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CONTENTS

Foreword	7
1. Paweł ANTONOWICZ, Liwia DELIŃSKA, Jędrzej SICIŃSKI, Piotr SLIŹ – Back to black? Macroeconomic analysis of hard coal sector in European Union 1990-2030	9
2. Alicja BALCERAK, Jacek WOŹNIAK – ICT-based recruitment and selection tools: the recruiters' perspective	35
3. Robert BALCERZYK, Jan ŽUKOVSKIS – Intellectual capital management of an organization surrounding VUCA	59
4. Joanna BARTNICKA, Tayyaba JAMIL, Patrycja KABIESZ – Safety culture in global research: a systematic literature review	73
5. Izabela BEDNARSKA-WNUK, Tomasz NOGA – Gender of the consumer and the role of organizations in purchasing decisions	85
6. Jolanta BIENŃKOWSKA – Virtual versus sustainable fashion: a systematic literature review	101
7. Agata BOROWSKA-PIETRZAK, Kateryna STOIAN – Changes in the structure of the CSR strategy of companies in the context of Russia's military invasion of Ukraine in 2022	127
8. Aneta BRZESKA – Financial and non-financial reporting of entities in the real-estate development segment – exploratory study	149
9. Dorota CHMIELEWSKA-MUCIEK, Bartłomiej ZINCZUK – Organizational culture conducive to the implementation of corporate social responsibility (CSR) in the enterprise	177
10. Karolina CZERWIŃSKA, Andrzej PACANA, Lucia BEDNÁROVÁ – Analysis of the level of sustainability with the application of KPIS	191
11. Zbigniew DREWNIAK, Agnieszka GOŹDZIEWSKA-NOWICKA, Urszula SŁUPSKA – The influence of remote work on ergonomics and work satisfaction	205
12. Szymon DZIUBA, Jacqueline ROWIECKA – Effect of diets of patients using dietary guidance services in south-western Poland on quality of life	221
13. Paweł FILIPOWICZ – User as a source of the innovation based product value	233
14. Grzegorz GLISZCZYŃSKI, Agnieszka SUROWIEC – Impact of the Covid-19 pandemic and the inflation crisis on the financial condition and expenditure structure of Poles	253
15. Stanisław HOŃKO, Marzena STROJEK-FILUS, Katarzyna ŚWIETLA – Professionalization of the accounting profession: opportunities and threats related to certification. Evidence from Poland	279

16. Malgorzata HORDYŃSKA, Joanna FURMAN, Jakub KOCJAN, Tomasz TABIN, Bartłomiej KUKLA, Nicolas BACIA, Dominika KULEJ, Klaudia MIESZCZAK-KUKLA, Bartłomiej STEPIEŃ, Dawid WICHARY – Improving medical processes in healthcare facilities in Poland	297
17. Leszek KAZMIERCZAK-PIWKO, Piotr KULYK, Adrianna DYBIKOWSKA, Piotr DUBICKI – Sustainable consumption among children in the food market	323
18. Artur KISIOŁEK, Marcin GURTATOWSKI – TUNA organisational environment and the needs of members of a co-opetition network, using the example of construction companies associated in the “stropy.pl” organisation	333
19. Kamila KOWALIK, Izabela BAGIŃSKA – The SWOT-TOWS analysis as a tool for quality management for an enterprise with PKD 85.59b – extracurricular forms of education	351
20. Łukasz Jarosław KOZAR – Toward green social enterprises: identifying key areas of greening and future research directions	363
21. Piotr KULYK, Leszek KAZMIERCZAK-PIWKO, Adrianna DYBIKOWSKA, Piotr DUBICKI – Sustainable consumption among children in the aspect of waste management	385
22. Malgorzata MALEC, Lilianna STAŃCZAK – Employees’ job satisfaction and its impact on management processes at the KOMAG Institute of Mining Technology	397
23. Iryna MANCZAK, Justyna DĄBROWSKA, Volodymyr MOROZ – Experts’ perceptions of the organisation’s stakeholders – semantic field analysis	415
24. Anna MARYNIAK, Paweł KLIBER – Resilient chains and chain shortening – trade exchange perspective	431
25. Katarzyna MAZUR-WŁODARCZYK, Katarzyna ŁUKANISZYN-DOMASZEWSKA, Elżbieta KARAŚ – Craftsmanship as a development potential of the region - a case study of craftsmen from Opole Silesia (Poland)	449
26. Larysa MOSORA, Michał MOLENDĄ, Vitaliy TOLUBYAK, Sviatoslav KIS, Volodymyr OLENYUK – The role of the state in the formation of migration attractiveness – example of Ukraine and Poland	471
27. Andrzej PACANA, Karolina CZERWIŃSKA, Peter STOLARIK – Analysis of the implementation of the concept of sustainable development using the indicator method	483
28. Rafał PITERA – Verification of the effectiveness of discrimination models for forecasting bankruptcy of enterprises	497
29. Joanna ROSAK-SZYROCKA, Krzysztof KNOP – Sustainable development universities: key initiatives and impact on student awareness and engagement	513
30. Mariia SKULYSH, Antoni WILIŃSKI, Artur KOZŁOWSKI – The situation in the fight against the pandemic in Ukraine just before the war was improving	529
31. Marzena STROJEK-FILUS, Melania BAŁ, Andrzej BAŁ – Green reporting in the perception of reports preparers. Evidence from Poland	555

32. Malgorzata SZTORC, Konstantins SAVENKOV – Shaping the digital potential of the large enterprise sector following the implementation of the European digital decade strategy	585
33. Beata TARCZYDŁO, Joanna MIŁOŃ, Jerzy KLIMCZAK – Experience branding in theory and practice. Case study	617
34. Beata TARCZYDŁO, Joanna MIŁOŃ – Stakeholders’ expectations and experiences regarding school events. Results of research	637
35. Dorota TENETA-SKWIERCZ, Hanna SIKACZ – Corporate governance in the context of ESG issues in ICT companies in Poland – results of surveys	655
36. Daniel TOKARSKI, Anna DĄBROWSKA – The impact of logistics and marketing customer service on courier services	673
37. Daniel TOKARSKI, Łukasz ŁUCZAK – Optimization of logistics processes in the sustainable development of manufacturing enterprises	683
38. Daniel TOKARSKI, Dorota WOLAK – The impact of logistics and marketing customer service on e-commerce	693
39. Jerzy Witold WIŚNIEWSKI – An econometric model of household electricity consumption. A case study of Poland	705
40. Radosław WOLNIAK, Wies GREBSKI – Smart biking and traditional biking	717
41. Radosław WOLNIAK, Wies GREBSKI – The five stages of business analytics	735
42. Radosław WOLNIAK, Bożena GAJDZIK, Wies GREBSKI – The implementation of Industry 4.0 concept in Smart City	753
43. Piotr WRÓBEL – Implementing full-time remote work in the IT sector: consequences and solutions	771
44. Olga ZIEMIŃSKA – Assumptions of the concept of a phase model of an infrastructural project implemented on this basis of Yellow FIDIC conditions of contract	793

FOREWORD

Presented number of Silesian University of Technology. Scientific Papers. Organization and Management Series. Contemporary management. Presented papers contain result of researches conducted by various universities from Poland. 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: economics, information management, intellectual capital management, safety management, human resource management, Corporate Social Responsibility, sustainability, quality management, the impact of Covid-19 pandemic on management, innovation management, healthcare management, logistics, marketing, Industry 4.0 and Smart City.

Radosław Wolniak

BACK TO BLACK? MACROECONOMIC ANALYSIS OF HARD COAL SECTOR IN EUROPEAN UNION 1990-2030

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Purpose: The purpose of the article is to present the results of a PEST analysis of the legal, economic, social and technological determinants of hard coal market development in the European Union from 1990 to 2030.

