An opportunity is a positive risk, which occurrence is favorable to one or multiple project objectives.
- A threat is a negative risk, which occurrence can endanger one or more of the project objectives.

The likehood of most events is influenced by both exogenous as well as endogenous factors. In general sources of exogenous uncertainty include (Klastorin, 2004):

- changes in technology,
- government regulations or policies,
- unexpected losses due to deterioration, theft, etc.,
- market fluctuation in prices and suppliers,
- legal and contractual issues,
- natural hazards such as weather delays, earthquakes.

Endogenous risk include (Klastorin, 2004):

- variations in component performance,
- inaccurate or incomplete data,
- personnel issues,
- impacts of other projects,
- cash flow,
- inability to accurately forecast due to lack of data, experience or foresight.

We can divide risk into two types (Resiss, 1995):

- Qualitative risk – refers to the general type of risk that can be imagined and foreseen but can only be discussed in general terms. Sure, you can put some simple numbers to some of these risks but the mathematics is going to be dead simple.
- Quantitative risk – brings risk and critical path analysis together along with mathematics, probabilities and Monte Carlo techniques. Here you must start off with a critical path diagram of the project created within the bowels of a project planning software package. These packages bear the tag ‘project management software’ but it is just not true—they are only planning tools.

To analyze risk project manager should calculate risk score which is determined by the product of the risk’s probability of occurrence and magnitude of the impact (Wolniak and Skotnicka, 2011; Wolniak and Skotnicka-Zasadzień, 2008, 2010, 2018, 2022; Wolniak et al., 2019; Wolniak and Sułkowski, 2016). Risk management is an organized, systematic decision-making process for efficiently planning, assessing, handling, monitoring, controlling and documenting risk in order to increase likehood of achieving projects goals and decrease the likehood that a risk becomes a future problem (Smart, 2021; Hyttinen, 2017; Harris et al., 2020). The risk management plan focus on the relationship between risk and their characteristics, such as risk exposure and project importance to the organization and stakeholders. Components of a risk management plan should include the following points (We, 2020; Zwikael and Smyrk, 2019):

- Risk strategy. Overall plan for managing threats and opportunities. This often reflects the organization, the project, or stakeholders' risk culture and appetite and the risk exposure of the project.
- Approach. Methods, processes, and tools for identifying, analyzing, and responding to risks. It can also include the extent of planning and analysis, such as trigger point analysis, contingency planning, sensitivity analysis, and so on, to be applied on the project.
- Roles and responsibilities. Outline of who will lead, support, and coordinate risk management activities. Key risk owners are also identified and appointed. Risk owners are project stakeholders who are assigned to be the primary person responsible for overseeing and managing the assigned risks.
- Financial. Financial funding to buffer the project budget in the event of negative risks becoming a reality. As risks are "probabilities" that may not happen, securing sufficient funding can be difficult.
- Scheduling. Coordination of resources at the optimal time for identifying, evaluating, prioritizing, and responding to risks.
- Tools. How to capture risks and maintain an active register, what risk category to use, and how to track and record progress. In some organizations, risk audit is an important activity.
- Special. How to deal with risks that are not yet known, also called unknown–unknowns.

Today, especially in pandemic COVID-19 era, we often works in team projects in virtual environment (Stecuła and Wolniak, 2022). It is very important to adjust the team and it's functioning to such situation. Project managers can leverage the strength and talents of multiple individuals that match the project plan, strategy and desired outcomes (Jonek-Kowalska and Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022). Managing virtual team can be rewarding as well challenging. Virtualk Hires identified nine main guidelines that can be applied when selecting and managing individuals and teams in virtual environment (Virtual, 2014):

1. Perform a project evaluation. Project leaders must be knowledgeable about goals, tactics, and deliverables if they are to communicate effectively with prospective team members.
2. Determine the skill sets needed by team members. Match the skills of team members to the delegated tasks and mutually reach consensus on assignments. Leveraging individual strengths promotes measurable outcomes.
3. Identify and anticipate obstacles. Knowing what has been attempted previously to resolve a problem or opportunity can only benefit the present outcomes. Conversely, disregarding this information can mean a loss for the plan, as the strategy may actually require only a minor redesign or assignment of a team member with matching skills and competencies.

4. Constantly engage members and encourage bidirectional communication. Contact with virtual team members often is employed to verify needs for supervision and encouragement. Likewise, the team member can communicate successes and challenges encountered that require intervention.
5. Establish a timeline and milestones. Identify expectations and the schedule needed to move the project toward completion. Monitor progress at designated intervals. Share accomplishments with all virtual members and stakeholders.
6. Ensure individual team member accountability. Recognizing the importance of each individual member's investment in achieving the critical priorities of a specific project and their buy-in to the larger institutional performance is a critical success factor.
7. Be cognizant of cultural differences. Being aware and sensitive to the diversity of virtual team members is important to avoid conflicts and delays in completing assigned tasks.
8. Manage conflict and difficult team members. Avoiding a conflict will only perpetuate the issue and result in inefficiency of the individual and team function. Although crucial conversations may be difficult on a personal level, they are valuable for resolution of identified issues that may create project paralysis.
9. Provide education and training. Just-in-time or accelerated learning techniques may be required to assure all team members are on the same page with respect to the project goal and strategies. Using practical application examples and techniques matched with evidence, flexibility, and innovative teaching strategies can strengthen project outcomes and create synergy among virtual team members.

Effective governance of the virtual team is the key to success (Hąbek and Wolniak, 2013, 2016; Jonek-Kowalska and Wolniak, 2021; Hys and Wolniak, 2018). Bad prepared organizational management structure, overlapping roles, problems with decision-making can prevent a project from achieving success and valuable outcomes.

Projects are largely led and performed by people, and this means that the conflict between them is likely to be. This phenomenon can impacts all projects professionals all over the world. In such a situation every project manager should have deep knowledge about conflict management (Martinelli and Milisevic, 2016). Project conflicts and their resolution have been found to have a high correlation with success. Conflicts have been found to deteriorate emotions and the general atmosphere of the project (Campbell, 2020; Denise, 2019). When conflicts are well managed, the benefits include greater team collaboration and discussion. Conflicts in projects can be categorized into some typical types which we characterized in take table 3.

**Table 3.**
*Type of project conflicts*

| Conflict type | Characteristic |
|---|---|
| Conflicts over priorities | These are conflicts that occur over the sequence of activities and tasks, and it can occur at multiple levels – within project teams, between project teams, and with other groups. |
| Conflict over administrative procedures | These are conflicts over how the project is to be managed. This includes reporting relationships, roles and responsibilities, execution plan, and procedures for administrative support. |
| Conflict over technical options and performance trade-offs | In projects where technology is a consideration, conflicts may arise over technical issues, option analysis, performance specification, and trade-off decisions. |
| Conflict over manpower resources | These are staffing conflicts that can occur, especially on matrix organizations. |
| Conflict over cost | These are conflicts involving estimation of overall or parts of projects, allocation of budget to different parties, and willingness of different parties to share the cost. |
| Conflict over schedule | These conflicts involve timing, sequencing, and scheduling of project-related tasks. |
| Personality conflict | These are interpersonal conflicts that develop around personal differences rather on "technical" issues. These are typically emotion-based and when unresolved can spiral into major firestorms. |

Source: (We, 2019).

Using project management in organization needs to use many tools and techniques adjusted to particular aspects of project management (Klastorin, 2004; Kerzner, 2015). In the table 4 we put main tools and technique using in project management dividing them into project area's (Gorod at al., 2020).

**Table 4.**
*Division of project management tools and techniques according knowledge area's*

| Knowledge area | Tools and techniques |
|---|---|
| Integration management | Project selection, project methodology, project charters, stakeholder analysis, work authorization process |
| Scope management | Project scope statements, record documentation, scope change analysis |
| Time management | Pivot and pie charts, Gantt charts, project network diagrams, PERT, milestone evaluation, Critical path analysis |
| Quality management | Ishikawa diagrams, quality audits, quality control charts and procedures, six sigma, TQM |
| Cost management | Return on investment analysis, payback analysis, business cases, case studies, project portfolio management and control, cost estimation software, financial reports |
| Communication management | Communication plan, project web sites, status reports, relationship control |
| Human resource management | Motivation and productivity techniques, conflict management, responsibility matrices, team contracts, resource histogram, intellectual capital management |
| Risk management | Risk plan, probability/impact matric risk ranking, Monte Carlo simulation |

Source: (Bakator et al., 2017).

## 5. Conclusion

The publication concentrate on problems connected with various aspects of project management. The paper says about ISO and non ISO related projects trying to characterize and compare various types of standards and approaches. There is a spatial attention towards analysis of quality management in projects. Especially problems connected with risk in process which are important part of quality management and also play important role in ISO 9001 quality management standards. Paper also contains some analysis connected with the impact of COVID-19 pandemic on the project management and try to conclude main methods how to manage teams in project management in virtual environment.

## References

1. Bakator, M., Petrović N., Terek E., Borić S., Ivetić N. (2017). *Improving project management with the ISO 21500:2012.* VII International Conference Industrial Engineering and Environmental Protection 2017 (IIZS 2017) October 12-13th, Zrenjanin, Serbia.
2. Billows, D. (2014). *Project plan template: How to create a project plan*. http://4pm.com/project-plan-template, 5.04.2022.
3. Campbell, A. (2020). *Agile: Essentials of Team and Project Management.* Manifesto for Agile Software Development, Wiley, London.
4. 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.
5. Denise, T. (2019). *The human factor in project management.* London: CRC Press.
6. 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.
7. Drozd, R., Wolniak, R. (2021). Systematic assessment of product quality. *Journal of Open Innovation: Technology, Market, and Complexity, 7(4),* 1-12.
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. Gębczyńska, A., Wolniak, R. (2018). *Process management level in local government.* Philadelphia: CreativeSpace.
15. Gorod ,A., Hallo, L., Ireland, V., Gunawan, I. (2020*). Evolving toolbox for complex project management.* Boca Raton: CRC Press Taylor & Francis Group.
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. Harris, J., Roussel, L., Dearman, C., Thomas, P. (2020). *Project planning and management. A guide for nurses and interprofessional teams.* Burlington: Jones & Barlett Learning.
20. 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.
21. 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.
22. 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.
23. Hąbek, P., Wolniak, R. (2016). Relationship between management practices and quality of CSR reports. *Procedia – Social and Behavioral Sciences*, *220*, 115-123.

24. Hys, K., Wolniak, R. (2018). Praktyki przedsiębiorstw przemysłu chemicznego w Polsce w zakresie CSR. *Przemysł Chemiczny*, *9,* 1000-1002.
25. Hyttinen, K. (2017). *Project management handbook.* Laurea University of Applied Sciences.
26. *Introduction to project management* (2021), https://www.manage.gov.in/studymaterial/PM.pdf, 5.09.2022.
27. ISO 10006:2018, Quality management systems – Guidelines for quality management in projects.
28. ISO 21500:2020 Guidance on project management.
29. ISO 21504:2015 Project, programme and portfolio management – Guidance on portfolio management.
30. Jonek-Kowalska, I., Wolniak, R. (2021). Economic opportunities for creating smart cities in Poland. Does wealth matter? *Cities*, *114*, 1-6.
31. 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.
32. 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.
33. 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.
34. Juran, J.M. (1992). *Juran on quality by design*. New York, NY: Simon and Schuster.
35. Kerzner, H. (2019). *Innovation Project Management: Methods, Case Studies, and Tools for Managing Innovation Projects.* New York: John Wiley & Sons.
36. Kerzner, H. (2015). Project management: a systems approach to planning, scheduling, and controlling. Hoboken, NJ: John Wiley & Sons.
37. Klastorin, T. (2004). *Project management. Tools and Trade-offs*. New York: Wiley.
38. 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.
39. 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.
40. 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.

41. Lewis, J.P. (2011). *Project planning, scheduling and control: The ultimate hands-on guide to bringing projects in on time and on budget*. New York, NY: McGraw-Hill.
42. Martinelli, R.J., Milosevic, D.Z. (2016). *Project Management ToolBox: Tools and Techniques for the Practicing Project Manager.* New York: Wiley.
43. 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.
44. 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.
45. Project Management Institute (2013). *A guide to project management body of knowledge (PMBOKguide)*. Newtown Square.
46. Reiss, G. (1995). *Project Management Demystified. Today's tools and techniques*. London: Spon Press.
47. Smart, Ch. (2021). *Solving for Project Risk Management.* Boston: McGraw-Hill.
48. Stawiarska, E., Szwajca, D., Matusek, M., Wolniak, R. (2020). *Wdrażanie rozwiązań przemysłu 4.0 w wybranych funkcjonalnych obszarach zarządzania przedsiębiorstw branży motoryzacyjnej: próba diagnozy.* Warszawa: CeDeWu.
49. Stawiarska, E., Szwajca, D., Matusek, 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.
50. Steculа, 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.
51. Steculа, 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.
52. Sułkowski, M., Wolniak, R. (2016). Przegląd stosowanych metod oceny skuteczności i efektywności organizacji zorientowanych na ciągłe doskonalenie. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarzadzanie*, *67*, 63-74.
53. Sułkowski, M., Wolniak, R. (2018). *Poziom wdrożenia instrumentów zarządzania jakością w przedsiębiorstwach branży obróbki metali.* Częstochowa: Oficyna Wydawnicza Stowarzyszenia Menedżerów Produkcji i Jakości.
54. Tuthill, J.M. (2014). *Practical project management for informatics! How to manage a project without losing your mind*. API Annual Conference, Chicago, IL.
55. *Virtual Hires, 15 tips for effectively mapping your virtual employee*. Retrieved from http://www.virtualhires.com/resources.cgi?file=15-tips-to-effectively-managing-your-virtual-employee, 2014, 5.09.2022.

56. We, T. (2020). *Optimizing project management.* Boca Raton: CRC Press Taylor & Francis Group.
57. Wolniak, R., Sułkowski, M. (2015). Motywy wdrażanie certyfikowanych Systemów Zarządzania Jakością. *Problemy Jakości, 9,* 4-9.
58. Wolniak, R, Skotnicka-Zasadzień, B. (2014). The use of value stream mapping to introduction of organizational innovation in industry. *Metalurgija*, *53(4),* 709-713.
59. Wolniak, R. (2011). *Parametryzacja kryteriów oceny poziomu dojrzałości systemu zarządzania jakością.* Gliwice: Wydawnictwo Politechniki Śląskiej.
60. Wolniak, R. (2013). A typology of organizational cultures in terms of improvement of the quality management. *Manager*, *17(1),* 7-21.
61. Wolniak, R. (2013). Projakościowa typologia kultur organizacyjnych. *Przegląd Organizacji*, *3,* 13-17.
62. Wolniak, R. (2014). Korzyści doskonalenia systemów zarządzania jakością opartych o wymagania normy ISO 9001:2009. *Problemy Jakości*, *3,* 20-25.
63. Wolniak, R. (2016). Kulturowe aspekty zarządzania jakością. *Etyka biznesu i zrównoważony rozwój. Interdyscyplinarne studia teoretyczno-empiryczne*, *1,* 109-122.
64. Wolniak, R. (2016). *Metoda QFD w zarządzaniu jakością. Teoria i praktyka*. Gliwice: Wydawnictwo Politechniki Śląskiej.
65. 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.
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 Ślaskiej. Seria Organizacja i Zarządzanie*, *116*, 203-214.
89. Wolniak, R., Grebski, M.E. (2018). Innovativeness and creativity as nature and nurture. *Zeszyty Naukowe Politechniki Ślaskiej. 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 Ślaskiej. Seria Organizacja i Zarządzanie*, *116*, 227-240.
91. 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.
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. 1*. 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 condition s 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. (2016). The reasons for the implementation of quality management systems in organizations. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie*, *92*, 443-455.
105. Zwikael, O., Smyrk, J.R. (2019). *Project Management: A Benefit Realisation Approach*. Geneva: Springer.