Design/methodology/approach: The research process was carried out with the use of four methods: analysis and synthesis (1) critical review of the literature (2), statistical techniques (3) and an industry case study (4).

Findings: Detail regulatory (legal), economic, social (socio-cultural) and technology variables affecting the hard coal market have been identified. All the factors examined exhibited a destimulating effect on the development of the market, from the perspective of the entities operating on the hard coal extraction and utilization market in the European Union. The most pronounced negative effect stems from the social factors. The impact of the legal and economic determinants is of similar magnitude, whereas technological changes show the lowest potency in this regard.

Research limitations/implications: Dynamic geopolitical changes and high susceptibility to interventionism can significantly affect the deviations of point forecasts in the pest coal industry in the long run.

Practical implications: PEST analysis is used to assess the development of economic sectors regardless of the industry life cycle phase. It can also help determine a given industry's life cycle phase and its future migration trends in practice.

Originality/value: The originality of this article lies in the employment of the quantification of macroenvironmental areas significantly affecting the industry, using an authorially modified PEST-based analysis.

Keywords: coal market; hard coal trade; economy of fossil fuels; PEST analysis.

Category of the paper: Research paper.

1. Introduction

The hyper-turbulent economic environment is shaping the functioning of many sectors of the economy in the European Union. The geopolitical situation associated with the conflict in Europe has driven the COVID-19-pandemic-related problems of broken supply chains to persist. It has also generated a state of affairs in which actions are being taken in the legal, economic, social and technological dimensions to accelerate the regulatory efforts and policies aimed at the search for alternative energy sources. This is accompanied by a change in the way hard coal, which once constituted a key factor in Europe's energy security and today is still of no small importance to EU industry and heating, is perceived. What is more, the uncertainty with regard to the price and availability of an interim fuel, i.e., natural gas, has been intensifying discussions on the future of hard coal and strategies for the sector in coming years.

The research problem was formulated into a question of the following wording: What are the main legal, economic, social and technological determinants of hard coal market development in the European Union between 1990 and 2030? The structure of the research problem, in terms of the areas studied, refers to the assumptions of the PEST analysis, which predetermined the shape of the research questions (RQ) and the main objective. The implementation of the method of diagnosing the PEST environment for the assessment of this sector also determines the originality of this study.

- RQ1: What changes in the legal framework governing the mining, transportation and processing of hard coal have affected and may affect the functioning of the hard coal market in the European Union?
- RQ2: Which economic factors have determined the development of the hard coal market in the European Union most heavily?
- RQ3: Which social factors should be addressed, and what is the impact thereof on the development of the hard coal market in the European Union?
- RQ4: What is the relevance of technology in the context of hard coal mining and processing in the European Union?

The structure of the research questions has delineated the main objective of the article, which is to present the results of a PEST analysis of the legal, economic, social and technological conditions affecting the development of the hard coal market in the European Union from 1990 to 2030. The article aims to provide knowledge of the factors which have shaped the hard coal market, as well as the potential significance thereof in the future. In order to implement a research problem and objectives formulated as such, the methods of literature review and PEST analysis were used.

In summary, the main axis of this article is aimed at an attempt to assess the current state, forecast the future state and identify potential challenges to the development of the hard coal market in the European Union. The Authors also draw attention to the fact that the originality

of this article lies in the use of highly operationalized PEST analysis, incorporating an economic perspective on problem solving and challenge assessment within the hard coal market. The economic dimension of the assessment can facilitate identification of the coal market transition supporting potentials and limiting factors, taking the interdisciplinary nature of the issue under study into account.

The article is organized into 4 parts. The first outlines the theoretical background to the research problem formulated, to establish the current state of knowledge. The methods section presents the methodology adopted and the structure of the data used in the PEST analysis. Part 3 presents, and comments on, the partial results for the legal, economic, social and technological dimensions. The final section (discussion) elaborates on the results obtained, while the conclusion presents the factors likely to affect the sector examined in the longer term, i.e., after 2020. Study limitations and directions for further research have also been outlined.

2. Literature review

The COVID-19 pandemic (Galaś et al., 2021; Wang et al., 2022) and the conflict in Ukraine have generated a set of exogenous factors sharply affecting the operation of the energy sector (Nerlinger, Utz, 2022a). This applies to both the global perspective (Guenette et al., 2022; Khudaykulova et al., 2022), as well as the functioning of companies within the energy sector itself (Nerlinger, Utz, 2022b). Following the COVID-19 pandemic (2020-2022), a global cost-of-living crisis, characterized by rising levels of energy poverty, has emerged (Benton et al., 2022). Currently, as of February 24, 2022, the war in Ukraine has been generating a scenario in which the risk of energy poverty appears to be increasing, as the Russia-Ukraine conflict affects both the conventional and renewable energy markets (Umar et al., 2022). Moreover, the high energy and food prices pose a direct threat to human security, in the context of post-pandemic inflation and limited fiscal capacity, particularly among low-income and vulnerable populations in all economies (Benton et al., 2022).

The rationale presented here renders it necessary to examine the determining factors of selected energy sectors in EU countries for years 2020-2030, using data from 1990 onwards. The hard coal sector is, in the Authors' opinion, a sector requiring such analysis. Coal extraction in the European Union countries, particularly in countries such as Poland and the Czech Republic, historically constituted a key branch of the economy. The literature review made it possible to determine that, according to the current state of knowledge, there is a shortage of research in this sector using retrospective analysis (past) and an attempt to assess the shaping of trends in the future. In addition, no one has previously assessed this sector using PEST analysis, so the approach proposed by the authors will be pioneering. The analysis of the European Community's coal sector determinants is of particular importance, as it fills, at least

in part, the cognitive gap regarding the paucity of publications outlining the directions of coal sector development through adoption of multiple evaluation criteria. To be more precise, the article focuses on presenting the legal, economic, social and technological conditions affecting the development of the hard coal market in the European Union in the period 1990-2030, using PEST analysis. The rationale behind the employment of PEST analysis stemmed from the studies of the literature on the subject, which revealed that the context of hard coal market operation is linked to the areas of: legal and political regulation (See: Hámor, 2004; Brauers, Oei, 2020), economics (See: Dorian, Humphreys, 1994; Anderson, 1995; Manowska et al., 2018), sociology (See: Ponomarenko et al., 2016; Mancini, Sala; 2018; Manowska et al., 2018; Yousefian et al., 2024) and technology (Shoko et al., 2006; Allen, 2012; Kaczmarek et al., 2022).

3. Materials and methods

The research process was carried out using four methods: analysis and synthesis (1) critical review of the literature (2), statistical techniques (3) and industry case study (4). Conventionally in science, the case-study method is most often implemented to assess unit enterprise cases (e.g., a single entity), but its potential in sectoral analyses should be likewise emphasized (Lindgreen et al., 2021). The overarching goal of the study was achieved by means of a PEST-type macroeconomic environment analysis technique. The name (PEST) is an acronym referring to four preeminent sources of variability flowing from the downstream environment, namely the political, economic, social and technological spheres (Sammut-Bonnici, Galea, 2015). The result of the PEST analysis provides a diagnosis of the most important spheres of the environment which, in current as well as future terms, will require appropriate strategic adjustments to the object under study. This method is widely recognized in both the scientific as well as the practical domain, owing to its universality and timelessness. The solution was first proposed by F. J. Aguilar, who suggested that the approach provides an apt starting ground for scanning the business environment and the forces piling up within it (Aguilar, 1967). The PEST model also serves as a complementary reinforcement of other strategic analysis methods, such as SWOT analysis and M.E. Porter's five forces model. Its versatility is practically unlimited – the method shows high application value in terms of studying entire economies, sectors (emerging as well as declining), business entities, nonprofit and sports organizations (Antonowicz, Jedel, 2015), as well as individual organizational units, as exemplified by, for instance, its successful implementation in the study of the academic library environment (Cox, 2021). Inherent in the process of PEST-based diagnosis is the use of 'brainstorming', which is particularly suitable when determining and listing the factors within a given sphere of the environment, including the associated risks (Butryn et al., 2015).

The analysis of the coal sector, carried out by the Authors, followed a hybrid (i.e., facilitated by other research methods and techniques) implementation schedule for each phase of the PEST technique. The general course of this process is presented in Table 1.

Table 1.

The course of the implemented PEST-model-employing research on the hard coal sector - proposed hybrid method

PEST analysis phase	Phase description	Phase objective	Accompanying research methods and techniques in a given phase		
			Literature analysis	Brainstorming	Statistical techniques
1.	Identification of the most relevant factors within each area, i.e., the political, technological, social and economic spheres.	Compilation of a list of the most critical forces of influence in the coal sector, within each PEST area.	Yes	Yes	No
2.	Assessment of the strength and trend in the identified forces affecting the coal sector.	Each of the forces designated was assigned an appropriate intensity of impact (-5;+5), followed by establishment of long-term trends within the four PEST areas.	Yes	Yes	Yes
3.	Assessment of the weights of influence for individual forces.	Each of the forces designated was assigned an appropriate weight within the area plane, factoring in the fact that the weight ratings for a PEST i-area must meet the condition: $\Sigma=100\%$	Yes	Yes	Yes
4.	Visualization of the results, estimation of the gap in the sector's potential, and proposed strategic diagnosis for the sector through 2030.	Demonstration of the long-term trends and regularities in the impact of environmental forces on the coal sector, including assessment of shortage in the industry's potential.	Yes	No	Yes

Source: own elaboration.

In the first phase, a literature review was carried out to identify the most relevant environmental forces affecting the sector within specific areas, i.e., the political, technological, social and economic spheres. The team of Authors, through brainstorming, reduced the initial list of forces to those of greatest relevance, taking the expert opinions presented in specialized industry reports on hard coal into account. Once the environmental forces were identified and reduced, each force was assigned an appropriate direction and intensity of impact on the sector under study (-5; +5). This process was carried out in two rounds and backed up by a re-analysis of the literature, including a review of the industry reports factoring in the industry opportunities and development risks, as well as a review of European statistical data from 1990 onward. The first round of designating the forces of influence was carried out by each of the Authors in the form of blind analysis, as an effect of the expert evaluation and literature review. In the second round, the final impact intensity rating assigned to a given force entailed the

arithmetic mean of all the Authors' indications developed via blind analysis, which was ultimately confirmed through renewed brainstorming. The third stage was characterized by a procedure similar to the second - here, however, the subject of estimation and averaging were the weights (relevance ratings) of a given force within each sphere of the PEST analysis. As per the methodology macroenvironment environment analysis techniques, the sum of the weights for a given area needed to be equal to 100%. In this phase, the formulation of weights was coupled with other research methods, due to the need to examine coal-sector-related industry reports and publications of a statistical nature. The final stage, which synthesized the results of the preceding phases, entailed graphical presentation of the long-term development trend for all identified forces, estimation of the gap in the industry's potential, and diagnosis of strategic implications for the sector through 2030.

4. Results

4.1. Regulatory (legal and political) determining factors

State interventionism is defined as the main state administrative function in the shaping of economic order taking social expectations into account (Kraśniewski, 2018). Based on the literature study, the following premises were factored into the summative assessment of Variable 1A: EU member states' implementation of national energy sector development programs (e.g., in Poland: *Strategia na Rzecz Odpowiedzialnego Rozwoju* [Strategy for Responsible Development], 2017), EU member states' internal policies regarding coal mining regulations and limits (See: Szczerbowski, 2018), the decreasing volume of coal mined in Europe and Poland (Eurostat, 2023d), the declining number of coal-mining countries within the EU (Eurostat, 2023d), the efforts to seek energy sources alternative to hard coal, the realization of European decarbonization goals by 2050 (See: Searle, Christensen, 2018) and The European Green Deal (Pleißmann, Blechinger, 2017a, 2017b). It should be noted here that Poland is the main hard coal miner in Europe (Eurostat, 2023d), but the volume of mining in million tons has decreased fourfold between 1980 and 2020 (Frużyński, 2009; Geoportal, 2023). The summative assessment of the area in question, presented in Table 2, is the resultant of the incorporation of the aforementioned criteria. Noteworthy is the change in perception, from the perspective of the coal sector of 2000-2010, caused by the limits on hard coal mining in the European Union, and the restrictions on hard coal im-ports into the EU, particularly considering year 2022 (embargo on coal from Russia) (Eurostat, 2023a). Summing up, the regulatory perspective of European Union (EU) countries exerts strong influence on the coal sector. In recent years, the EU has been laying emphasis on greenhouse gas emission reduction, pushing the member states to reduce emissions from fossil fuel-based, primarily coalfired, power generation.

Table 2.

Regulatory (legal) market development determinants in the coal mining and coal power generation sector – weighted assessment of 1990-2030 market changes in the European Union

No.	Regulatory (legal) determinants of coal mining and coal power generation market development	WEIGHT		a RATING (from -5 to + 5)				
				b weighted RATING (product of weight and rating)				
				1990	2000	2010	2020	2030
1a	Level of state interventionism (mining restrictions, embargoes, regulated prices, subsidies and coal purchase aid)	17.50%	a	3.00	2.00	0.25	-1.00	-2.25
1b			b	0.53	0.35	0.04	-0.18	-0.39
2a	Energy mix - the role of hard coal substitutes	26.25%	a	2.00	0.75	-1.25	-2.50	-3.50
2b			b	0.53	0.20	-0.33	-0.66	-0.92
3a	Geopolitical determining factors of hard coal distribution (import/export disruptions, regulatory framework for the operation of coal depots)	18.75%	a	-0.25	0.00	2.25	0.25	-2.75
3b			b	-0.05	0.00	0.42	0.05	-0.52
4a	CO2 emission rights market (free movement of rights, level of restrictions, risk of speculation)	20.00%	a	0.00	-1.00	-2.00	-3.25	-4.25
4b			b	0.00	-0.20	-0.40	-0.65	-0.85
5a	Level of intra-Community law harmonization - the level of autonomy in the formation of Member States' energy policies	17.50%	a	4.00	2.50	0.75	-2.00	-3.25
5b			b	0.70	0.44	0.13	-0.35	-0.57
TOTAL		100.00%	-	1.70	0.78	-0.13	-1.78	-3.25

Source: own elaboration.

The expert assessment of Variable 2A incorporated such factors as the global growth of energy consumption (both European and worldwide), and the increase in the prominence of alternative energy sources in the mix (oil, nuclear energy, natural gas, renewable energy). To be more precise, it is worth noting the significant increasing the role of wind power production in the European Union since 2015 (See: Katić et al., 2012). The resultant assessment structure clearly indicates that a change in the assessments, from the coal sector's perspective, is discernable after 2000. The rationale behind the negative values in Table 2 primarily stemmed from the drop in the share of coal in the energy mix, both in Europe and globally (2000-2020). “The structure of primary energy carrier consumption is largely determined by its availability, understood both as the possession of own resources as well as the potential to obtain resources on world markets” (Czaplicka-Kolarz, Pyka, 2007). It is worth noting that each EU country is free to create its own energy mix. Hard coal resources in Poland – the main extractor of this resource in Europe – can provide energy security for several decades, hence hard coal and lignite are recognized as the country's security stabilizer and is disposed to play an important part in the national (Polish) energy mix (Kielerz, Porzerzyńska-Antonik, 2019). To sum up, the energy mix plays a key role in the issue under study. Increasing the share of renewable energy sources, such as wind and solar, can support greenhouse gas emission reduction as well as strengthen energy independence. It is worth emphasizing here that a more sustainable energy mix requires investment in new infrastructure, advanced technologies and smart energy systems.