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# SUSTAINABLE ENGINEERING

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**Purpose:** The aim of the paper is to analyze the concept of sustainable engineering.
**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 sustainable engineering. Especially there is a presentation of main principles of sustainable engineering. In the case of each principle there is an description of those topic with the approaches and the analysis of its importance in industrial organization. The sustainability is an very important concept which can be used in in Industry 4.0 implementation. We should mention that efficient engineering organization should know how to link the sustainability and Industry 4.0 concepts. This can bring the market advantage due to new technology implementation and sustainable production from business and environmental point of view.
**Originality/value**: Detailed analysis of all subjects related to the problems connected with sustainable engineering principles.

**Keywords:** sustainability, sustainable engineering, Industry 4.0, production, engineering.

**Category of the paper:** literature review.

## 1. Introduction

Sustainable development is now a very broadly used concept in management and engineering. The term sustainable development was introduced in 1987 in the report published by Burtland Commission (Grabowska et al., 2019, 2020; Hąbek, Wolniak, 2013, 2016; Hys, Wolniak, 2018). The title of the report was "Our Common Future" and authors in it tried to link the issues of economic development and environmental stability (Wolniak, Sułkowski, 2015; Wolniak, Grebski, 2018; Wolniak et al., 2019; Wolniak, Hąbek, 2015, 2016; Wolniak Jonek-Kowalska, 2021). In report they defined Sustainable Development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 1987). And this was the mostly cited definition of sustainable development concept.

The aim of the paper is to analyze the concept of sustainable engineering.

## 2. Sustainable development dimensions

The concept of sustainability explores the relationship that exist between economic development, environmental quality and social equity (Wolniak, Jonek-Kowalska, 2022; Wolniak et al., 2019, 2020; Wolniak, Skotnicka, 2011; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2018, 2022; Wolniak, Sułkowski, 2016). Sustainable development has three main dimensions: economic, environmental and social. These are frequently referred to as the triple bottom line (Fig. 1), and are used to gauge the success of a particular development program or a project. The concept of triple bottom line was firstly used by John Elkington the founder of British consultancy called SustainAbility (Elkington, 1994).

We have three approaches to sustainability each based on emphasis on one of the mentioned dimensions. The description of them there is in table 1.

**Table 1.**
*Main dimensions of sustainable development*

| Dimension | Characteristic |
|---|---|
| The economic approach: Maximize income while maintaining constant or increasing stock of capital | The core idea of sustainability is that current decisions should not impair the prospects for maintaining or improving future living standards. This implies that our economic systems should be managed so that we can live off the dividends of our resources.<br>Sustainable economic growth means that real GNP per capita is increasing over time and the increase is not threatened by "feedback" from either biophysical impacts (pollution, resource degradation) or from social impacts.<br>Sustainable development means basing developmental and environmental policies on a comparison of costs and benefits and on careful economic analysis that will strengthen environmental protection and lead to rising and sustainable levels of welfare. |
| The ecological approach: Maintain the resilience and robustness of biological and physical systems. | Sustainable development is about maintenance of essential ecological processes and life support systems, the preservation of genetic diversity, and the sustainable utilization of species and ecosystems.<br>The term "sustainable development" suggests that the lessons of ecology can, and should be applied to economic processes. It encompasses the ideas in the World Conservation Strategy, providing an environmental rationale through which the claims of development to improve the quality of (all) life can be challenged and tested. |
| The socio-cultural approach: Maintain the stability of social and cultural systems. | Sustainable economic development is directly concerned with increasing the standard of living of the poor, which can be measured in terms of increased food, real income, education, health care, water supply, sanitation, and only indirectly concerned with economic growth at the aggregate. |

Source: Own work based on: (Rogers et al., 2008).

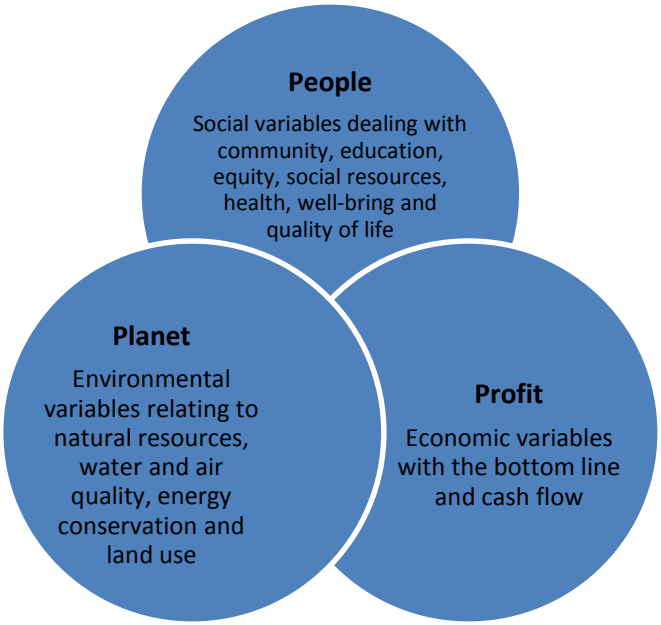


**Figure 1.** Interconnections of the elements of the triple bottom line concept. Source: (Dalibozhko, Krakovetskaya, 2018).

To implement the goals of sustainable development into a business practice we need to carefully implementation of this concept into the whole business, political and social environment. The indispensable part of it it's the big role of civil society. Civil society are association of citizen (outside their families, friends and business) entered into voluntarily to advance their interests, ideas and ideologies. From sustainable development point of view we can distinguish the following main roles of civil societies (Rogers et al., 2008):

- demand rights to life and health,
- demand access to land, water and other services,
- form user groups to manage common propriety resources sustainably,
- mobilize individual household and community resource groups for improving the environment,
- share information and resources with other groups about common environmental and political concerns,
- pressure industries to clean up, and hold business accountable,
- increase group empowerment,
- pressure governments and developers into taking seriously the rights and needs of marginalized people.

When we think about sustainability there is a spectrum of views about the concept (Fig. 2). At one end of spectrum are those who suggest that we should conserve at all costs, change the way we live and seek a reduction of economic growth as a means of reducing consumption (Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018; Grabowska et al., 2021). At the other end of spectrum are those who believe that necessity is

the mother of invention and that a "technical fix" will be invented which will remove the needs for such drastic measures to be taken (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021; Kwiotkowska et al., 2021, 2022).

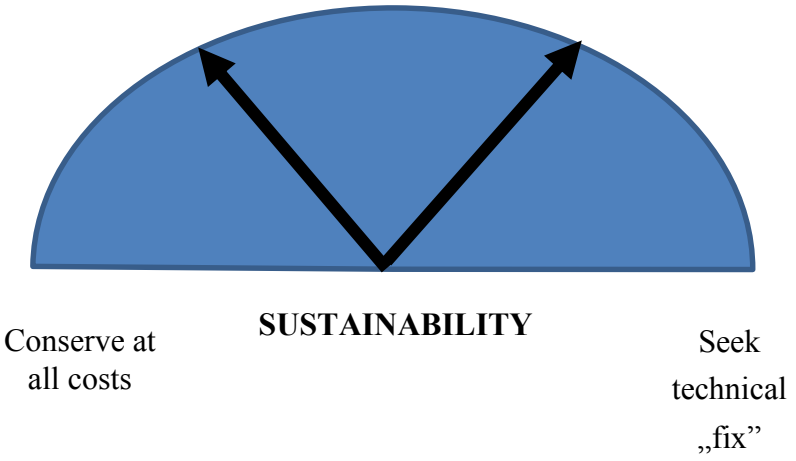


**Figure 2.** The spectrum of views on sustainability. Source: (Brandon and Lombardi, 2005).

## 3. Principles of sustainable engineering

If mankind is to achieve sustainable development, we should adopt it's patterns that reflect natural processes (Orzeł, Wolniak, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Steculа, Wolniak, 2022). The role of engineers in sustainable development is very important and can be illustrated by close-loop human ecosystem that mimics natural system. Engineers contribute to natural ecosystem to all their steeps (Engineers, 2002):

- By developing, processing and transporting natural resources in closed-loop systems, we can reduce waste and increase the efficient use of resources.
- Harvesting renewable resources such as water, fish and trees within the limits allowed by nature will ensure a continuing supply of resources for humans and natural ecosystems. Minimizing our use of non-renewable resources, such as petroleum and scarce minerals, and replacing them with environmentally friendly substitutes will also help extend the supply of natural resources.
- Processing natural resources efficiently and with little or no waste helps to preserve the earth's finite natural resources. We can further preserve resources by designing products and packaging for reuse and recycling, and we can protect resources through industrial processes and facilities that have minimal adverse environmental impacts throughout their full life-cycles.

- Transporting goods contributes heavily to pollution; to minimize these effects, we can transport resources and manufactured goods efficiently to consumers by pipelines, rivers, railways, roads, ships and airplanes using technologies that have minimal impacts on the surrounding land use and serve the needs of consumers with little waste.
- How we develop, process and transport resources can improve living standards in many ways. These include providing clean water, energy, housing and commercial buildings and streets and other forms of infrastructure; efficiently storing and distributing food; and meeting acceptable health standards, including high-quality waste management and treatment.
- To allow natural and built environments to be clean and unpolluted, we can reduce waste throughout this ecosystem cycle by continually recycling and recovering residual byproducts of resource development, industrial processing and meeting consumer needs. Some waste in the system is inevitable but should be in forms that have minimal long-term impacts on the natural environment. The impacts from residual waste can be offset by continuing programs to clean up and reuse old waste sites, along with other forms of environmental restoration.
- The effects of developing energy sources on the atmosphere, earth and water can be reduced by more efficient use of power and by production from non-fossil sources.

For example the engineer role is very important in supply chain in the consumption goods production and logistics (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2014; Wolniak, 2011, 2013, 2014, 2016). They should concentrate on improvement of the processes to be more eco-friendly. They should considered at each stage in production process of all good and services following points (Azapagic et al., 2005):

- reducing the material requirements (total mass consumed),
- reducing the energy intensity (energy consumed during every phase of production),
- reducing toxic dispersion (release of toxic substances to all media),
- enhancing material recyclability (reuse of materials or energy),
- maximizing sustainable use of renewable resources (avoiding depletion of finite resources),
- extending product durability (optimising product life),
- increasing the service intensity (creating value-added while reducing environmental impacts).

Linking the conception of sustainability with engineering knowledge we achieve the so called conception of sustainable engineering (Wolniak, 2016, 2017, 2018, 2019, 2020, 2021, 2022). We can define the sustainable engineering as a concept which takes into account interactions in engineering activities of technical, ecological, social and economic systems and avoiding shifting problems from one area to the other (Sustainable, 2021).

We can distinguish twelve principles of sustainability engineering which we described in table 2. Those principles are used in the stage of creating new products/processes.

**Table 2.**
*Principles of sustainable engineering*

| Principle | Approach | Importance |
|---|---|---|
| Strive to ensure that material/energy inputs and outputs not hazardous | Reduce hazard. Reduce exposure. | Reduces/minimizes dangers by reduction of intrinsic hazards. |
| Waste minimization over waste management. | Good design is creative about use of by-products. | Lowers expenses in purchasing and disposal. |
| Design for easy separation and purification | Plan for recycle and reuse. | Easy separation/purification = easy waste management. |
| All components must be designed for maximum mass, energy, and temporal efficiency. | Smaller is generally better. Lowers expenses. | Lowers expenses. |
| Avoid unnecessary consumption of mass/energy versus. | Production must respond to real-time demands. | Minimization of overproduction. |
| Use entropy and complexity as guidelines to decide end-of-cycle. | Not all products should receive the same end-of cycle treatment. | Disposal solutions can no longer be seen as one-size-fits-all. |
| A product must not outlast its uses. | Over-design is a design flaw. | Decrease accumulation of high-tech waste. |
| A product must not have unnecessary capabilities/capacities. | Design for realistic uses and conditions. | Reduces/eliminates the use of components needed. |
| Minimize material diversity. | Minimize the use of different materials, esp. adhesives, sealants, coating. | Simplify waste management. |
| Product creation is only one part of the cycle. | Take into account methods of extraction of needed resources and transport. | Minimize environmental impact of related life-cycle steps. |
| Evaluate products based on life-cycle analysis. | Take into account methods of extraction of needed resources and transport. | Minimize environmental impact of related life-cycle steps. |
| Prioritize the use of renewable and readily available resources. | Avoid using non-renewables, except when using renewables may be more damaging. | Minimize the overall impact of resource use. |

Source: (The 12 principles, 2021).

## 4. Conclusion

The publication concentrate on problems connected with sustainable engineering. Especially there is a presentation of main principles of sustainable engineering. In the case of each principle there is an description of those topic with the approaches and the analysis of its importance in industrial organization. The sustainability is an very important concept which can be used in in Industry 4.0 implementation. We should mention that efficient engineering organization should know how to link the sustainability and Industry 4.0 concepts. This can bring the market advantage due to new technology implementation and sustainable production from business and environmental point of view.

## References


1. Azapagic, A., Perdan, S., Clift, R. (2005). *Sustainable development in practice. Case Studies for Engineers and Scientists.* Chichester: Wiley.
2. Brandon, P.S., Lombardi, P. (2005). *Evaluating sustainable Development in the built environment.* Kundli: Blackwell Science.
3. Dalibozhko, A., Krakovetskaya, A. (2018). Youth entrepreneurial projects for the sustainable development of global community: evidence from Enactus program. *HS Web of Conferences, 57*, 01009.
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. Ehrenfeld, J. (2008). *Sustainability by Design, New Haven.* CT, USA: Yale University Press.
7. Elkington, J. (1994). Towards the Sustainable Corporation: Win Win Win Business Strategies for Sustainable. *California Management Review, 36, 2,* 90-100.
8. *Engineers and Sustainable Development, World Federation of Engineering Organizations' Committee on Technology* (2002). https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwizrcbSoPXtAhWjBhAIHV9-D8oQFjABegQIAxAC&url=https%3A%2F%2Fwww.researchgate.net%2Fprofile%2FArvind_Singh56%2Fpost%2FHow_engineers_can_play_their_role_in_the_sustainable_development4%2Fattachment%2F5abcdd5b4cde269658663419%2FAS%253A609497244520449%2540152232687540 8%2Fdownload%2F2.pdf&usg=AOvVaw2SBkgCwaiJ2WjrCf4N1idt, 5.9.2022.
9. 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.
10. 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.
11. Gajdzik, B., Wolniak, R. (2021). Transitioning of steel producers to the steelworks 4.0 – literature review with case studies. *Energies*, *14(14),* 1-22.
12. 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.