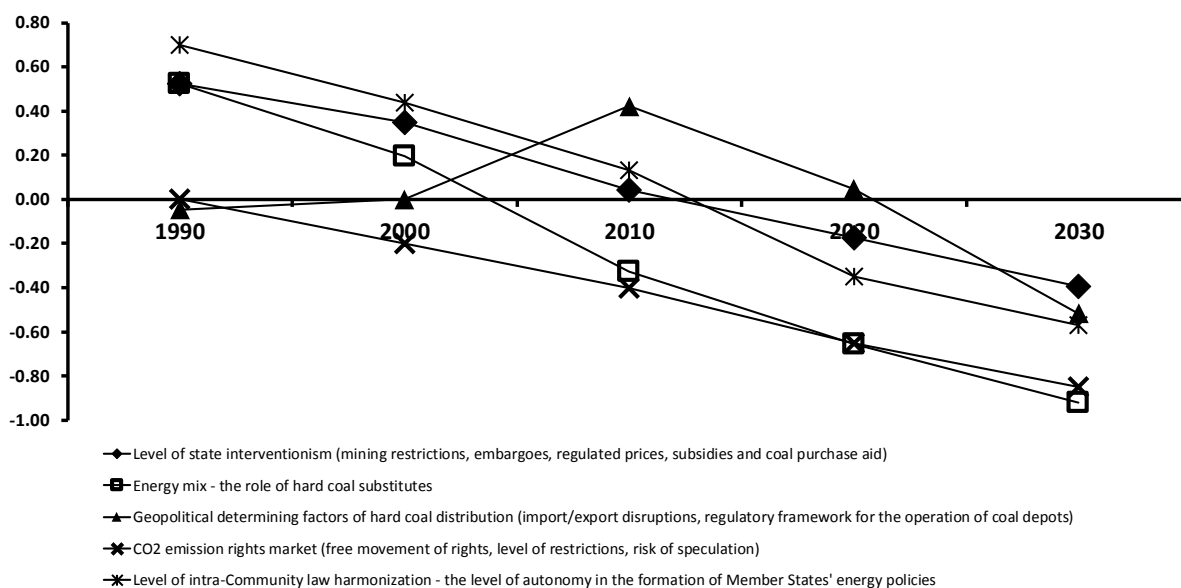


Figure 1. Weighted rating of the variables affecting the regulatory (legal) environment of the EU coal mining and coal power generation market in 1990-2030.

Source: own elaboration.

The geopolitical outlook in European Union countries exerts strong influence on the coal sector. Decisions on energy policy and energy supply within the EU, but also on the import and export of raw materials are largely determined by strategic factors. It should be noted here that, in terms of hard coal, European countries used to rely heavily on imports of this raw material from Russia. This has generated efforts to diversify the sources of energy, in order to reduce dependence on the imports from Russia. This section of the assessment focuses on the determining factors of coal distribution, from the perspective of the geopolitical premises determining the functioning of the coal sector in Europe. The experts' assessments were positive until 2020, which was related to the increase in coal imports to EU countries between 1990 and 2020, from 8.49 million tons (1990) to 43.7 million tons (Eurostat, 2023c). It is also worth noting that the positive assessments during the period in question were associated with the volume of hard coal exports by EU countries (Eurostat, 2023b). Conversely, the main post-2020 factors taken into account in the experts assessment included: the war in Ukraine and the embargo on the import of coal from Russia to EU countries, as well as the internal regulations of member states on restrictions on trade in raw materials from Russia. In sum, the factoring in of the geopolitical perspective into the analysis carried out was crucial considering the coal sector under study. This is supported by such premises as the implementation of the EU and member countries' energy policies, the supply of energy, but most importantly the efforts to protect the climate and the search for alternative sources of energy located outside the countries covered by the embargo on imports.

This section of the assessment primarily covered two parameters, the first of which entailed the implementation degree of EU CO₂ Emissions Trading System phases in years 2005-2021. According to Kaczyński et al., 2019, starting in 2021, phase 4 began, which has affected the

negative assessment for 2020 and 2030 (See: Table 2). Moreover, the assessment incorporated the current price of CO₂ emission rights (up to 2020) (IBISWorld, 2022) and the projected increase in the EU ETS price of CO₂ emission allowances. It is worth noting here that in 2023, the price per tCO₂ emission exceeded 100 euros. From the coal sector perspective, the measures to reduce CO₂ emissions, as well as the increase in the price of EU-ETS, have caused the industry to be associated with negative assessments (since 2000) in the period under review. From the perspective of the coal sector in Europe, the implementation of CO₂ emission regulations and the EU-ETS has made coal-fired generation of electricity less profitable, whereas the cost of emissions has been included in the cost of energy production. This means that the implementation of formulated climate targets within the EU (see, e.g., climate neutrality by 2050, decarbonization) results in a need to reduce the coal sector's CO₂ emissions and abandon the use of coal in the long term.

The sphere concerning the level of intra-EU harmonization of laws exerts significant influence on the coal sector, particularly within the context of hard coal mining and coal use as a raw material for generation of electricity. Intra-Community regulations cover a number of aspects, such as environmental protection (CO₂ reduction) and the external/internal trade rules. The ongoing efforts to harmonize the EU law are causing the demand for hard coal in the community to decrease significantly. This has been expressed by the hard coal mining parameters, the number of coal-producing countries, but also the volumes of coal imports and exports. One of the effects of legislative harmonization are the directives and regulations on greenhouse gas emissions, resulting in lower profitability of hard coal in relation to other energy sources (such as gas). According to the Authors, the EU directives on environmental protection and CO₂ emission reduction, but also the search for alternative (renewable) sources of energy, have contributed to the post-2010 decline in the demand for investment in the coal sector.

4.2. Economic determining factors

The economic environment has a nonnegligible impact on the hard coal sector in Europe. Despite the fact that production of coal is already at a marginal level in most EU countries (Grudziński, 2019), and it is not uncommon for the actors in this sector to be offered various central-budget financial respiration mechanisms, the sector remains vulnerable to the forces flowing from selected economic spheres. This is due to the multi-dimensional relationship between hard coal and other goods (substitutes and complementary goods) as well as the direct impact thereof on the formation of energy derived demands. The hard coal sector remains an important employer, not only regionally but also nationally - which is particularly the case in countries such as Poland, Germany and the Czech Republic. Human resources, trained and experienced in working with hard coal, customarily comprise highly competent personnel, who often possess narrow yet very specialized technical skills. The aspect of the potential re-skilling of miners, particularly hard coal workers, has been debated for years by the community countries. Among others, a study on the restructuring of the coal sector, carried out in 2009

(Dubiński, Turek, 2009), draws attention to this thread. It is thus reasonable to include a factor quantifying the important role labor market plays within the coal sector in environmental analysis. A number of transformations are currently observed on this labor market and incentives to participate in the process of reskilling towards the renewable energy sector are being undertaken. The steadily declining enrollment in technical mining classes (a phenomenon observed in Poland and the Czech Republic), as a consequence of lower interest among young people in entering this profession is also noteworthy (Energetyka24.com, 2023). The prospects for the next few years do not seem to be bright – the negative impact of the labor market economics factor will intensify. This also follows from the administrative guidelines regarding carbon dioxide emission reduction, and the coal sector extinguishment policy supporting the realization of this goal through e.g., offers of financial incentives for miners to retire sooner, which exacerbates the negative impact of the labor market on the sector under study.

Table 3.

Economic (business-related) market development determinants in the coal mining and coal power generation sector - weighted assessment of 1990-2030 market changes in the European Union

No.	Economic (business-related) determinants of coal mining and coal power generation market development	WEIGHT		a RATING (from -5 to + 5)				
				b weighted RATING (product of weight and rating)				
				1990	2000	2010	2020	2030
1a	Level of coal mining sector concentration - relevance to the labor market	21.25%	a	-1.50	-0.25	-1.25	-2.50	-3.75
1b			b	-0.32	-0.05	-0.27	-0.53	-0.80
2a	Share of coal mining sector in GDP of member states	20.00%	a	1.75	1.25	0.00	-2.00	-3.25
2b			b	0.35	0.25	0.00	-0.40	-0.65
3a	CSR relevance and costs - internalization of external costs (inter alia, environmental costs)	16.25%	a	0.00	-0.75	-1.75	-2.50	-3.75
3b			b	0.00	-0.12	-0.28	-0.41	-0.61
4a	Industry-sector profitability	25.00%	a	1.75	0.50	-2.75	-0.75	-3.75
4b			b	0.44	0.13	-0.69	-0.19	-0.94
5a	Level of investment in mining and logistics infrastructure	17.50%	a	2.50	1.75	-0.75	-2.00	-3.00
5b			b	0.44	0.31	-0.13	-0.35	-0.53
TOTAL		100.00%	-	0.91	0.51	-1.37	-1.88	-3.52

Source: own elaboration.

Until a decade or so ago, mining constituted an important, and for many European countries even a priority, economic area in terms of the contribution of generated added value to gross domestic product (Eurocoal, 2023). This state of affairs provided a natural stimulus for new investments and the development of mining as the flywheel of many economies. It should be emphasized, however, that European regions, which currently as well as in the past relied significantly on coal production, today in the vast majority show levels of GDP per capita lower than the average of their respective countries (Alves Dias et al., 2018). Accordingly, it is reasonable to consider the inclusion of a factor representing the coal sector's share in the GDP of European Union countries in the PEST environment analysis as legitimate. As highlighted above, the development trend of this factor should be assessed and forecast negatively – which corresponds to the average expert impact ratings ranging from +1.75 in 1990 to -3.25 in

the closing period of the analysis (2030). This can be explained by the increasing concentration of production structure in the EU countries and the pan-European downward trend of the so called coal rents, measured as a share of GDP (Data World Bank, 2023).

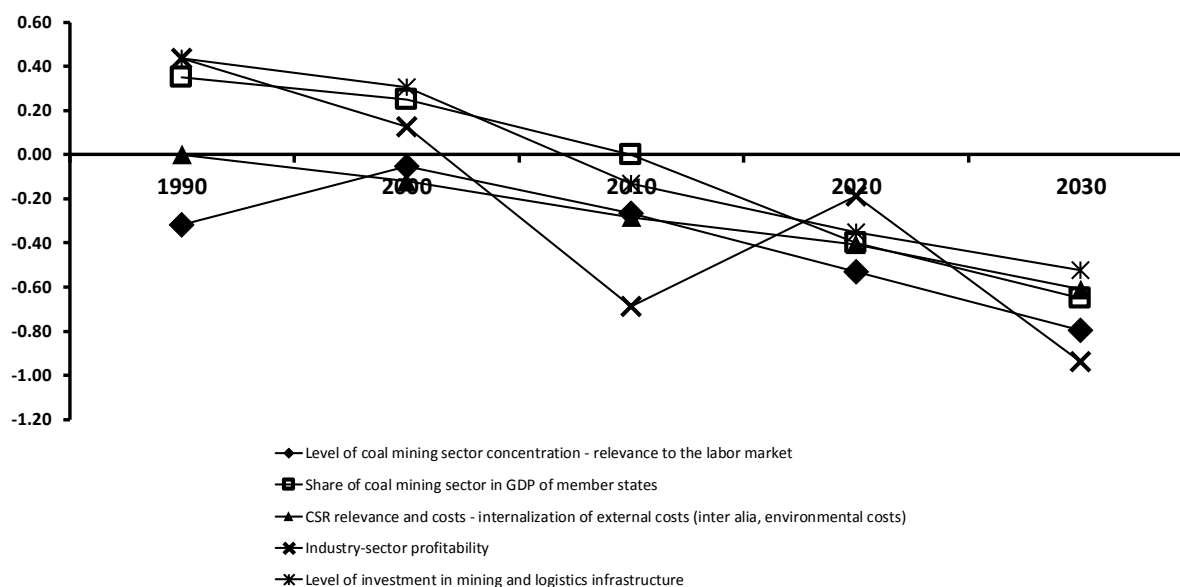


Figure 2. Weighted rating of the variables affecting the economic environment of the EU coal mining and coal power generation market in 1990-2030.

Source: own elaboration.

Another important economic factor, which conditions the health of the coal sector, pertains to the sphere of CSR and the costs of internalizing the externalities of coal production. Despite the fact that the sphere of mining externality reclamation and internalization can in itself create additional jobs and generate added value for the economy (creation of so-called ‘green jobs’) (Czyżak, Kukuła, 2020), the overall impact of this force on the coal sector is negative. The direction of the factor’s impact on the coal production sector, as well as the trend in its intensity, should therefore be considered (as well as projected for the future) as eminently unfavorable. This can be substantiated by the increasing scale and cost of externality internalization (including subsequent reclamation) by hard coal mining sites, as well as the exclusion of the coal energy sector from financial support via the so-called EDM mechanism¹ (Czyżak, Kukuła, 2020).

The next aspect of the economic environment analyzed pertains to the general decline in the sector's profitability, which has been evident almost continuously over the years. This phenomenon has been apparent, for instance, in the previously mentioned historically low, in relation to GDP, level of coal rents in Europe (World Bank, 2023), the increasing burden of

¹ EDM - Early Decommissioning Mechanism: “The Early Decommissioning Mechanism (EDM) supports numerous coal-fired power units, which should be decommissioned several years earlier EDM does not comply with a Paris Agreement-compliant coal budget available for Poland”, source: Czyżak, Kukuła (eds.) (2020). *Monopol węglowy z problemami. Analiza restrukturyzacji polskiego sektora energetycznego (Poland’s planned coal monopoly – who pays the price? Analysis of the restructuring of the Polish power sector)*. ClientEarth & Instrat.

CO₂ emission rights prices, and the low number of newly commissioned mining operations in the community, which generally entails extraction of deeper and less profitable coal seams. It should be emphasized, however, that the years 2022-2023 may bring about a temporary return to profitability for many coal mines (due to the strong volatility of coal quotations as a result of the war in Ukraine). In addition, a significant challenge for stable profitability is also the significant seasonality of sales in the sector (Rybak, Manowska, 2017). The higher value of the market surpluses captured by hard coal producers, in turn, is likely to worsen the financial condition of such industrial coal consumers as thermal power plants, power plants and steel mills. This induces the need to implement shielding mechanisms addressed to mass consumers of hard coal (including plants of strategic continuity), which are costly for the budget. As such, the direction and strength of the impact exerted by this factor (profitability) on the sector's overall health, proposed in the PEST analysis, has been based on a data-supported assumption that a general decline in hard coal production profitability is observed in the 21st century (Jonek-Kowalska, 2014). Moreover, according to the Authors of the study, the short-term increase in the sector's profitability, associated with the strong volatility of coal price quotations to the advantage of the mining sector in the midst of the war in Ukraine, will not have a lasting impact and is not going to reverse this long-term trend.

The last factor identified in the economic sphere of the PEST analysis is the level of investment in mining and logistics infrastructure. This factor, in the Authors' opinion, shall be characterized by a negative impact trend and an increasing (negative) effect on the coal production sector. Motivating arguments for this choice include the general trend of moving away from coal, the administrative targeting of EU funds on investments in the low-carbon economy (Dembicka-Niemiec et al., 2023), as well as the increasing importance of ESG reporting and the consequent change in bank financing policies, e.g., limited crediting of new coal assets and the rise in the adoption of the so-called green banking (Zhang et al., 2022).