13. 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.
14. 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.
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. Hys, K., Wolniak, R. (2018). Praktyki przedsiębiorstw przemysłu chemicznego w Polsce w zakresie CSR. *Przemysł Chemiczny*, *9,* 1000-1002.
24. Jonek-Kowalska, I., Wolniak, R. (2021). Economic opportunities for creating smart cities in Poland. Does wealth matter? *Cities*, *114*, 1-6.
25. 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.
26. 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.
27. 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.

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. 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.
30. 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.
31. 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.
32. 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.
33. 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.
34. Rogers, P.P., Jalal, K.F., Boyd, J.A. (2008). *An introduction to Sustainable Development.* London: Glen Educational Fundation.
35. Stawiarska, E., Szwajca, D., Matusek, M., Wolniak, R. (2020). *Wdrażanie rozwiązań przemysłu 4.0 w wybranych funkcjonalnych obszarach zarządzania przedsiębiorstw branży motoryzacyjnej: próba diagnozy.* Warszawa: CeDeWu.
36. Stawiarska, E., Szwajca, D., Matusek, 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.
37. Steculа, 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.
38. Steculа, 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.
39. Sułkowski, M., Wolniak, R. (2016). Przegląd stosowanych metod oceny skuteczności i efektywności organizacji zorientowanych na ciągłe doskonalenie. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacja i Zarzadzanie*, *67*, 63-74.
40. Sułkowski, M., Wolniak, R. (2018). *Poziom wdrożenia instrumentów zarządzania jakością w przedsiębiorstwach branży obróbki metali.* Częstochowa: Oficyna Wydawnicza Stowarzyszenia Menedżerów Produkcji i Jakości.
41. Sustainable engineering (2021). https://www.engineering.unsw.edu.au/civil-engineering/sustainable-engineering, 2.09.2021.

42. The 12 principles of sustainable engineering (2021). https://www.e-education.psu.edu/eme504/node/5, 3.09.2021.
43. *United Nations General Assembly* (1987). *Report of the world commission on environment and development: Our common future*. Oslo, Norway: United Nations General Assembly, Development and International Co-operation: Environment.
44. Wolniak R., Sułkowski M. (2015). Motywy wdrażanie certyfikowanych Systemów Zarządzania Jakością. *Problemy Jakości*, *9,* 4-9.
45. Wolniak, R, Skotnicka-Zasadzień, B. (2014). The use of value stream mapping to introduction of organizational innovation in industry. *Metalurgija*, *53(4),* 709-713.
46. Wolniak, R. (2011). *Parametryzacja kryteriów oceny poziomu dojrzałości systemu zarządzania jakością.* Gliwice: Wydawnictwo Politechniki Śląskiej.
47. Wolniak, R. (2013). A typology of organizational cultures in terms of improvement of the quality management. *Manager, 17(1),* 7-21.
48. Wolniak, R. (2013). Projakościowa typologia kultur organizacyjnych. *Przegląd Organizacji*, *3,* 13-17.
49. Wolniak, R. (2014). Korzyści doskonalenia systemów zarządzania jakością opartych o wymagania normy ISO 9001:2009. *Problemy Jakości*, *3,* 20-25.
50. Wolniak, R. (2016). Kulturowe aspekty zarządzania jakością. *Etyka biznesu i zrównoważony rozwój, Interdyscyplinarne studia teoretyczno-empiryczne*, *1,* 109-122.
51. Wolniak, R. (2016). *Metoda QFD w zarządzaniu jakością. Teoria i praktyka.* Gliwice: Wydawnictwo Politechniki Śląskiej.
52. 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.
53. 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.
54. 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.
55. 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.
56. Wolniak, R. (2017). The Design Thinking method and its stages. *Systemy Wspomagania Inżynierii Produkcji, 6,* 247-255.
57. Wolniak, R. (2017). *The use of constraint teory 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.

58. Wolniak, R. (2018). Functioning of social welfare on the example of the city of Łazy. *Zeszyty Naukowe Wyższej Szkoły, Humanitas. Zarządzanie, 3,* 159-176.
59. 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.
60. Wolniak, R. (2019). Context of the organization in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *133*, 121-136.
61. Wolniak, R. (2019). Downtime in the automotive industry production process – cause analysis. *Quality, Innovation, Prosperity*, *2,* 101-118.
62. Wolniak, R. (2019). Leadership in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *133*, 137-150.
63. Wolniak, R. (2019). Support in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *137*, 247-261.
64. Wolniak, R. (2019). The level of maturity of quality management systems in Poland-results of empirical research. *Sustainability*, *15*, 1-17.
65. Wolniak, R. (2020). Design in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *148*, 769-781.
66. Wolniak, R. (2020). Operations in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *148*, 783-794.
67. 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.
68. 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.
69. Wolniak, R. (2021). Performance evaluation in ISO 9001:2015. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *151*, 725-734.
70. Wolniak, R. (2022). Engineering ethics – main principles. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *155*, 579-594.
71. Wolniak, R. (2022). Management of engineering teams. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *157*, 667-674.
72. Wolniak, R. (2022). Project management in engineering. *Silesian University of Technology Scientific Papers. Organization and Management Series*, *157*, 685-698.
73. 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.

74. Wolniak, R. Sułkowski, M. (2015). Rozpowszechnienie stosowania Systemów Zarządzania Jakością w Europie na świecie – lata 2010-2012. *Problemy Jakości*, *5,* 29-34.
75. Wolniak, R., Grebski, M.E. (2018). Innovativeness and creativity as factors in workforce development – perspective of psychology. *Zeszyty Naukowe Politechniki Ślaskiej. Seria Organizacja i Zarządzanie*, *116*, 203-226.
76. Wolniak, R., Grebski, M.E. (2018). Innovativeness and Creativity of the Workforce as Factors Stimulating Economic Growth in Modern Economies. *Zeszyty Naukowe Politechniki Ślaskiej. Seria Organizacja i Zarządzanie*, *116*, 227-240.
77. 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.
78. Wolniak, R., Hąbek, P. (2015). Quality management and corporate social responsibility. *Systemy Wspomagania w Inżynierii Produkcji*, *1,* 139-149.
79. Wolniak, R., Hąbek, P. (2016). Quality assessment of CSR reports – factor analysis. *Procedia – Social and Behavioral Sciences*, *220*, 541-547.
80. 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.
81. 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.
82. 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.
83. 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.
84. Wolniak, R., Skotnicka, B. (2011). *Metody i narzędzia zarządzania jakością – Teoria i praktyka, cz. 1*. Gliwice: Wydawnictwo Naukowe Politechniki Śląskiej.
85. Wolniak, R., Skotnicka-Zasadzień, B. (2008). *Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach.* Gliwice: Wydawnictwo Politechniki Śląskiej.
86. Wolniak, R., Skotnicka-Zasadzień, B. (2010). *Zarządzanie jakością dla inżynierów.* Gliwice: Wydawnictwo Politechniki Śląskiej.
87. Wolniak, R., Skotnicka-Zasadzień, B. (2018). Developing a model of factors influencing the quality of service for disabled customers in the condition s of sustainable development, illustrated by an example of the Silesian Voivodeship public administration. *Sustainability*, *7,* 1-17.
88. Wolniak, R., Skotnicka-Zasadzień, B. (2022). Development of photovoltaic energy in EU countries as an alternative to fossil fuels. *Energies*, *15(2),* 1-23.

89. 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.
90. 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.

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# CHALLENGES DETERMINING THE IMPLEMENTATION OF REMOTE WORK IN THE OPINION OF THE REPRESENTATIVES OF GENERATION Z IN POLAND

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**Purpose:** The aim of the article is to identify the challenges that are significant for the implementation of remote work in the opinion of the representatives of Generation Z in Poland.
**Design/methodology/approach**: The implementation of the chosen goal was possible thanks to the literature review and the survey carried out among the representatives of Generation Z in Poland. The empirical part of the article presents the results of the authors' own research. The survey was conducted among representatives of the Z generation and concerned the perception of challenges related to remote work and the assessment of their impact on its implementation.
**Findings:** Working time flexibility and remote work outside the office are becoming the norm. The conducted research allowed to identify the perception of challenges for the implementation of remote work by representatives of Generation Z in Poland. According to the respondents, the most important of them are: the necessity of technical and IT development of the organization and its resources. It is important to develop the competences of employees, both those necessary to manage remote work (virtual teams) and its implementation in accordance with the expectations of the employer. Great importance is also attached to the need to monitor remote work by the employer (implementation of the control function in management) and the development of self-control skills and self-discipline of employees.
**Research limitations/implications**: The conducted research is one of the first in Poland and may be an inspiration for the next ones. Their limitation is the number of respondents who took part in the survey. Nevertheless, conducting them allowed to identify the perception of the challenges of implementing remote work by representatives of Generation Z in Poland.
**Practical implications:** The awareness of the challenges related to remote work among the representatives of Generation Z allows for better preparation of the organization, both employees and managers, for the implementation of remote work.
**Originality/value:** The value of the article is the identification of the perception of challenges for the implementation of remote work by employees of Generation Z. Research was carried out on representatives of a generation that, due to the knowledge of new technologies, seems to be prepared for remote work, and in the coming years will constitute an increasing percentage of people on the labor market (both as specialists and managers). The research shows that in order to achieve the benefits of remote work for both the employee and the employer,

it is necessary to meet the challenges of working in a virtual environment. The results and conclusions of the conducted research may be useful for managers, employees and job applicants who should develop the required competences.

**Keywords:** remote work, generation Z, work in Industry 4.0.

**Category of the paper:** Research paper.

## 1. Introduction

The dynamic, changeable and complex environment obliges organizations to shape competences that determine flexible use of emerging opportunities and adapting to changes. It is possible when organizations understand the essence of innovation and are able to effectively use the opportunities resulting from technical and technological progress. Nowadays, achieving the ability to develop in the long term is possible thanks to the rational use of artificial intelligence, digitization and organization automation. This requires the development of not only infrastructure, but also the creation of conditions ensuring the effectiveness of communication between stakeholders, employees, machines (Łukasiński, Bińczycki, Dorocki, 2021, p. 43). Organizations, in order to meet the challenges, are obliged to develop their competences conditioning the adaptation to changes (e.g. in relations with partners) ensuring the effectiveness of management or production processes. The level of an organization's readiness to change varies considerably. Organizational learning is necessary, investments in infrastructure and the development of specialist staff competences (Mączyńska, Okoń-Horodyńska, 2020, p. 15). Organizational competences can be perceived as a set of knowledge and talents of employees, their personalities and styles of action, which, if properly used and improved, should lead to the achievement of the chosen strategies (Sajkiewicz, 2002, p. 90).

Nowadays, organizations take actions focused on the changing needs and preferences of stakeholders. Flexibility in meeting customer needs is related to the product life cycle, which is getting shorter and shorter. Improving quality, producing innovative products requires the use of modern technologies, investments in the development of the organization, both its technical and human resources (The Fourth Revolution..., 2017, p. 3). It is important to effectively use the acquired knowledge, shape attitudes and behaviors, optimally using human capital (Waśkowski, 2018, pp. 301-302).

When making investments, it is important to plan and expect that the introduced changes and the resulting benefits will exceed the costs incurred (Mączyńska, Okoń-Horodyńska, 2020, p. 14). One of the possibilities of development may be the implementation of remote work in the organization. Organizations are more and more willing to use this form of work. Employees, especially young people, are interested in it because they value flexibility in work and mobility

in life. The representatives of the generation Z include people born from the 90s of the twentieth century. They are characterized by the ability to operate a computer, mobile devices, the ability to search and process information in virtual reality. For Generation Z employees, the digital world is something they cannot imagine functioning without. Thanks to the competences acquired in the world with access to the Internet, full of modern technologies and mobile devices, these people are perfectly prepared to function in modern organizations in the context of the use of information technologies, so important in remote work (Muster, 2020, pp. 131-132). Moreover, young employees appreciate flexibility at work. Generation Z is a generation not only acquiring education, but also entering the labor market in increasing numbers. According to the ManPower Group Millenial Careers: 2020 Vision report, in 2020 it accounted for 24% of the global workforce (ManPower Group..., 2020, p. 3). The attitudes and views of this generation will shape the future labor market (Messiah, 2021, p. 98). The behavior, attitudes and expectations of this generation should be analyzed, because its representatives become the leading group of junior specialists recruited for positions (Desant Z..., 2017).

The aim of the article is to identify the challenges that are significant for the implementation of remote work in the opinion of the representatives of Generation Z in Poland. Its implementation was possible thanks to the literature review and the survey conducted among the representatives of Generation Z in Poland. It is interesting how they perceive the challenges that determine the implementation of remote work.

## 2. Methods

Based on the analysis of the literature on the subject, an attempt was made to define the challenges related to the implementation of remote work that organizations face, having an impact on the results they achieve. On this basis, a questionnaire was created, which was used in the process of collecting information. The study was conducted in the period May 2021 - April 2022 via an online survey. In order to conduct the survey, a purposeful selection of the studied sample was used. The units were selected on the basis of age and experience in remote work. The questionnaire was completed by 522 people representing the so-called generation Z. Among the respondents, 61% were women and 39% men. Secondary education was declared by 56% of the respondents, and 46% - higher education. Among the respondents, 2% stated that they are an employer, and 7% already hold managerial positions. In order to interpret the obtained results, the following statistical measures were calculated: arithmetic mean, median and coefficient of variation. The coefficient of variation was calculated as the quotient of the standard deviation of a feature and its arithmetic mean. The coefficient of variation determines the degree of variation in the value of a variable. A high value of the coefficient means a large diversity of the trait and indicates the heterogeneity of the studied population, while the low

value - low variability of the trait and homogeneity of the studied population. The value of the coefficient is expressed as a percentage, and its interpretation depends on the value of the coefficient. It was assumed that below 25% there is little variability, between 25% and 45% - average variability, between 45% and 100% - strong variability, and above 100% - very strong variability.

In order to compile the most related features, a cluster analysis was performed. For this purpose, first a weighted value was calculated for each display. For this purpose, a weight was assigned to each feature indicated by the respondents. If a given feature was not indicated, the value was entered zero. Next, the cluster analysis was performed using the Ward's method, where the analysis of variance approach is used to estimate the distance between clusters. This method aims to minimize the sum of the squared deviations of any two clusters that may be formed at any stage. The study used the Euclidean distance (geometric distance in a multidimensional space).