4.3. Social (socio-cultural) determining factors

Hard coal extraction and coal-fired generation of power have driven human progress and fundamentally transformed societies. Nevertheless, the impact of the long-term use of fossil fuels on the environment and human health is substantial (Finkelman et al., 2021). Climate change has become a major environmental problem on a global level. The progressive degradation of the environment is forcing reduction of carbon dioxide emissions, which are the main cause of most of the adverse climate changes (Moreira, Pacca, 2020). Coal combustion accounts for 40% of global CO₂ emissions from energy consumption (Jakob et al., 2020). In 2008, the European Union set a goal of reducing greenhouse gas emissions by 20% from the levels of 1990. This target has been met, with GHG emissions down by 24% in 2019 and 31% lower in 2020 (compared to 1990 levels). A new target was set in 2021 to reduce greenhouse gas emissions by at least 55% from the 1990 levels by 2030 (Europarlament, 2018).). To keep global warming below 1.5°C, most of the world's coal resources must remain unextracted

(Welsby et al., 2021). Pursuant to the Paris Agreement, this will be feasible if the world achieves zero emissions or climate neutrality by 2050 (Intergovernmental Panel on Climate Change, 2018). Summing up, the decade-to-decade increasing awareness of the climate ramifications resulting from the production and use of hard coal is affecting the sector under study adversely.

Table 4.

Social (socio-cultural) market development determinants in the coal mining and coal power generation sector - weighted assessment of 1990-2030 market changes in the European Union

No.	Social (socio-cultural) determinants of coal mining and coal power generation market development	WEIGHT	a RATING (from -5 to + 5)					
			b weighted RAITING (product of weight and rating)					
			1990	2000	2010	2020	2030	
1a	Awareness of the impact of coal production and use, in the context of environmental changes (including climate change)	17.50%	a	2.25	1.00	-1.25	-3.00	-4.75
1b			b	0.39	0.18	-0.22	-0.53	-0.83
2a	Awareness of the impact of coal production and use in, the context of health (health care, preventive care)	26.25%	a	0.00	-1.25	-2.50	-3.50	-4.50
2b			b	0.00	-0.33	-0.66	-0.92	-1.18
3a	The role of carbon footprint in consumer purchasing decisions (sustainable consumption - changes in consumer behavior)	11.25%	a	1.50	0.25	-1.25	-2.75	-4.00
3b			b	0.17	0.03	-0.14	-0.31	-0.45
4a	Consumers' absorption of alternative energy sources	28.75%	a	2.75	1.00	-1.00	-2.75	-4.75
4b			b	0.79	0.29	-0.29	-0.79	-1.37
5a	Labor market supply formation	16.25%	a	3.25	1.75	0.50	-1.00	-1.75
5b			b	0.53	0.28	0.08	-0.16	-0.28
TOTAL		100.00%	-	1.88	0.45	-1.22	-2.71	-4.11

Source: own elaboration.

Coal combustion releases a mixture of hazardous substances, which inhaled pose a serious threat to human health (Gasparotto, Martinello, 2021). The emission of harmful substances into the air, in particular, leads to the development of respiratory diseases. It is estimated that in Europe, carbon kills approximately 23,300 people each year, and the annual economic cost of the health implications caused by coal combustion is about \$70 billion (EndCoal, 2020). Climatologists and epidemiologists have modeled scenarios demonstrating that faster reductions in carbon emissions (to stabilize heating at 1.5-2°C) would prevent 150 million premature deaths globally between 2020 and 2100 (Shindell et al., 2018). Even though, coal mining in most countries is much safer than it was just a few decades ago, hundreds or thousands of miners lose their lives every year (Cunningham, 2014). Moreover, this occupational group is particularly vulnerable to coal workers' pneumoconiosis, the so-called black lung disease (Markandya, Wilkinson, 2007). Awareness of the impact of coal production and use, in a health context, has followed a similar trend as awareness of climate consequences. The Authors nevertheless assigned a higher weight to this factor, on account of the psychological aspects of the determinants affecting the direct and perceived determinants of change, at the level of individuals, rather than the world as a whole.

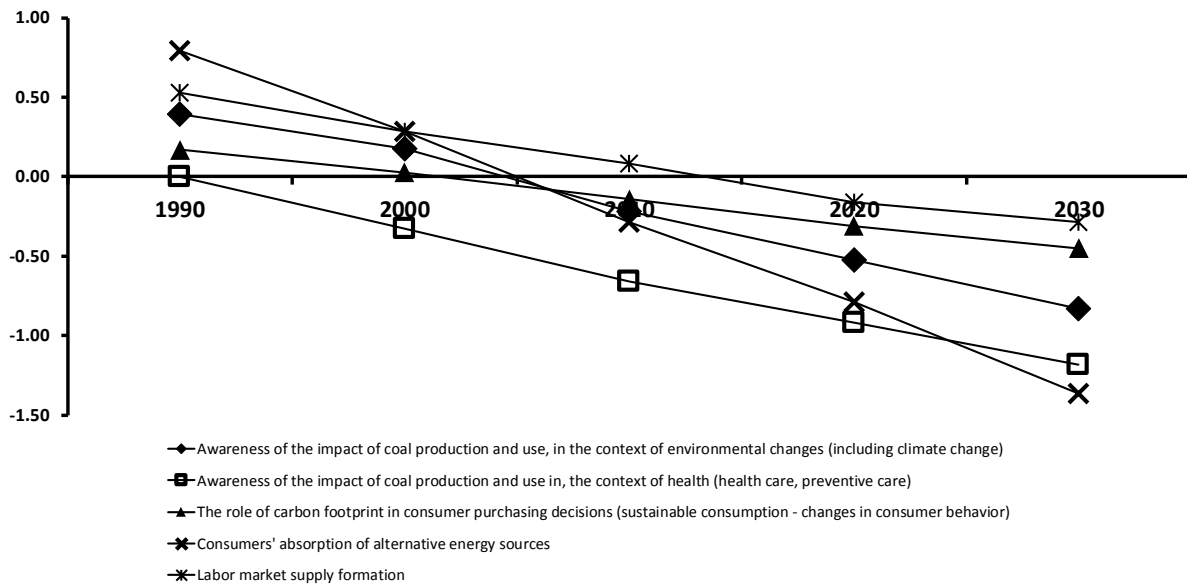


Figure 3. Weighted rating of the variables affecting the social environment of the EU coal mining and coal power generation market in 1990-2030.

Source: own elaboration.

Carbon footprint has been defined as the total sum of CO₂-equivalent emissions directly and indirectly caused by a given activity, person, organization, event or product (Wiedmann, Minx, 2008). The concept of carbon footprint was first proposed by British researchers as part of the ecological footprint, but its rise began in the early 21st century. The carbon footprint has become increasingly relevant in decisions, as many consumers wish to make sustainable purchases. Consumers who are aware of the climate impact of their lifestyles have become increasingly likely to choose products and services with smaller carbon footprints, or to forgo those that contribute to greenhouse gas emissions altogether. It is worth mentioning that in 2007 the world's first carbon footprint label – Carbon Trust – was created. The certification allows companies to measure and communicate the carbon footprint of the products they offer (Carbon.com, 2023). Carbon footprint information can guide consumers to make choices of lower impact on the environment, and climate change especially. In 2022, the Corporate Sustainability Reporting Directive (CSRD) was published in the EU Official Journal. The requirement to report on an organization's climate and environmental impact along the entire value chain is expected to apply to 50,000 companies in the European Union (Deloitte, 2022), further raising the weight of carbon footprint in future purchasing decisions.