## 3. Remote work – the results obtained from the literature review

The changing and complex economic reality obliges us to create social engineering systems capable of agile self-organization and flexible building of value chains. Intelligent organizations supported by information systems are able to create interoperability-oriented virtual networks that include employees and equipment (Bendkowski, 2017, p. 22). The implementation of the assumptions of the industry 4.0 concept requires adaptation to new conditions through: digitization, automation and robotization as well as human-machine integration (Ślusarczyk, 2019, p. 6). Effectively cooperating and complementing each other components create a new reality in which the integration of production, organizational and social systems takes place. This leads to the creation of an optimally organized and automated work environment, which gives the opportunity to perform it remotely (Adamik, 2018, p. 88). This requires employees to develop and acquire new competences. This is necessary because technological, social and personal skills are important. The effect of the progressive automation is the possibility of leveling out inequalities. Both women and people with disabilities can get more jobs. There is a possibility of employment based on telecommunications and information technologies (e.g. remote work via platforms, which enables the performance of duties at a convenient time, outside the headquarters of the organization). There may be the impression that robots and AI will replace workers. However, in practice, only about 5% of professions can be fully automated (Czwarta rewolucja..., 2020, p. 8). Changes in technology make it necessary to adjust the competences of the staff. This requires the development of a policy of an organization focused on changes in production, existing systems or personnel, which will enable adaptation to new requirements (Hawksworth, Berriman, & Goel, 2018, p. 39).

Investments in increasing employee competences include costs related to, among others, the necessity to organize trainings that will make employees gain knowledge in the field of newly introduced technologies. As a result, in the future, it will contribute to an increase in the efficiency of the organization (Bughin et al., 2018, p. 40). It is extremely important in the case of remote work. In this form, work is usually carried out outside the employer's office and is supported with ICT tools. Remote work can be implemented in various forms and is defined by various terms, including: teleworking, mobile work based on ICT, mobile e-work, mobile virtual work, work at home (Garrett, Danziger, 2007; Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022). The accelerated development of remote work took place during the Covid-19 pandemic, but its beginnings and a gradually increasing popularity trend started in the 1960s (Wójcik, 2021, p. 264). Along with the development of ICT technologies, tools and applications enabling communication, access and sending documents in digital form, remote work became more and more feasible. Remotely, it is possible to carry out tasks with a high complexity of tasks, characterized by a high degree of independence, no need for constant interaction with other colleagues, which are carried out by specialists with extensive experience. It is important that during their execution it is possible to access documents also outside the office of the organization (e.g. access to documents in the cloud, electronic document flow) and that it is possible to remotely send the results (Clark, 1998; Peters, Tijdens, Wetzels, 2004; Jones, 2010; Peters et al., 2016; Vilhelmson, Thulin, 2016; Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022).

The popularity of remote work results, on the one hand, from the increasing technical possibilities of its implementation, and on the other hand, from the benefits that it can bring for the organization and its employees. The most frequently indicated motives for implementing remote work by organizations in the literature include (Baruch, 2000; Donnelly, Proctor-Thomson, 2015; Ferreira et al., 2021; Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022):

- employee well-being, employee job satisfaction translating into, among others, lower rotation and higher efficiency,
- cost reduction - remote work transfers some of the costs to the employee,
- the possibility of achieving a competitive advantage thanks to remote work,
- using remote work as an alternative plan for the continuity of the organization's operation during various types of threats and natural disasters, e.g. pandemics, in emergency situations.

The benefits of working remotely in the organization speak for the continuation of this trend. Nevertheless, when implementing this form of work, there are also a number of challenges that organizations face. They include, among others (Teo, Lim, Wai, 1998; Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022):

- formal preparation on the part of the organization, updating goals, procedures, rules,
- providing the necessary infrastructure, maintaining IT tools and equipment (e.g. ensuring safe access to data and systems, repairing and maintaining equipment in employees' homes),
- remodeling of processes, including the possibility of working remotely,
- creating rules and communication paths corresponding to working remotely,
- developing methods of monitoring and measuring performance,
- preparing managers (managers, supervisors, superiors, team leaders) and employees to work in the new environment.

Given the changes resulting from the fourth industrial revolution, it becomes necessary to take measures to meet these challenges. When reviewing the reports of Deloitte, Capgemini and Ernst and Young[i], it should be stated that remote work is currently and will be implemented in many organizations. The most popular model is the hybrid model, combining remote and stationary work, which is designed to take advantage of the advantages of remote work, while minimizing its limitations, such as the feeling of isolation of employees or the lack of social contacts. It requires adjusting the functioning of the organization, including the form of communication. It is becoming important to shape interpersonal relationships, manage dispersed teams, and define how to monitor the course of remote work in the long term (Wójcik, 2021, pp. 269-270). The above-described challenges affecting the implementation of remote work were used in the process of building a research tool.

The challenges related to remote work undoubtedly also include the development of digital competences, perceived as a tool for cooperation, collaboration and communication. Their development requires critical thinking, supporting the implementation of higher mental operations, being a tool increasing the effectiveness of problem solving (Kwiatkowski, 2018, p. 174). Technical IT competences determine the effectiveness of remote work (Głomb, 2020, p. 15). Due to the extensive use of ICT in remote work, it could be assumed that it is primarily technical competences, such as computer operation or knowledge of programs/systems used in a given organization, e.g. knowledge of MS Office, SAP or Adobe will be the key competences. Along with the development of research on remote work, it is indicated that "soft" skills also play a very important role in its implementation (Clark, 1998; Peters, Tijdens, & Wetzels, 2004; Jones, 2010; Madsen, 2011; Peters et al., 2016; Vilhelmson, Thulin, 2016; Krasnova, 2021, Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022). A feature of the future is undoubtedly a change that must be accepted. It is important to develop competences that increase the ability to effectively and efficiently react to new solutions. Nevertheless, it requires the self-development of employees, their creativity and openness to innovation.

Working remotely can affect your organization's performance. If it is well organized, it can contribute to the growth of the achieved results and value of the organization. However, in order to achieve these results, organizations face many challenges that affect the likelihood of achieving the intended goals and achieving above-average results. This is related to the possibility of reducing the costs of running a business (Baruch, 2000; Fereirra et al., 2021) and increasing employee productivity (Urbaniec, Małkowska, Włodarkiewicz-Klimek, 2022). It is important that employees and managers are aware of the challenges related to remote work, so that they can take actions aimed at using them as opportunities that generate development opportunities. Despite the research on the challenges of remote work in the literature, there is a lack of information on how they are perceived by the representatives of Generation Z in Poland. The results of the questionnaire survey presented below are part of filling this gap.

## 4. Results of the survey conducted

In the survey, the respondents were asked to indicate the 7 most important challenges related to the implementation of remote work in the context of the results achieved by the organization (Table 1).

**Table 1.**
*Key challenges related to the implementation of remote work*

| Marking on the chart | Specification | Number of responses | Structure in % taking into account the number of respondents |
|---|---|---|---|
| B | Development of technical and IT infrastructure necessary for remote work | 324 | 62,07% |
| A | Development of competences conditioning the effectiveness of remote work management | 287 | 54,98% |
| D | Employee's acceptance of the terms of remote work (adapting to the virtual work environment) | 254 | 48,66% |
| H | Creation of conditions ensuring work efficiency | 240 | 45,98% |
| C | Finding means and methods to train and develop employee competencies | 216 | 41,38% |
| L | The need to monitor remote work | 205 | 39,27% |
| Q | Development of self-control skills at work and self-discipline | 200 | 38,31% |
| U | Ensuring the organization's competence to quickly adapt to changes | 181 | 34,67% |
| E | Effective use of information and communication technologies | 176 | 33,72% |
| G | Creation of an information and knowledge management system | 164 | 31,42% |
| J | The need to ensure the security of data and transmitted information | 163 | 31,23% |
| T | The ability to precisely formulate expectations and commands towards employees | 162 | 31,03% |

Cont. table 2.

| | | | |
|---|---|---|---|
| S | Developing the ability to learn from mistakes and look for solutions | 161 | 30,84% |
| K | Creation of remote work implementation procedures and documentation flow management | 160 | 30,65% |
| R | Develop emotional intelligence to control stress | 146 | 27,97% |
| N | Adjusting the organizational structure to the implementation of remote work and the adopted strategy | 143 | 27,39% |
| F | Motivating employees to develop competences that determine team cohesion | 138 | 26,44% |
| O | Development of strategic thinking skills and systemic perception of problems | 100 | 19,16% |
| P | Identifying areas of uncertainty and estimating the risks associated with remote work | 94 | 18,01% |
| I | Providing solutions for health and safety at work | 86 | 16,48% |
| M | Focus on stakeholder satisfaction (primarily the customer) | 54 | 10,34% |

Source: Own elaboration based on the conducted questionnaire research.

Among the challenges related to the implementation of remote work affecting the results achieved by the organization, more than half of the respondents indicated the development of the technical and IT infrastructure necessary for remote work (62.07% of respondents) and the need to develop competences conditioning the effectiveness of remote work management (54.98% ). This may prove the high awareness of the respondents who decided that the challenge for managers is both the development of technical and IT resources for remote work and the competences necessary to manage remote work. Over 40% of the respondents considered the necessity to accept by the employee the conditions of remote work (adapting to the virtual work environment) (48.66%), creating conditions ensuring work efficiency (45.98%) and finding resources and methods for training and development of employees' competences (41.38%). Therefore, the respondents considered that the key challenges of remote work implementation are also related to the employee, his preparation both in terms of the organization of the workplace (outside the office of the organization) and the development of competences enabling efficient work remotely. The key challenges were also the necessity to monitor remote work (39.27%), development of self-control skills at work and self-discipline (38.31%). It follows that the challenge for the implementation of work outside the organization's seat is its control by the employer, as well as the discipline, self-assessment and self-control of the employee.

In order to organize and interpret the obtained results, a cluster analysis was used (fig. 1).

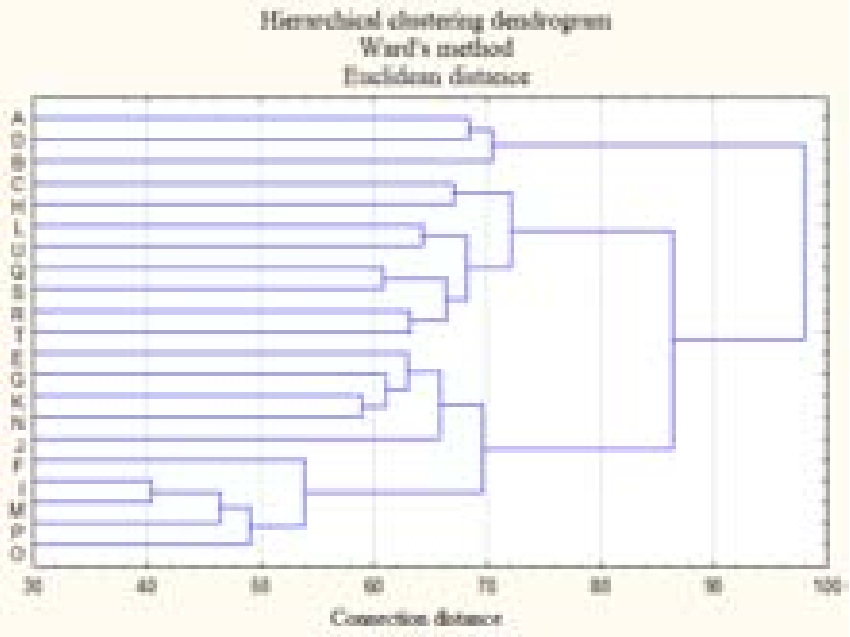


**Figure 1.** Dendrogram of key challenges of remote work. Source: Own elaboration based on the conducted questionnaire research.

When analyzing the typology of answers based on a dendrogram, we can distinguish four clusters (Chart 1) – four groups of remote work challenges. In Table 1 and in figure 1, these groups are marked with symbols: ADB, CHLUQRST, EGKNJ, IMPOF. When making a typology on the basis of the dendrogram, the features are duplicated according to the greatest (ADB) and the smallest (IMPOF) number of indications by the respondents. The most frequently indicated area concerns the preparation of the workplace for the implementation of remote work and the remote work management system, which seems to be justified as the basis for the implementation of remote work in the organization. The least indicated was the area of issues related to, inter alia, with occupational health and safety, focus on stakeholder satisfaction, risk assessment, considering problems in a systemic way or competences that determine the cohesion of the team. The lower number of indications of these features could result from the greater association of these areas by the respondents with stationary work, and the questions in the questionnaire strictly related to remote work, therefore the respondents indicated the challenges that, in their opinion, constitute the most challenges for remote work. The other two areas (CHLUQRST) can be defined as a group of challenges related to remote work, current tasks, work control, development of employee competences, coping with stress and changes in the organization, etc., and the next area (EGKNJ) can be defined as a group challenges related to communication, adapting the organization (its strategy and structure) to remote work, information and knowledge management, access to information, ensuring the security of information used in remote work.

Then, the respondents were asked to assess the extent to which, on a scale from 0 (no impact) to 5 (significant impact), individual challenges affect the implementation of remote work in the organization in the context of the results achieved by it (Table 2).