Consumers' uptake of alternative energy sources is the social determinant to which the Authors assigned the highest weight. It is the level of renewable energy source utilization that determines the reduction of greenhouse gas emissions from the combustion of fossil fuels. Worth mentioning is the fact that in 2022, 37% of energy in the EU came from renewable sources (Eurostat, 2022d). Interest in alternative energy sources is growing among consumers. One example is the photovoltaic market, where increasing numbers of households opt to install

solar panels, solar collectors or heat pumps. A surge in the uptake of alternative energy sources is also likely to occur as a result of Russia's invasion of Ukraine in 2022. In response to the difficulties and disruptions in the global energy market, the European Commission has put forward the REPowerEU plan, which calls for an increase in the share of renewable sources, including the uptake of photovoltaic energy (among other things, it is planned to phase in a mandatory installation of solar panels on new buildings) (European Commission, 2022).

The section assessing the formation of labor market supply incorporates such factors as employment in the coal mining sector, the training of new cadres for the mining industry, the demand for labor in mining, the retirement age in mining, or the number of workers in need of labor market support as a result of decarbonization. In recent years, Poland's coal mining sector has seen multiple restructuring and downsizing, due to financial difficulties, environmental challenges and increased competition from other energy sources. In 1990, the Polish coal mining sector employed 388,000 workers, compared to 83,000 in 2020 (Cire.pl, 2020), which indicates a systematic employment reduction in the sector. On the one hand, a decline in employment can be observed, yet on the other, the demand for employees with advanced qualifications and skills, particularly in mining process automation and digitization, has been growing. What is more, the number of mining graduates in Poland has also dropped over the years. The demand for labor in Poland (in Silesia) is forecast to outstrip supply starting in 2026, due to a projected shortage of at least 20,000 workers per year in the region (Sokołowski et al., 2022). In sum, from a social-sphere perspective, the impact assessment coincides with the conclusions drawn with regard to the economic sphere - the general supply situation in the coal labor market has a destimulating effect on the area under study.

4.4. Technological determining factors

Sector decline does not take place in isolation from capital flows. The PEST-analyzed aspects were assessed from an economic perspective, among other things. Materialization thereof, however, takes place in technology precisely. After all, it seems impossible to think of a sector, and heavy industry in particular (including manufacturing, mining or processing activities, which require significant capital outlays), ending its life cycle without previously withdrawing or gradually reducing investment/replacement expenditures. All the more so as this sector can be deemed traditional, meaning, it is ingrained in our mentality - both socially and economically. Through this multi-decade experience, we are well aware of the technology investment and depreciation cycles. We can also assess the prospectiveness of further R&D development in this sector. Two of the five variables analyzed are stimulants of the market's further development, namely (2) the impact of clean-coal technologies (CO₂ emissions, gasification) as well as (5) the technical devices and machinery (safety, productivity, technological support). In the intervals adopted, these were assessed differently from the other

factors, since they potentially provide support to the sector by prolonging its declining (as diagnosed in the conclusions) phase. At one end of the spectrum, clean-coal technology can play a role in reducing negative environmental impacts, but on the other, the directional legislative changes, as known from the observation thereof (see analysis of the ‘P’ determinants, in the PEST model), are moving towards an energy model different from the current one. The Special Report on Carbon Capture Utilization and Storage (International Energy Agency, 2020) refers to a scenario of zero-carbon production in term of the world's energy potential by 2070, with precisely the year 2030 set to mark an interim stage, involving the modernization of fossil-fuel-based energy, i.e., the modernization of current assets and the facilitation of low-carbon hydrogen production.

Table 5.

Technological market development determinants in the coal mining and coal power generation sector - weighted assessment of 1990-2030 market changes in the European Union

No.	Technological determinants of coal mining and coal power generation market development	WEIGHT		a RATING (from -5 to + 5)				
				b weighted RATING (product of weight and rating)				
				1990	2000	2010	2020	2030
1a	R&D expenditures on technologies supporting the coal mining process	18.75%	a	2.50	1.25	0,00	-1.25	-2.00
b			0.47	0.23	0,00	-0.23	-0.38	
2a	Impact of clean-coal technologies (CO2 emissions, gasification)	17.50%	a	-1.00	0.00	1,00	1.75	2.50
2b			b	-0.18	0.00	0,18	0.31	0.44
3a	Impact of energy sources alternative (substitute) to hard coal	28.75%	a	2.00	0.50	-0,75	-2.25	-3.50
3b			b	0.58	0.14	-0,22	-0.65	-1.01
4a	Technology depreciation versus asset replacement expenditures	25.00%	a	4.00	1.00	-1,00	-2.75	-4.75
4b			b	1.00	0.25	-0,25	-0.69	-1.19
5a	Technical devices and machinery used at work (safety, efficiency, technological support)	10.00%	a	-0.50	0.50	1,50	2.50	3.25
5b			b	-0.05	0.05	0,15	0.25	0.33
TOTAL		100.00%	-	1.82	0.68	-0,14	-1.01	-1.81

Source: own elaboration.

The last of the variables analyzed – technical devices and machinery, which affects the safety, but also the efficiency (optimization), of labor, also acts as a stimulant in the period under examination. This, however, does not stem from the uniqueness of the sector, but rather from the general (cross sector) premises relating to the growing improvement of labor management methods, the optimization of labor and, most importantly, the changes translating into increased safety.

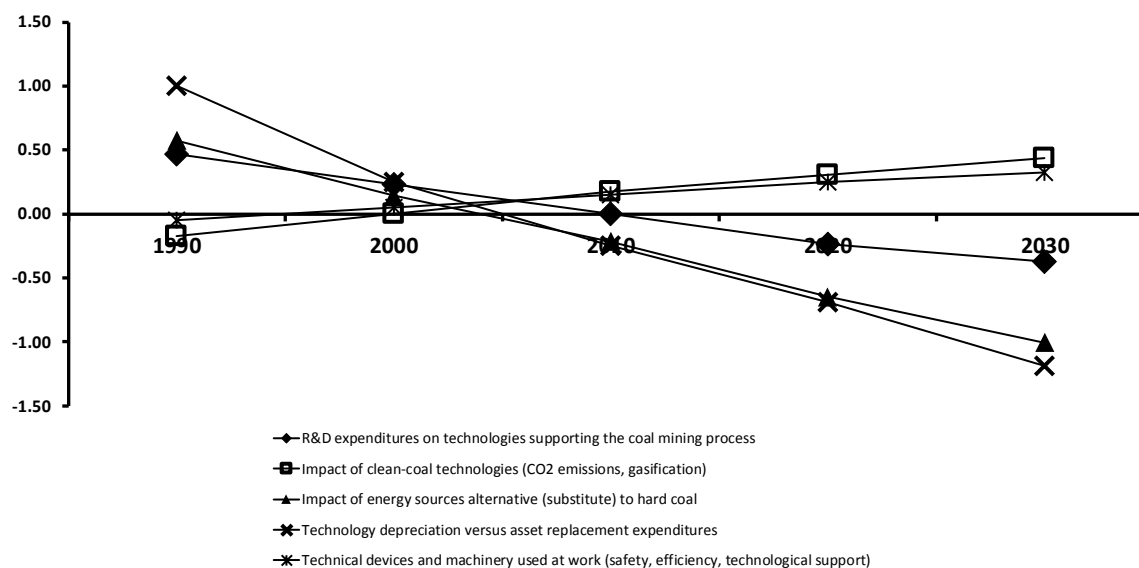


Figure 4. Weighted rating of the variables affecting the technological environment of the EU coal mining and coal power generation market in 1990-2030.

Source: own elaboration.