**Table 2.**
*The impact of challenges on the implementation of remote work*

| Specification | Average | | | Median | | | Coefficient of variation [%] | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | M | W | A | M | W | A | M | W |
| Development of competences conditioning the effectiveness of remote work management | 3,7 | 3,6 | 3,9 | 4 | 4 | 4 | 32,3 | 35,2 | 30,3 |
| Development of technical and IT infrastructure necessary for remote work | 4,0 | 3,8 | 4,1 | 4 | 4 | 4 | 28,4 | 31,3 | 26,2 |
| Finding means and methods to train and develop employee competencies | 3,6 | 3,4 | 3,7 | 4 | 4 | 4 | 33,2 | 35,3 | 31,6 |
| Employee's acceptance of the terms of remote work (adapting to the virtual work environment) | 3,8 | 3,5 | 3,9 | 4 | 4 | 4 | 31,2 | 34,9 | 28,3 |
| Effective use of information and communication technologies | 3,6 | 3,4 | 3,7 | 4 | 4 | 4 | 32,9 | 35,9 | 30,8 |
| Motivating employees to develop competences that determine team cohesion | 3,4 | 3,2 | 3,5 | 4 | 3 | 4 | 34,1 | 35,5 | 32,9 |
| Creation of an information and knowledge management system | 3,5 | 3,4 | 3,5 | 4 | 4 | 4 | 35,5 | 36,6 | 34,8 |
| Creation of conditions ensuring work efficiency | 3,7 | 3,6 | 3,8 | 4 | 4 | 4 | 30,8 | 33,1 | 29,2 |
| Providing solutions for health and safety at work | 3,1 | 2,8 | 3,3 | 3 | 3 | 3 | 44,7 | 48,9 | 41,5 |
| The need to ensure the security of data and transmitted information | 3,9 | 3,7 | 4,0 | 4 | 4 | 4 | 31,3 | 34,4 | 29,1 |
| Creation of remote work implementation procedures and documentation flow management | 3,6 | 3,5 | 3,7 | 4 | 4 | 4 | 33,5 | 36,0 | 31,8 |
| The need to monitor remote work | 3,6 | 3,4 | 3,8 | 4 | 4 | 4 | 35,3 | 39,2 | 32,4 |
| Focus on stakeholder satisfaction (primarily the customer) | 3,2 | 3,0 | 3,3 | 3 | 3 | 3 | 41,3 | 45,9 | 38,2 |
| Adjusting the organizational structure to the implementation of remote work and the adopted strategy | 3,5 | 3,4 | 3,7 | 4 | 4 | 4 | 33,6 | 36,1 | 31,8 |
| Development of strategic thinking skills and systemic perception of problems | 3,4 | 3,2 | 3,5 | 3 | 3 | 4 | 36,2 | 41,0 | 32,8 |
| Identifying areas of uncertainty and estimating the risks associated with remote work | 3,3 | 3,1 | 3,5 | 4 | 3 | 4 | 35,6 | 39,1 | 33,0 |
| Development of self-control skills at work and self-discipline | 3,7 | 3,4 | 3,9 | 4 | 4 | 4 | 33,8 | 38,3 | 30,3 |
| Develop emotional intelligence to control stress | 3,5 | 3,2 | 3,7 | 4 | 3 | 4 | 37,5 | 43,4 | 33,2 |
| Developing the ability to learn from mistakes and look for solutions | 3,7 | 3,5 | 3,8 | 4 | 4 | 4 | 32,1 | 34,9 | 30,1 |
| The ability to precisely formulate expectations and commands towards employees | 3,8 | 3,5 | 3,9 | 4 | 4 | 4 | 31,7 | 35,9 | 28,3 |
| Ensuring the organization's competence to quickly adapt to changes | 3,6 | 3,5 | 3,9 | 4 | 4 | 4 | 30,4 | 34,3 | 27,3 |

Legend: A - all, M - men, W – women.

Source: Own elaboration based on the conducted questionnaire research.

The challenges that the respondents perceive as significantly affecting the implementation of remote work in the organization are: development of the technical and IT infrastructure necessary for remote work, which seems to be understandable and treated as the basis for remote work to be carried out. When assessing this challenge, the respondents – women and men – were the most consistent in their answers. The second highly assessed challenge is the need to ensure the security of data and transmitted information. Despite the fact that it did not appear in the top seven key challenges, it was rated highly in the next question, on average at 3.9 (on a scale from 0 to 5). Among the challenges that the respondents assessed as having a significant impact on the implementation of remote work in the context of the results achieved by the organization, the following were indicated, among others:

- the employee's acceptance of the conditions of remote work (adapting to the virtual work environment),
- the ability to precisely formulate expectations and instructions towards employees,
- development of managerial competences in managing remote work,
- creating conditions ensuring work efficiency,
- development of self-control skills and self-discipline,
- developing the ability to learn from mistakes, look for solutions,
- ensuring the organization's competence to quickly adapt to changes.

Among the above-mentioned, some of them were among the indicated 7 key challenges of remote work, and some were rated highly only in the second question. In general, all the challenges identified during the analysis of the literature were assessed on average by the respondents above 3.0 (on a scale from 0 to 5), thus concluding that each of them has an impact on the functioning of remote work in the organization. The surprising thing is the low assessment of the need to provide solutions for health and safety at work. This may be due to, inter alia, the respondents associating the area of occupational health and safety with stationary work at the organization's headquarters, the lack of comprehensive legal regulation of this area in relation to remote work, or the lack of experience in occupational health and safety training for remote work. In the case of assessments of most challenges, the average variability of the data can be observed. The greatest difference of opinion between women and men was noted when assessing the need to ensure occupational health and safety. Based on the results presented in Table 2, it can be observed that men assessed the impact of individual challenges lower on the implementation of remote work in the organization lower.

Remote work can bring many benefits and accelerate the development of both employees and the entire organization. It is possible only when the organization properly prepares and responds to the challenges related to the implementation of remote work. The awareness of these challenges and their high evaluation by the representatives of Generation Z is a positive phenomenon, because this generation will to a large extent work remotely and manage this form of work.

## 5. Summary and conclusions

The development of digitization and automation gives opportunities to implement remote work in many organizations, which on the one hand is an opportunity, and on the other, it creates some challenges and the need for changes in the organization. A change that is in line with the idea of Industry 4.0. is the implementation of work remotely. The implementation of changes requires, among others: investment in technologies, adopting a new business model, improving employee competences. However, the funds invested will be returned if, along with the implementation of changes, the managers are aware of the challenges posed by the decision to perform remote work and will try to meet them. There are many challenges related to the functioning of remote work in an organization that affect the results of this work (organization results). It is important that the representatives of Generation Z are aware of the challenges that affect the implementation of remote work in the organization and the results it achieves, because remote work will function and develop also after the Covid-19 pandemic, and young employees will be the people who will do it and manage it.

Based on the survey, it can be concluded:

- the development of the technical and IT infrastructure necessary to implement remote work enables its popularization, competences should be developed that determine flexible adaptation of the organization to changes,
- managing and carrying out remote work generates the need to develop not only ways of monitoring and controlling it, but also precisely formulating expectations and instructions towards employees,
- the implementation of remote work requires the development of employees' competences, including their self-discipline skills, self-control of work, independent thinking, the ability to learn from mistakes, look for solutions,
- it is important to provide organizational solutions that determine data security and the ability to work efficiently.

The conducted research is one of the first in Poland and may inspire others. Their limitation is the number of respondents who took part in the survey. Nevertheless, conducting them allowed to identify the perception of the challenges of implementing remote work by representatives of Generation Z in Poland.

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## References

1. Adamik, A. (2018). Inteligencja organizacji w erze IR 4.0. *Studia i Prace Kolegium Zarządzania i Finansów*, *No.161.* Szkoła Główna Handlowa, pp. 81-97.
2. Baruch, Y. (2000). Teleworking: Benefits and pitfalls as perceived by professionals and managers. *New Technology, Work and Employment, Vol. 15, Iss. 1,* pp. 34-49.
3. Bendkowski, J. (2017). Zmiany w pracy produkcyjnej w perspektywie koncepcji „Przemysł 4.0". *Zeszyty Naukowe Politechniki Śląskiej, Seria: Organizacja i Zarządzanie*, *No.112,* pp. 21-33.
4. Bughin, J., Hazan, E., Lund, S., Dahlström, P., Wiesinger, A., Subramaniam, A. (2018). *Skill shift: Automation and the future of the workforce.* McKinsey Global Insitute, McKinsey & Company.
5. Clark, E. (1998). *Telecommuting and working from home*. IPCC 98. Contemporary Renaissance: Changing the Way we Communicate. Proceedings of the 1998 IEEE International Professional Communication Conference. Quebec City, QC, Canada: IEEE, pp. 21-25.
6. *Czwarta rewolucja przemysłowa i jej wpływ na rynek pracy* (2020) Monitoring rynku pracy. Raport Polskiej Agencji Rozwoju Przedsiębiorczości. Retrieved from https://www.parp.gov.pl/storage/publications/pdf/Czwarta-rewolucja-przemysowa_200730.pdf, 10.01.2022.
7. Desant Z. *Setki tysięcy absolwentów wchodzą na polski rynek pracy*. Reterieved from https://hrstandard.pl/2017/07/24/desant-z-setki-tysiecy-absolwentow-wchodza-na-polski-rynek-pracy/, 24.07.2017.
8. Donnelly, N., Proctor-Thomson, S.B. (2015). Disrupted work: Home-based teleworking (HbTW) in the aftermath of a natural disaster, *New Technology, Work and Employment*, *Vol. 30, Iss. 1,* pp. 47-61.
9. Ferreira, R., Pereira, R., Bianchi, I.S., da Silva, M.M. (2021). Decision Factors for Remote Work Adoption: Advantages, Disadvantages, Driving Forces and Challenges. *Journal of Open Innovation: Technology, Market, and Complexity*, *No. 7(1),* 70.

10. Garrett, R.K., Danziger, J.N. (2007). Which telework? Defining and testing a taxonomy of technology-mediated work at a distance. *Social Science Computer Review*, *No. 25(1),* pp. 27-47.
11. Głomb, K. (2020). *Kompetencje 4.0. Część I: Cyfrowa transformacja rynku pracy i przemysłu w perspektywie roku 2030*. Warszawa: Agencja Rozwoju Przemysłu S.A.
12. Hawksworth, J., Berriman, R., Goel, S. (2018). *Will robots really steal our jobs? An international analysis of the potential long term impact of automation.* London: PWC.
13. Jones, K. (2010). Going Home: New Technology's Impact on Remote Work Engagement. *Advances in Business Research, No. 1,* pp. 168-175.
14. Krasnova, A. (2021). Wymagania kompetencyjne wobec pracowników ds. HR wykonujących pracę zdalnie. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, *No. 2(992),* pp. 91-101.
15. Kwiatkowski, S.M. (2018). *Kompetencje przyszłości*, *Seria naukowa, Tom 3*. Warszawa: Wydawnictwo FRSE.
16. Łukasiński, W., Bińczycki, B., Dorocki, S. (2021). *Kluczowe kompetencje organizacji XXI wieku*, Wrocław: Oficyna Wydawnicza Arboretum.
17. Mączyńska, E., Okoń-Horodyńska, E. (2020). Przedsiębiorstwo i jego otoczenie w obliczu czwartej rewolucji przemysłowej – wyzwania, szanse i zagrożenia. *Przegląd Organizacji, No. 1,* pp. 9-21.
18. Madsen, S.R. (2011). The Benefits, Challenges, and Implications of Teleworking: A Literature Review. *Culture & Religion Journal, No. 1*, pp. 148-158.
19. ManPower Group Millennial Careers: 2020 Vision. Facts, Figures and Practical Advice from Workforce Experts (2020). ManPower Group. Retrieved from https://www.manpowergroup.cl/wps/portal/manpowergroup/cl/millennial/carreras.
20. Messyasz, K. (2021). Pokolenie Z na rynku pracy – strukturalne uwarunkowania i oczekiwania. *Acta Universitatis Lodziensis. Folia Sociologica, No. 76,* pp. 97-114.
21. Muster, R. (2020). Pokolenie „Z" na współczesnym rynku pracy w opiniach pracodawców. *Humanizacja pracy, Nr 1*, pp. 131-146.
22. Peters, P., Ligthart, P.E.M., Bardoel, A., Poutsma, E. (2016). 'Fit' for telework? Cross-cultural variance and task-control explanations in organizations' formal telework practices. *International Journal of Human Resource Management, No. 27*, pp. 2582-2603.
23. Peters, P., Tijdens, K.G., Wetzels, C. (2004). Employees' opportunities, preferences, and practices in telecommuting adoption. *Information & Management, No. 41,* pp. 469-482.
24. Sajkiewicz, A. (2002). *Jakość zasobów pracy*. Warszawa: Poltext.
25. Ślusarczyk, B. (2019). Potencjalne rezultaty wprowadzania koncepcji przemysłu 4.0 w przedsiębiorstwach. *Przegląd Organizacji, No. 1*, pp. 4-10.
26. Teo, T.S., Lim, V.K., Wai, S.H. (1998). An Empirical Study of Attitudes Towards Teleworking among Information Technology (IT) Personnel. *International Journal of Information Management, Vol. 18, Iss. 5,* pp. 329-343.

27. *The Fourth Revolution is now: are you ready?* Future of Operations (2017) London: Deloitte LLP.
28. Urbaniec, M., Małkowska, A., Włodarkiewicz-Klimek, H. (2022). The Impact of Technological Developments on Remote Working: Insights from the Polish Managers' Perspective. *Sustainability. Sustainable Employee Management. No. 14.*
29. Vilhelmson, B., Thulin, E. (2016). Who and where are the flexible workers? Exploring the current diffusion of telework in Sweden. *New Technology, Work and Employment, Vol. 31, Iss. 1,* pp. 77-96.
30. Waśkowski, Z. (2018). Zarządzanie kompetencjami przedsiębiorstwa w procesie tworzenia wartości dla nabywców. *Handel Wewnętrzny, No. 5(376),* pp. 300-309.
31. Wójcik M., (2021). Perspektywy wykorzystania pracy zdalnej po zakończeniu pandemii COVID-19. In: A. Jaki, B. Ziębicki (Eds.), *Wiedza – Gospodarka – Społeczeństwo. Wyzwania współczesnych organizacji i gospodarek* (pp. 263-272). Warszawa: Instytut Nauk Ekonomicznych PAN.

**Footnotes**

[i] This applies to reports: *Deloitte. Raport: The voice of the European workforce 2020. Niech moc pracowników będzie z Wami; Raport Capgemini: The Future of Work. From remote to hybrid*. and two reports Ernst and Young – badanie pt. *Organizacja pracy w czasie pandemii. Wyzwania dla HR w 2021. Praca hybrydowa – mierzenie efektywności – nowa polityka wynagrodzeń i świadczeń pozapłacowych* and research *EY 2021 Work Reimagined Employee Survey; Raport Capgemini: The Future of Work. From remote to hybrid*.

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# COVID-19 PANDEMIC AS A FACTOR INCREASING TRUCK DRIVERS' STRESS

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**Purpose:** The questionnaire-based study investigated whether the COVID-19 pandemic increased stress in busy truck drivers' jobs.
**Design/methodology/approach**: The sample of 239 drivers was examined in March-August, 2021.
**Findings:** The study revealed that most drivers were resilient to COVID-19-related stressors. Some stressors, such as age, seniority, recovering from COVID-19, and worsening family financial conditions, were found to have more impact on some respondents than others. Age and seniority were related to anxiety about increased occupational activities. Those whose economic conditions worsened were afraid of job loss. People who recovered from COVID-19 felt overworked more often than others and tended to be scared of safety on the road and being alone in the truck. They more often required psychological support.
**Research limitations/implications**: The study is based on a sample of drivers observed conveniently in 2021. Monitoring them in two or three waves is recommended to compare the impact of other processes that could affect responses.
**Practical implications:** The outcomes are valuable in practice twofold. Firstly, the knowledge is acquired directly from the drivers who proved to be pretty resilient to COVID-related issues; however, some were more sensitive than others. That means the drivers as an occupational group cannot be considered uniform. Some needed psychological support, and such cases should be identified at the enterprise level. Secondly, the results show that COVID-related stressors with other accompanying issues increase the impact on drivers' health.
**Originality/value:** The empirical results revealed the most significant stressors. They were justified by using several stress definitions and psychological theories, particularly the Conservation of Resources Theory. They can be considered in the drivers' management process.

**Keywords:** stressor, truck driver, COVID-19, economic conditions, support implications.

**Category of the paper:** research and conceptual paper.

## 1. Introduction

The COVID-19 pandemic caused enormous complications related to the road transport of passengers and goods. In the first phase of the pandemic announced in March 2020, the European borders were blocked by many trucks waiting for border crossing despite the Schengen zone regulations. As a result, drivers were exposed to coronavirus infections, accompanied by high uncertainty about its consequences. Many restrictions were imposed and introduced all over Europe. The most important included strict hygienic requirements (IRU, 2020), travel restrictions, often accompanied by quarantine requirements for cross-border travelers, border controls reintroduced within internal European Union borders, and heavy goods transport (Osińska and Zalewski, 2020). All those unprecedented events caused truck drivers many difficulties, primarily imposed on the COVID-19 occupational group due to transporting goods for considerable distances. While driving long distances, drivers interact with other people, which leads to a contagious corona effect.

The road transport industry is a human-related area of economic activity. Karanina et al. (2020) identified the main issues related to human capital in the transport industry. They identified three problems resulting from insufficient human capital in most road transport companies. They are: ignoring advanced technologies and tools for working with personnel, lack qualified and trained managers, and lack social and psychological support for employees. Such a picture has been confirmed in many studies (Kucharčíková and Mičiak, 2018; Zalewski, 2019). However, the pandemic, which started in 2020, enforced using the IT technologies in transport and consequently increased IT literacy among both drivers and office workers. At the same time, the number of tasks in transport has increased and, together with the risk of virus infection, has led to an increase in stress at work, particularly among drivers. Long-distance drivers experience many stressing situations related to their occupations. Many papers related stress to hours of service on-road (Jensen and Dahl, 2009) and work organization and sleep (Hege et al., 2019). Da Silva-Júnior et al. (2009) found that such factors as low educational level, use of stimulants, and wage-earning, as opposed to self-employment, increased the risk for depression among truck drivers. The age of over 45 was the protective factor. Van der Beek (2012) provided an exhaustive overview of drivers' duties on the road, emphasizing that they spend from 50% to almost 100% of working time behind the wheel, depending on the driver category. The result of heavy job conditions, dramatically observed at present, is the truck drivers' shortage experienced in Europe during the pandemic. The shortage of heavy goods vehicle drivers reached 400,000 across the whole EU (https://www.ft.com/…) and is associated with the aging, stress, and difficulties related with the job.

The paper aims to determine the areas of truck drivers' occupational activity in which the COVID-19 pandemic increased their stress. The paper's novelty lies in the original data obtained using a designed questionnaire in which drivers directly answered the questions related

to their stress or anxiety reactions to several potential factors. Furthermore, they were asked during the pandemic, often before vaccination, which allows revealing the most urgent aspects and effects of stress during pandemic. The study consisted in answering the following research questions:

RQ1. Are truck drivers vulnerable to the health, social, economic, and organizational disturbances related to the pandemic?

RQ2. What are the most critical stressors faced by drivers during the COVID-19 pandemic?

RQ3. Can the stress factors be explained from a psychological standpoint?

RQ4. What are the key indications for management in the road transport industry?

The remainder of the paper is organized as follows. In Section 2, the literature review was presented. In Section 3, the data and a questionnaire are described, while in Section 4, the empirical results are presented and discussed. In the last section, we conclude.

## 2. Literature review

The literature on drivers can be divided into publications related to stress and those on the COVID-19 pandemic.

The first strand argues that drivers' professional road transport performance is strongly linked to emotional stress, which is related to dynamic and often unpredictable situations. In particular, the relationship between emotional stress and drivers' reactions is significant. While the relationship between these variables is well described in the literature, mainly by Hebb's (1965) optimum activation theory, the content aspect of emotions such as anger, fear, positive feelings, and satisfaction has not yet been clearly interpreted. In general, drivers' emotional states arise from their extra-occupational lives and situations occurring on the road.

A stress study conducted in 1992 on a population of 318 drivers of a US trucking company indicated that truck drivers scored well above the comparative norm resulting from other occupations (Orris et al., 1997). The so-called Global Severity Index, as a single summary measure of psychological stress in the SCL 90-R indicated a T-score for drivers of 64.20. This group perceived significantly more daily stressful events than occupational groups in other industries. As a result, the researchers concluded that work stress was a health risk for the drivers studied.

Öz et al. (2010) investigated stress reactions, speeding, number of penalties, and accident involvement among different driver groups like taxis, minibuses, heavy vehicles, and non-professional drivers. The results of the empirical study revealed differences between other driver groups in terms of both risky driving behaviors and stress reactions in traffic.

Fort et al. (2016) found that specific socio-occupational categories figured significantly more often among exposed employees: professional drivers (PCS 64), skilled workers (PCS 61), private-sector intermediate administrative and commercial professions (PCS 46), and company executives (PCS 36). Truck drivers are by far the main category exposed to work-related road risk and had the largest number of work-related road accidents as reported by the *Rhône administrative département* of France. On the other hand, however, they are less at risk of road accidents than different occupational categories after adjustment to exposure duration (in hours or mileage), with a rate of 1.3 accidents per 100,000 km driven for work, compared to 8 for skilled construction workers and post and telecoms workers, around 12 for security agents and 18 for skilled workers in the metallurgy and mechanics sectors.

Useche et al. (2017) indicated that professional driving a truck or bus is highly demanding. Reducing stress levels and improving driver quality can be achieved through the use of infrastructure solutions. A study on the application of Bus Rapid Transit (BRT) conducted on a group of 361 Colombian drivers working in both traditional public transport and BRT companies indicated that the incidence of stress was highly correlated with a factor called job burnout. The results showed that BRT drivers perform significantly better concerning stress or job burnout than their counterparts working in public transport.

Tucker et al. (2018) investigated the interactive effects of three roles stressors on employee strain (psychological strain and sleep disturbances) and employee morale (job dissatisfaction and turnover intentions) among 443 Australian road transport and logistics workers. Regression analyses revealed significant three-way interactions among role overload, role ambiguity, and role conflict, showing that when both role ambiguity and role conflict were high, psychological strain, sleep disturbances, job dissatisfaction, and turnover intentions remained high, regardless of the level of role overload.

Montoro et al. (2018) point out that the monotony of the tasks performed in urban and intercity public transport is closely related to driver behavior. Furthermore, there are significant relationships between work-related factors and measures of stress, anger, and the impact of these factors on risk predisposition concerning, for example, traffic sanctions. Research has shown a clear relationship between driving experience, hourly driver intensity, and stress during transport processes.

Belzer (2018) investigated the relationship between road safety and pressure to complete transport tasks. While not confirming a cause-and-effect relationship, the results suggest that economic factors significantly influence the occurrence of truck road accidents. This conclusion can be indirectly related to the pandemic situation when transport companies influenced drivers in terms of delivery times due to numerous restrictions.

Musselwhite, Avineri, and Susilo (2021) pointed to essential changes observed in transport regarding pandemic-related conditions. One of these is a drastic reduction in human mobility, especially in the early phase of the pandemic. The authors cite data from Google (Google, 2021), according to which car use in the UK fell by 30% and bus use decreased by 76% between

March and December 2020. However, the authors conclude that many of these changes may be temporary, as behavioral norms and habits are harder to change than thought. It may also be that individual governments have not done enough to maintain these changes. The introduced restrictions, according to the researchers, encourage a shift towards more sustainable and healthy mobility on the one hand and increased use of public transport, mainly based on electromobility, on the other hand. Unfortunately, this does not apply to goods transport, which in its essence is the primary source of supply for citizens.

The behavior of drivers carrying out transport tasks both locally and internationally is also influenced by the World Health Organization (WHO) recommendations to all countries and participants in public and economic life. BBC, 2020 reminds us that restrictions differed much across the countries. As Dam et al. (2020) point out, the practice of total and partial blocking has been undertaken as an essential strategy to limit the spread of the COVID-19 virus among the populations of different countries. Moreover, individuals commuting to the borders of other countries were isolated, and quarantine was imposed on them.

During the pandemic, many ways of preventing contagion were introduced, in particular, hygiene and disinfection requirements and electronic forms of communication and document transmission. Road transport had to be implemented given the possibility of a complete breakdown of supply chains and the need to implement processes to distribute goods, especially essential goods. In addition, the requirements for widespread testing of truck drivers were a burden (IRU, 2021). These represent additional activities and require extra time to be taken into account in the drivers' existing work, which increases stress in certain situations.

Lemke et al. (2020) ask how truck or bus driving conditions during a pandemic affect driver stress and how to mitigate these impacts. Emerging evidence suggests that the COVID-19 pandemic exacerbates existing stressors and introduces new ones, potentially more significant implications on driver health and safety disparities. As COVID-19 exerts several multi-level stress elements on commercial drivers, syndemic symptoms may arise, which indicate substantial correlations of the Sars-Cov2 virus with mortality. The co-occurrence of ailments may also result in a deterioration in the level of road safety or the certainty of transport orders. The authors conclude that the effects of the COVID-19 pandemic on professional drivers cannot be adequately understood or analyzed in isolation from the endemic chronic stressors and health and safety disparities that characterize the profession. However, this will only be possible after post-data analysis due to the still too limited knowledge of the effects of the virus.

Road transport is a critical branch in delivery processes, especially where it is difficult to find a substitute in the form of other modes of transport (rail, inland waterway, air). In anticipation of health, including mental health, measures have been introduced for truck drivers in South Africa to access health care along the transport corridors of the sub-Saharan corridor. A study conducted (Lalla-Edward et al., 2018) clearly indicated that the introduction of such arrangements, which can provide *ad hoc* as well as structured assistance to transport drivers, significantly/ affects their well-being and productivity. Following the example of

medical facilities located in Western Europe, especially in motorway areas, it should also be recommended to introduce benefit models based on wireless communication and satellite systems allowing the driver to be in contact with the point of delivery of health services.

It is worth noting that COVID-19-related stressors were empirically considered from a more general perspective. Ermasova and Rekhter (2021) investigated how perceived vulnerability to COVID-19 at the early pandemic stages is related to perceptions of stress and accompanying health issues among different population groups. Their study found the top five stressors for the sample population: difficulties/problems with work, social media news, emotional issues, non-social media news, and financial matters. It shows that the stressors impacted female respondents more than male respondents. Also, young adults had higher mean values in the perception of emotional problems, family problems, difficulties/problems with work, and unemployment.

Graupensperger et al. (2022) examined associations between COVID-19-related stressors (i.e., job-related, financial-related, social/relational, and illness-related stressors) and indices of mental health and well-being in the initial phase of the pandemic (April/May 2020) while accounting for participants' pre-pandemic levels of these outcomes in January of 2020. They found that COVID-19-related stressors were generally stronger in earlier months and decreased linearly across the pandemic. They found that social/relational stressors were most strongly related to increased symptoms of anxiety/depression, and financial stressors were most strongly associated with decreased satisfaction with life.

## 3. Sample characteristic

Due to the occurrence of the pandemic and the maintenance of social distance, and other constraints occurring at a time of relatively low vaccination rates, it was challenging to conduct the driver survey and difficult to implement the study in its full scope. The main issues to solve were the definition of the target group and the possibility of making a structural division of the study group. Therefore, the focus was on the group of available drivers of professional trucks with a permissible weight above 3.5 T, which corresponds in most cases to heavy transport performed mainly in Europe and Asia.

The study was conducted between March and August 2021, based on a survey questionnaire containing 14 main questions, with in-depth questions used for four questions. A total of 239 respondents participated in the survey, including five women. Drivers answered the questions in online (203) and traditional (36) versions. The drivers filled in the questionnaires at the headquarters of transport companies and during their car park stopovers. They were informed about the aim and scope of the survey, the possibility of refusing to participate, and the complete anonymity of the data provided. The list of questions is shown in table 1.

**Table 1.**
*Questions and scale of observations*

| Question | Scale | Remarks |
|---|---|---|
| Gender | Nominal | |
| Age [in years] | Metric | |
| Seniority [in years] | Metric | |
| Destination of transport services | Ordered | Domestic/domestic and international/international |
| Did you suffer from COVID-19? | Nominal | Yes, no, I don't know |
| Were you on sick leave? | Nominal | Yes, no |
| Does the current pandemic impact the deterioration of the family's financial conditions? | Nominal | Yes, no |
| Feeling stress/anxiety | Likert (5) | Details in Table 2 |
| Impact of stress anxiety on health | Likert (5) | Details in Table 2 |
| Demand for professional support | Nominal | Yes, no, I don't know |
| What form of support do you need? | Qualitative | |
| Have your working conditions changed compared to before the pandemic? | Nominal | Yes, no |
| How have the conditions changed? | Qualitative | Details in Figure 4 |

Note: The Likert scale is defined as a five-point scale, allowing individuals to express how much they agree or disagree with a particular statement (Likert 1932; Jamieson 2004).

The structure of the respondents across age and work seniority is presented in Figure 1.

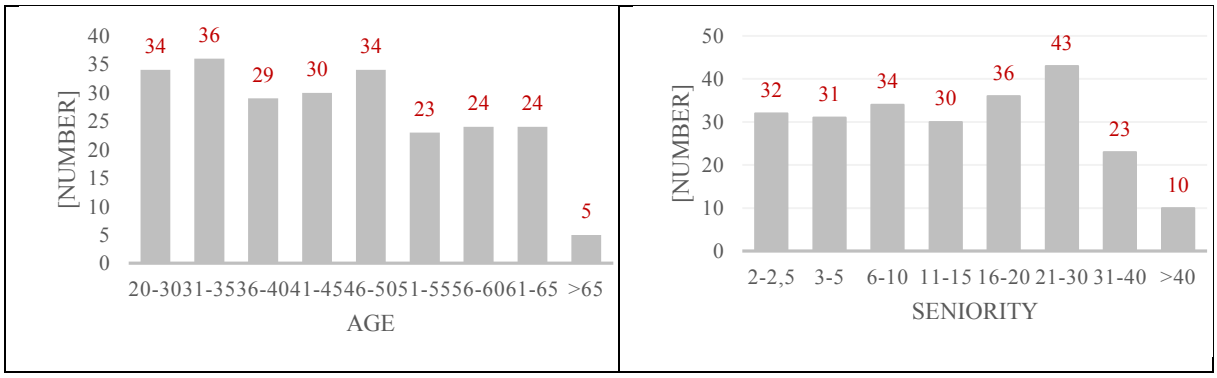



**Figure 1.** Age and seniority structure of the respondents [in years].

More than 140 respondents were over 40 years of age, representing nearly 59% of the respondents. At the same time, nearly half of the drivers had more than 15 years of professional driving experience, and almost 60% had over a decade. The average age was 44.21 years, while the average length of service was 16.36 years. Age and time of service are essential for studying drivers' behavior who have thoroughly familiarised themselves with the specifics of their tasks and working conditions in this profession. Thanks to their experience, they are able to regulate their emotions related to the stress associated with their occupation. It is in line with the strength and vulnerability integration (SAVI) model (Zacher & Rudolph, 2022), which states that development across the adult lifespan is accompanied by improvements in emotion regulation and declines in physiological flexibility. Due to these age-related changes, emotional well-being is expected to be higher among older (vs. younger) adults who experience no or only minor stressors. In contrast, more intense stressors should lead to lower well-being among older adults.

Furthermore, the initial analysis of the answers revealed that:

- The answers given by women did not differ from those provided by men.
- 56.1% of the respondents were involved in international transport and 28% in international and domestic transportation. This result suggests that many respondents had to face temporary border restrictions, detailed inspections, and operate under pressure to fulfill a transport task in a pandemic situation.
- When asked if they were infected with COVID-19, 154 respondents (64.4%) gave a negative answer, 67 respondents answered in the affirmative (28%), and the rest answered 'don't know.' The implication is that the drivers were trying to comply with the sanitary authorities' requirements and take care of their health in order not to endanger other people operating in transport.
- Only 49 respondents to the survey said that they had to take sick leave as a result of the illness and recorded absences from work.
- In response to the question on the impact of the pandemic on the deterioration of the living conditions of the driver's immediate family, the majority, i.e., 141 respondents (58%), said that the state had no impact on the deterioration of their material situation. At the same time, 97 people indicated that their living conditions had deteriorated due to COVID-19. One person had no opinion on this issue.

## 4. Results

The convenience sample indicated some potential factors of stress the truckers faced during the COVID-19 pandemic, which could have impacted their work. The assumed stress factors were socio-demographic primarily, such as age and seniority, COVID-19-related, i.e., sick due to COVID-19, sick leave, organizational, i.e., destination (driving routes), and economic, such as family financial conditions. The scheme of assumed relations is shown in figure 2.

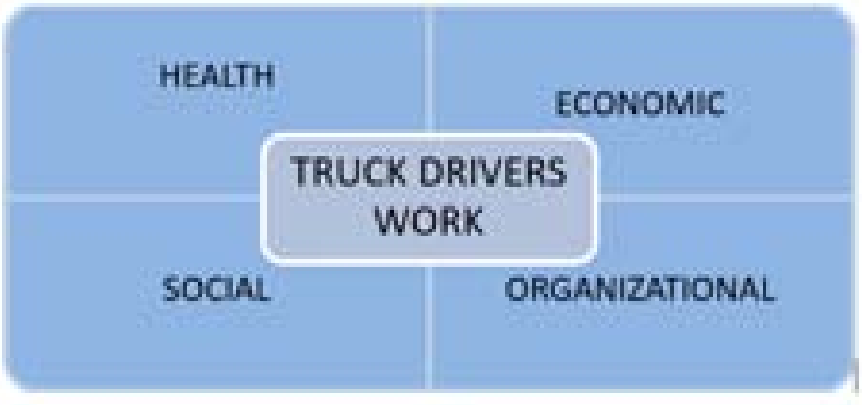



**Figure 2.** Relations between stress factors and truck drivers' work during the pandemic.

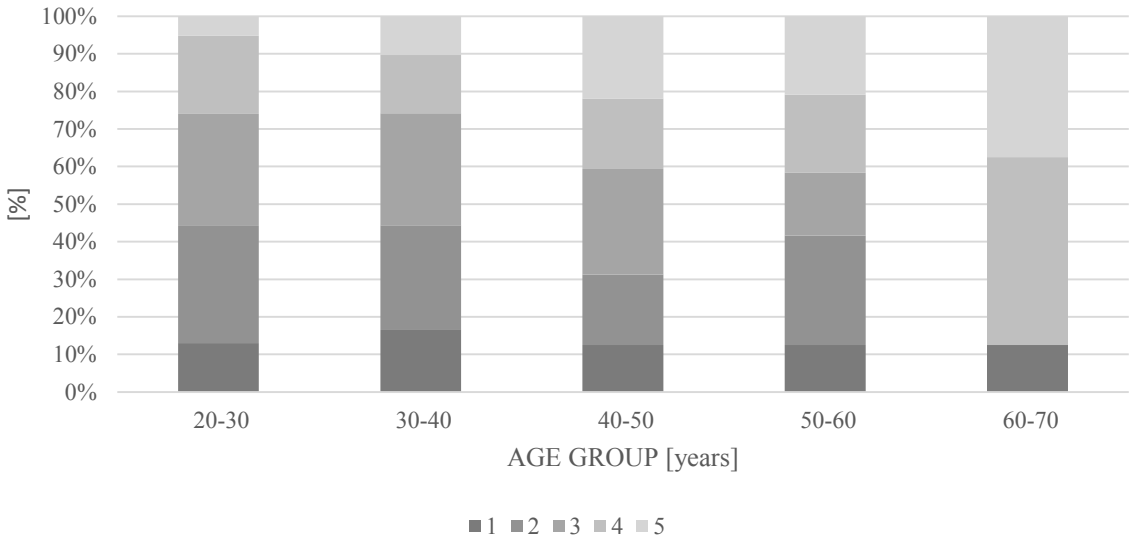
It is worth emphasizing that the majority of respondents (71-92%) showed no anxiety or slight stress increase related to the period of the pandemic. Therefore, it is necessary to focus on minorities, which indicates some issues. The first question was about anxiety accompanying the driver in different circumstances, and the second one referred to anxiety's impact on the driver's health. The percentages of the answers provided are shown in Table 2.

**Table 2.**
*Respondents' answers about COVID-19-related stress [in % (numbers)]*

| **Feeling stress/anxiety** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| I feared losing my job | 15% (37) | 36% (87) | 20% (47) | 18% (42) | 11% (26) |
| I had no one to turn to in order to talk about professional matters | 30% (72) | 44% (104) | 15% (35) | 9% (22) | 3% (6) |
| I felt anxious about overwork | 26% (61) | 40% (95) | 18% (42) | 14% (33) | 3% (8) |
| I felt anxious about the increasing difficulty of carrying out my job tasks (apart from driving) | 28% (66) | 38% (90) | 15% (36) | 15% (36) | 5% (11) |
| The greatest anxiety I felt was when I was alone on the road | 28% (68) | 35% (84) | 17% (40) | 11% (26) | 9% (21) |
| I felt other anxiety | 27% (64) | 34% (82) | 19% (45) | 14% (34) | 6% (14) |
| **Impact of stress anxiety on health** | **1** | **2** | **3** | **4** | **5** |
| It influenced the subjective willingness to work | 30% (70) | 39% (92) | 17% (41) | 10% (23) | 4% (9) |
| I began to experience physical ailments (headaches, back pain, others) | 35% (83) | 38% (89) | 11% (26) | 9% (21) | 7% (17) |
| Increased concerns about road safety related to driving | 35% (83) | 39% (91) | 11% (25) | 9% (22) | 6% (14) |
| The anxiety about whether I will be able to carry out my professional tasks properly has increased | 31% (73) | 41% (97) | 14% (32) | 10% (24) | 3% (8) |
| I do not feel like and do not want to meet and talk to anyone | 44% (104) | 34% (81) | 11% (25) | 6% (14) | 5% (11) |
| Sometimes I feel anxious, but it does not affect my health | 25% (60) | 34% (81) | 16% (38) | 16% (38) | 8% (9) |

While analyzing the data in Table 2, it should be noted that in most situations in which a road transport driver may have found himself, he did not feel anxious about the pandemic. Only in the case related to the fear of losing one's job did respondents indicate answers 4 'rather yes' in 18% and 5 'definitely yes' in 11%, making a total of 29% of responses. Responses to the question about the impact of pandemic stress on health had a similar distribution, with a predominance of responses 1 'definitely not' and 2 'rather not'. Drivers sometimes felt anxiety, but it did not affect their health; 16% of 'rather yes' responses and 8% of 'definitely yes' answers, respectively. The number of affirmative responses, corresponding to options 4 and 5 on the Likert scale, ranged between 11 and 29% for feeling stress/anxiety and 11 and 16% for the impact of stress on health. The answers suggest that a particular group of drivers was more vulnerable to stress and anxiety during the pandemic.

It is difficult to say what factors of increased anxiety were most important. Still, we found that stress related to difficulties with occupational requirements is growing with age and occupational seniority (Figure 3).




Note: numbers 1-5 correspond to the responses on the Likert scale.

**Figure 3.** The relationship between age and anxiety of not meeting occupational requirements.

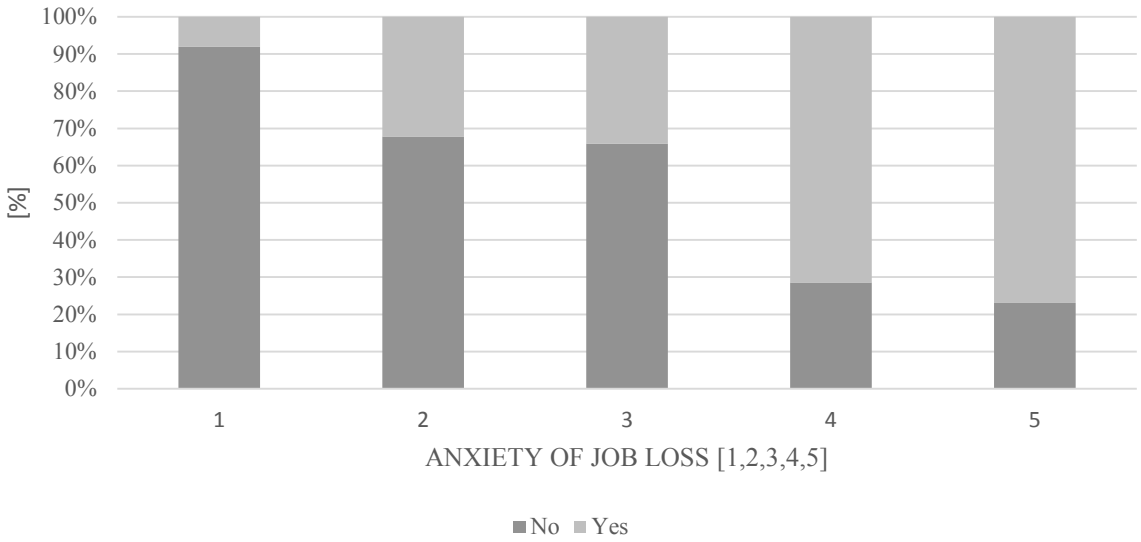
It is easy to notice that the highest share of answers '4' is for ages between 60 and 70, then for 20-30 and 50-60. The percentage of replies '5' increases with age. The Yule's phi coefficient equals 0.318, showing a relatively low association. Like age, the fraction of positive responses increased to seniority as a driver, with Yule's phi equaling 0.349. Yet, the overall nominal value of responses '4' and '5' was deficient and amounted to 13% of respondents.

Age and seniority were also important when answering the question about psychological support: 16 out of 30 'yes' replies come from drivers over 40 years old. It is not expected to organize individual support – only seven respondents out of 239 were interested in the personal approach. The respondents were almost equally distributed when saying if their work conditions changed during the pandemic: 100 said 'no' and 139 answered 'yes'. The destination was significant when drivers were asked about being overworked. The most overworked felt those driving on international routes. The same group indicated that their work conditions changed during the pandemic period.

People who recovered from COVID-19 felt overworked more often than others. Furthermore, they tended to be afraid of safety on the road and being alone in the truck. The group of drivers who recovered from COVID-19 changed their subjective attitude toward work and more frequently felt some physical and mental ailments, like headaches, spinaches, and feeling alone on the road. They more often required psychological support from the company and other individuals (Yule's phi 0.239). A similar impact was noticed in the case of respondents who were on sick leave. Among 49 respondents on sick leave, 18 suffered from COVID-19.

Another factor of stress and anxiety defined in the study relates to lowering financial conditions in the driver's family during the pandemic. Those who answered 'yes' (97 respondents) were more likely to be afraid of job loss (answer '4' was selected by 30 and

'5' by 20 persons, respectively) (Figure 4). The value of Yule's phi coefficient is the highest and amounts to 0.479.




Note: the answer 'no' corresponds to the case of not lowering financial conditions, and 'yes' means the opposite.

**Figure 4.** The relationship between worse financial conditions and anxiety of job loss.

Respondents indicated detailed issues related to the worsening of the job condition due to the COVID-19 pandemic (Figure 5). The group, who experienced the worse financial situation in the family due to the COVID-19 pandemic, was particularly vulnerable to a lack of direct talk about the job and actual job difficulties, like being overworked or being alone on the road. Their subjective attitude towards driving changed mainly among all subgroups of drivers being investigated.

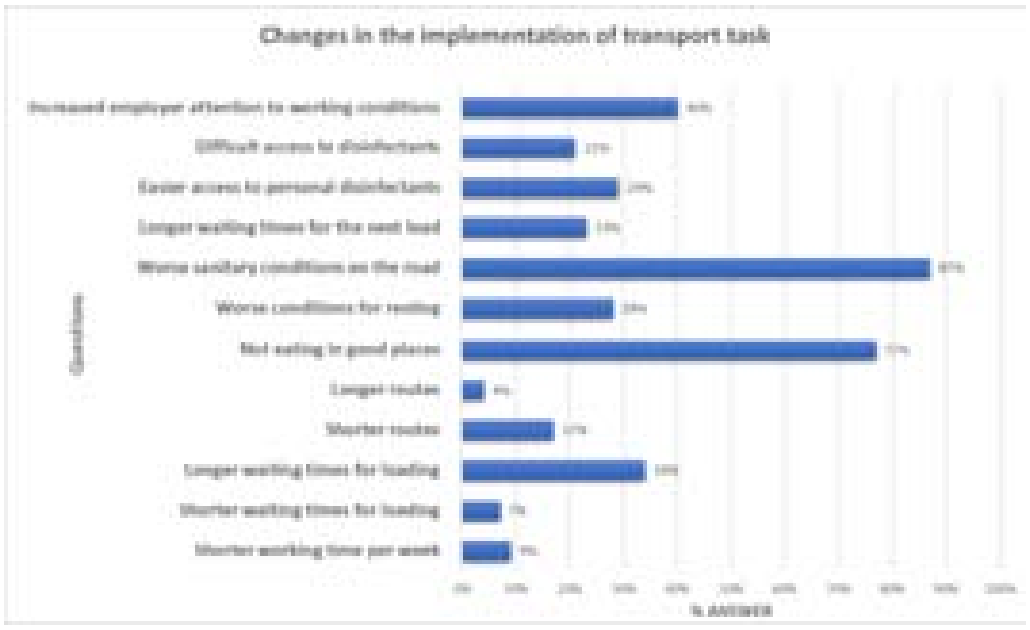



**Figure 5.** Respondents' answers on 'How have the conditions changed?' [in %].

The respondents indicated that the conditions of their work changed during the pandemic. They felt they could not meet occupational requirements and needed professional support. However, they did not feel depressed. This group mostly demanded psychological support, with Yule's phi coefficient equal to 0.311.

## 5. Discussion

In the study, we assumed that the COVID-19 pandemic had caused many negative consequences for truck drivers' physical and mental health since its very beginning. However, the results of the conducted research have shown that the relationship we assumed is not so obvious.

Respondents mostly denied that they felt increased anxiety during the pandemic period. Concern about the threat of losing their job was reported by 29% of respondents, while only 12% indicated that they felt anxious because they had no one to turn to for work issues. Anxiety about the increasing number of tasks was reported by 20% of respondents. Similarly, 20% of respondents also indicated feeling anxious on the road alone. Only 16% of the respondents (38 people) demonstrated a clear need for support, and only eight persons stated that it could be psychological support. These data suggest that despite the objectively high risk of falling ill, experiencing numerous difficulties related to longer waiting times for loading, increased discomfort due to problems in accommodation and eating places, and the threat of losing work or lack of orders, most respondents did not show extreme symptoms of anxiety and stress.

Our findings related to age as a factor of drivers' vulnerability confirmed that most drivers were pretty resilient to COVID-19-related stressors. However, in-depth cross-correlation analysis identified factors responsible for stress that affected a significant minority of respondents. Ages 20-30 and over 50 and long work experience were factors that increased anxiety about job loss, while age over 40 was a factor that increased the need for pandemic support. As the drivers' average age was 44.2 years and for seniority 16.36 years, the respondents were expected to overcome most stressors and achieve emotional stability. It should be emphasized that the age distribution among the examined drivers was 34 years for 25%, 44 for 50%, and 53 for 75%. It means that 25 percent of the drivers were over 53.

Overwork and deterioration of social conditions on the routes proved to be substantial stress factors, which mainly affected drivers working in international transport, traveling for long periods and over long distances. The incidence of COVID-19 was also a significant stressor. Although the number of drivers who became ill during the study period was only 18, they showed more physical and psychological complaints related to loneliness on the road and reported the need for psychological support. A significant proportion of respondents (40.5%) indicated that their family's material conditions deteriorated during the pandemic period.

These individuals were particularly vulnerable to hardship because they had experienced material problems. They missed talking about difficulties at work, feared difficulties fulfilling their professional obligations, felt overworked and lonely, and expected professional support.

The findings partly align with Zacher et al. (2014) results when concerns 20-30 years old. They showed that employees in their late 20s to early 40s had lower job satisfaction and higher emotional exhaustion than younger and more senior employees. In their study, time pressure and co-worker support fully mediated the U-shaped relationship between age and job satisfaction and the inversely U-shaped relationship between age and emotional exhaustion. In our study, drivers over 50 could be worried about new responsibilities related to electronic document exchange and other limitations due to the pandemic.

Ross (1998) provided the general framework for managing mental health in the work context. What relates to road drivers is high workloads and taking risks without making mistakes. Evidently, the latter is crucial for the drivers' and other road users' safety.

The empirical results can be discussed using several psychological theories. One is the stress definition proposed by Lazarus and Folkman (1984). They defined stress as a specific relationship between a person and the environment, which the person assesses as aggravating or exceeding his resources and threatening his well-being. Among our respondents, this transaction probably did not exceed their rich resources in such a way as to lead to very negative consequences.

Another explanation can be the process of coping with stress in the context of Stevan Hobfoll's Conservation of Resources Theory (COR) which used a combination of two other approaches: role theory (Kahn et al., 1964) and resource conservation theory (COR) (Hobfoll, 2001). In that context, Tucker et al. (2018) investigated the interactive effects of three roles stressors on employee strain (psychological strain and sleep disturbances) and employee morale (job dissatisfaction and turnover intentions) in road transport and logistics workers in Australia. They showed that the combinations of various stressors, their intensity, and duration create opportunities to alleviate or aggravate mental tension and employees' approach to work in the transport and logistics industry. Tucker et al. (2018) suggest that keeping stressors low does not turn an obstacle stressor into a challenge stressor for transport and logistics workers. This difference in findings may be due to the different occupations studied. The work carried out by managers and clerks in these studies differs much from the heart of transport and logistics work. Suppose transport and logistics workers' jobs are clearly defined, and there are no conflicts in reporting lines or responsibilities. In that case, the negative impact of a busy workload may be alleviated by psychological strain, sleep disturbances, job dissatisfaction, and turnover intentions.

The Conservation of Resources COR (Tucker, 2018) predicts that resource loss is a significant component of the stress process. In turn, the increase in these resources is presented as being more and more critical in the context of losses. As resources are also used to prevent resource loss, people are increasingly susceptible to the adverse effects of stress at each stage

of the stress process, which, if they persist, lead to rapid and significant spirals of losses. The COR theory is perceived as an alternative to assessment-based stress theories (Lazarus, 1990). It relies more on the environment's objective and culturally understood nature than on an individual's personal interpretation in determining the stress process. Therefore it is helpful in HR management in road transport. It turns the managers' attention to the loss of drivers' resources resulting from increased stress and burnout, enhancing the role of different forms of support such as peer support, support from superiors, support from the company, and psychological support.

## 6. Conclusions

The paper analyzed the truck drivers' occupational activity areas where the COVID-19 pandemic increased their stress. The sample of 239 drivers was examined in the period March-August, 2021. The study revealed that most of them were pretty resilient to COVID-19-related stressors. Some stressors, such as age, seniority, recovering from COVID-19, and worsening family financial conditions, were found to have more impact on some respondents than others. Age and seniority were related to anxiety about increased occupational activities. Those whose economic conditions worsened were afraid of job loss. People who recovered from COVID-19 felt overworked more often than others and tended to be scared of safety on the road and being alone in the truck. They more often required psychological support.

The study allowed answering the research questions. Firstly, truck drivers, in general, were not vulnerable to the health, social, economic, and organizational disturbances related to the pandemic. The group is resilient to stress because their occupation is among the most stressful professions. Furthermore, they are periodically examined by a psychologist to verify their workability. Secondly, the study allowed identifying several stressors such as age and seniority related to introducing new duties into the drivers' jobs. Also, some drivers were vulnerable to the aftermath of recovering from COVID-19 and worsening families' financial conditions. Those who drove on international routes were more inclined to change their working conditions. Thirdly, the psychological standpoint, particularly the Conservation of Resources Theory, helps explain the roots of the stress impact on the drivers' jobs. Furthermore, the results identified the crucial issues and allowed the formulation of several recommendations related to various forms of driver support.

This study has some limitations. Firstly, the sample is relatively small and limited to drivers employed in Poland. Therefore it is unclear whether drivers employed in other countries faced other problems than those shown in the paper. Following their individual experience, they could also express different needs related to working conditions. Secondly, comparing the results in time to observed changes in individual perceptions of the most urgent issues may be interesting.

Even so, this paper provides significant evidence that drivers were mainly resistant to increased stress caused by the pandemic and allows indicating several crucial stressors. As the results are very fresh, the study should be continued to evaluate changes in the medium and long-term horizon. Also, intertemporal and intercountry comparisons are necessary to formulate more general conclusions.

## Ethics

The Committee for Ethics in Research at The Faculty of Economic Sciences and Management Nicolaus Copernicus University approved the research based on decision no. 2/2022/FT.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

1. BBC (2020). *Coronavirus: the world in lockdown in maps and charts*. https://www.bbc.com/news/world-52103747, 10.01.2022.
2. Belzer, H.M. (2018). Work-stress factors associated with truck crashes: An exploratory analysis. *The Economic and Labour Relations Review, 29(2),* https://doi.org/ 10.1177%2F1035304618781654.
3. da Silva-Júnior, F.P., de Pinho, R.S.N., de Mello, M.T., de Bruin, V.M.S., & De Bruin, P.F.C. (2009). Risk factors for depression in truck drivers. *Social psychiatry and psychiatric epidemiology, 44*(2), 125-129. https://doi.org/10.1007/s00127-008-0412-3.
4. Dam, P., Mandal, S., Mondal, R., Sadat, A., Chowdhury, S.R., & Mandal, A.K. (2020). COVID-19: Impact on transport and mental health. *Journal Transport & Health, 19*, https://doi.org/ 10.1016/j.jth.2020.100969.
5. Ermasova, N. & Rekhter, N. (2021). COVID-19 stress, health issues, and correlations with different genders and age groups. *Journal of Gender Studies,* https://doi.org/10.1080/ 09589236.2021.1941815.

6. Fort, E., Ndagire, S., Gadegbeku, B., Hours, M. & Charbotel, B. (2016). Working conditions and occupational risk exposure in employees driving for work. *Accident Analysis & Prevention, 89,* 118-127, https://doi.org/10.1016/j.aap.2016.01.015.
7. Google (2021). *Community Mobility Reports*. https://www.google.com/COVID-19/mobility, 8.01.2022.
8. Graupensperger, S., Calhoun, B.H., Patrick, M.E., & Lee, C.M. (2022). Longitudinal effects of COVID-19-related stressors on young adults' mental health and well-being. *Applied Psychology: Health and Well-Being,* 1-23. https://doi.org/10.1111/aphw.12344.
9. Hebb, D.O. (1965). Drivers and the CNS. In: H. Fowler (Ed.), *Curiosity and exploratory behaviour*. New York: McMillan.
10. Hege, A., Lemke, M.K., Apostolopoulos, Y., & Sönmez, S. (2019). The impact of work organization, job stress, and sleep on the health behaviors and outcomes of US long-haul truck drivers. *Health Education & Behavior, 46*(4), 626-636. https://doi.org/10.1177/1090198119826232.
11. Hobfoll, S.E. (2001). The Influence of Culture, Community, and the Nested-Self in the Stress Process: Advancing Conservation of Resources Theory. *Applied Psychology, 50,* 337-421. https://doi.org/10.1111/1464-0597.00062.
12. IRU (2020). COVID-19 *Impacts on the Road Transport Industry – Executive summary*. https://www.iru.org/, 18.01.2021.
13. IRU (2021). https://www.itf-oecd.org/iru-report-covid-19-impact-road-transport-industry-update-june-2021, 11.11.2021.
14. Jamieson, S. (2004). Likert scales: How to (ab) use them? *Medical Education, 38*(12), 1217-1218. https://doi.org/10.1111/j.1365-2929.2004.02012.x.
15. Jensen, A., & Dahl, S. (2009). Truck drivers hours-of-service regulations and occupational health. *Work, 33*(3), 363-368. https://doi.org/10.3233/WOR-2009-0884.
16. Kahn, R.L., Wolfe, D.M., Quinn, R.P., Snoek, J.D., & Rosenthal, R.A. (1964). *Organizational stress: Studies in role conflict and ambiguity.* London: John Wiley.
17. Karanina, E., Kotandzhyan, A., Vershinina, N., & Davydova, J. (2020). Development and improvement of HR policy in the transport industry. *In E3S Web of Conferences (164,* p. 10018). EDP Sciences.
18. Kucharčíková, A, Mičiak, M. (2018). Human Capital Management in Transport Enterprises with the Acceptance of Sustainable Development in the Slovak Republic. *Sustainability, 10*(7), *2530.* https://doi.org/10.3390/su10072530.
19. Lalla-Edward, S.T., Matthewb, P., Hankinsc, C.A., Ventera, C.D. & Gomezc, G.B. (2018). Healthcare for truck drivers: Assessing accessibility and appropriateness of South African Roadside Wellness Centres. *Journal of Transport & Health 8,* 63-72. https://doi.org/10.1016/j.jth.2018.01.007.
20. Lazarus, R.S. & Folkman, S. (1984). S*tress, appraisal, and coping.* Cham: Springer.

21. Lazarus, R.S. (1990). Theory-Based Stress Measurement. *Psychological Inquiry 1*(1), 3-13. http://www.jstor.org/stable/1449700.
22. Lemke, M.K., Apostolopoulos, Y. & Sonmez, S. (2020). Syndemic frameworks to understand the effects of COVID-19 on commercial driver stress, health, and safety. *Journal Transport & Health, 18,* 100877, https://doi.org/10.1016/j.jth.2020.100877.
23. Likert, R. (1932). A Technique for the Measurement of Attitudes. *Archives of Psychology 140*, 1-55. https://legacy.voteview.com/pdf/Likert_1932.pdf.
24. Montoro, L., Useche, S., Alonso, F. & Cendales, B. (2018). Work Environment, Stress, and Driving Anger: A Structural Equation Model for Predicting Traffic Sanctions of Public Transport Drivers. *National Library of Medicine 15*(3)*,* https://dx.doi.org/10.3390%2Fijerph15030497.
25. Musselwhite, C., Avineri, E. & Susilo, Y. (2021). Restrictions on mobility due to the coronavirus COVID-19: Threats and opportunities for transport and health. *Journal of Transport & Health, 20,* 101042, https://doi.org/10.1016/j.jth.2021.101042.
26. Orris, P., Hartman, E.D., Strauss, P., Anderson, R.J., Collins, J., Knopp, C., Xu, Y. & Melius, J. (1997). Stress among package truck drivers. *American Journal of Industrial Medicine 31*(2)*.* https://doi.org/10.1002/(sici)1097-0274(199702)31:2<202::aid-ajim10>3.0.co;2-5.
27. Osińska, M., & Zalewski, W. (2020). Effectiveness of the Anti-Crisis Policy in the Period of COVID-19 Pandemic in the Road Transport Industry. *European Research Studies Journal, Special Iss. 2,* 40-57. https://doi.org/10.35808/ersj/1807.
28. Öz, B., Özkan, T., & Lajunen, T. (2010) Professional and non-professional drivers' stress reactions and risky driving. *Transportation Research, Part F: Traffic Psychology and Behaviour, 13*(9), 32-40. https://doi.org/10.1016/j.trf.2009.10.001.
29. Ross, F.M. (1998). Occupational bliss or occupational stress: Managing mental health in work contexts. *Journal of Occupational Science, 5, 3,* 155-160, https://doi.org/10.1080/14427591.1998.9686444.
30. Tucker, M.K., Jimmieson, N.L., & Jamieson, J.E. (2018). Role stressors in Australian transport and logistics workers: *Psychosocial implications, Safety Science, 109,* 12-19*,* https://doi.org/10.1016/j.ssci.2018.05.007.
31. Useche, S., Cendales, B., Alonso, A. & Serge1, A. (2017). Comparing Job Stress, Burnout, Health and Traffic Crashes of Urban Bus and BRT Drivers. *American Journal of Applied Psychology, 5*(1), 25-32. http://dx.doi.org/10.12691/ajap-5-1-5.
32. Van der Beek, A.J. (2012). World at work: truck drivers. *Occupational and environmental medicine, 69*(4), 291-295. http://dx.doi.org/10.1136/oemed-2011-100342.
33. Zacher, H., & Rudolph, C.W. (2022). Strength and vulnerability: Indirect effects of age on changes in occupational well-being through emotion regulation and physiological disease. *Psychology and Aging, 37*(3), 357-370. https://doi.org/10.1037/pag0000671.

34. Zacher, H., Jimmieson, N.L., & Bordia, P. (2014). Time pressure and co-worker support mediate the curvilinear relationship between age and occupational well-being. *Journal of Occupational Health Psychology, 19*(4), 462-475. https://doi.org/10.1037/a0036995.
35. Zalewski, W. (2019). Telematics systems in road transport. *Journal of Positive Management, 10*(1), 3-20. http://dx.doi.org/10.12775/JPM.2019.001.

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