The remaining variables of a technological nature analyzed show a tendency to exert increasing pressure on the sector, which translates (Figure 4) into these variables de facto taking on negative values since 2010. The variable with the strongest negative impact is the technological depreciation and asset replacement expenditures. Here, however, a significant disruption, resulting from Russia's war on Ukraine, is worth noting, though it should be born in mind that “increased demand for the raw material does not imply a return to coal, but a prolongation of the very process of coal mine shutdowns” (Sawicki, Parkiet, 2022). Investment outlays in Polish coal mines (Agencja Rozwoju Przemysłu, 2022) rose to PLN 1.78 billion by September 2022 (against PLN 1.49 billion in the previous year), while the industry's CAPEX increased from PLN 2.9 billion to PLN 3.9 billion. The year 2023 is expected to be a year of not only large investments, but also a strongly accentuated mining recovery. The analysis carried out breaks down the assessment not by year, but by decade, hence the industry's periodic prosperity is expected to be ultimately offset by the strategic plans of coal mine activity extinguishment. If, however, the mine investment data were to be regarded objective, and their contribution to a postponement of coal mine shutdowns beyond 2030 was assumed, the variable's assessment (in the current perspective, if not in the 2030 assessment as well) would have to be raised.

The last variable exerting a negative impact on the industry, is the growing relevance and development of energy sources alternative to hard coal. EUROSTAT data unequivocally shows a declining share of hard coal (production), with 1990 as the base period (Forsal.pl, 2021). “Coal pollution and its health impacts travel far beyond borders, and a full coal phase-out in the EU would bring enormous benefits for all citizens across the continent” (CAN, 2016). This, however, calls for alternative investments – differing at the level of member states, naturally, but accounting for, inter alia, such scenarios of energy demand hedging as:

(1. RES) wind technologies (including offshore), gas “Although natural gas is the cleanest of the fossil fuels, it is still a major source of the global increase in CO₂ emissions” (Jackson et al., 2018); (2. Nuclear scenario) involving retention of the youngest coal-fired power plants in the system, to perform a backup function (Stryjecki, 2019).

5. Discussion

The analysis presented in the study was carried out in a retrospective view (1990-2020) and as a forecast for 2030. While in respect to the analysis of historical data, the Authors have full confidence in the validity of quantifying the phenomenon of the gradual transition from energy production that is based on hard coal mining and processing towards its declining phase, the future perspective may empirically provide development scenarios different than those described in the article. All the more so as in most industry studies, two other (conventional) dates, in addition to the forecast horizon adopted in the paper, are also considered relevant, i.e., 2050 and 2070, when the power industry is to be entirely based on zero-carbon generation sources. This, however, could be considerably disrupted by various events affecting the further energy transition of the European Union and the World, which are qualitative in nature and involve significant - but at the same time extremely difficult to predict - leapfrogging changes. The past experiences of pandemics (2020, SARS COV-2) as well as Russia's war on Ukraine certainly qualify as such events. Given the decreasingly short business cycles, the intensified turbulence of the markets (both within the real sphere of the economy as well as on strictly financial markets), even today a hypothesis can be posed that the next crisis – on not only on a European, but also an intercontinental scale will occur before the end of the next decade. This calls into question the timing of the withdrawal of individual economies from traditional energy sources. More so, such radical changes should not be made in times of crisis, lest, both economically and socially, the problems associated with implementing the change in a socially and economically unstable environment escalate even further.

Equally important are the changes expected to take place in sub-sectors, or complementary and/or substitute sectors. The announced reduction in the sale of internal combustion vehicles in the EU as of 2030, for instance, will surely catalyze an increase in the demand for energy, which so far is mainly obtained precisely from the traditional, fossil fuel sources. Moreover, it is difficult to expect investors to suddenly withdraw from a given sector when capital expenditures (CAPEX) have not been fully amortized. In such large industries as power generation, the changes will be rather evolutionary, accommodating stakeholders gradually to the transformation which, according to the Authors, will unfold precisely within the four areas analyzed, i.e., regulatory, economic, social and technological. Any deviation from the plans, due to non-acceptance, technological misalignment, demand-supply imbalance or, as known from experience at the EU level, the years needed to achieve full legal harmonization – could

prolong these processes. This eventuality calls for preparation, while the fact that the environment is constantly changing is by no means a reason against analyzing and estimating the changes taking place precisely because of the successive variables affecting the future model of the energy market in the EU and worldwide. The results of the study bring new knowledge to the issues of this sector. This is, among others, the forecasted trend of the impact of individual dimensions of the environment, taking into account the extinguishing effect of the pandemic and the impact of the war in Ukraine on the flow of fossil resources in Europe. It should be emphasized that compared to previously conducted analyzes and past studies conducted by other researchers, we notice some similarities as well as differences. The completed PEST analysis confirms the decline of the hard coal sector in Europe and its consistent displacement from the energy mixes of European countries. On the other hand, research suggests that it will not happen as soon as it was thought before the pandemic. Due to the current economic and political situation, a quick, complete phasing out of the use of hard coal in Europe seems unrealistic. Taking into account the conditions of the macroeconomic environment, the departure from coal will be consistent, but not radical, as in some cases it will take over the function of a transitional fuel - i.e. the one previously attributed to natural gas. The next phase of research planned by the authors of this study will be an update of the PEST analysis after the fossil fuel market has fully stabilized after the end of the war in Ukraine and perhaps the return of Russian fossil fuels to the European market.

6. Conclusions

Using PEST analysis to assess life cycle prospectivity (or decline) for various sectors, a methodological attempt to weigh each of the four perspectives contained in this method can be made. However, there is always a certain research insufficiency consisting in the question of whether we have taken into account enough perspectives - PEST was, after all, significantly developed in the course of evolution to include other areas of analysis (such as environmental, or related to digitization, virtualization of the economy). However, we are convinced that in times of so much information (often of poor quality), quantification and multidimensional analysis is extremely useful in making decisions. In particular, when it comes to long-term decisions, as well as investment decisions. Therefore, we are sure that further extension of the analysis based on the proposed methodology can successfully bring new values - to the theory of management and quality science, economics and finance, but also (and perhaps above all) to economic practice. As the authors of the study, however, we are well aware that so many factors can disrupt our prediction. However, this does not mean that it is not worth making such predictions. They are a decision-making guidepost, and due to the multidimensionality of the analysis, we hope that it becomes particularly applicable to economic practice.

When it comes to the hard coal mining and coal power generation market, two clashing forces are de facto involved. On one side, there is the moral depreciation of coal as an energy carrier – as evidenced in the analysis of social determining factors, and the politicians' declarations (supporting these processes) regarding the advent of the Green Energy era. On the other, however, the sector needs to deal with the strong impact of the growing use of alternative energy sources, as well as the technological development of substitute markets placing heavy pressure Europe's existing model of energy market. The extent of the moving away from coal-fired generation of power is evident from the PEST synthesis (shown in Table 6). The sector's so-called 'missing potential', i.e., is the distance of the weighted assessment of all 20 analyzed variables from the maximum value the sector could hypothetically achieve, is relevant here. The increase in this gap to the projected level of 163.42% in 2030 indicates the potential phaseout of the sector.

Table 6.

PEST analysis summary of coal mining and coal power generation market development – years 1990-2030

Symbol	COAL MARKET DETERMINANTS ANALYSED	1990	2000	2010	2020	2030
P	Regulatory (legal) determining factors	1.70	0.78	-0.13	-1.78	-3.25
E	Economic determining factors	0.91	0.51	-1.37	-1.88	-3.52
S	Social (socio-cultural) determining factors	1.88	0.45	-1.22	-2.71	-4.11
T	Technological determining factors	1.82	0.68	-0.14	-1.01	-1.81
TOTAL	Total weighted rating [p.]	6.31	2.42	-2.86	-7.38	-12.68
MAX	Maximum sum of weighted ratings [p.]	20.00	20.00	20.00	20.00	20.00
N/A p.	Difference between rating and max value [p.]	13.69	17.58	22.86	27.38	32.68
N/A %	Sector's missing potential [%]	68.45%	87.92%	114.31%	136.89%	163.42%

Source: own elaboration.

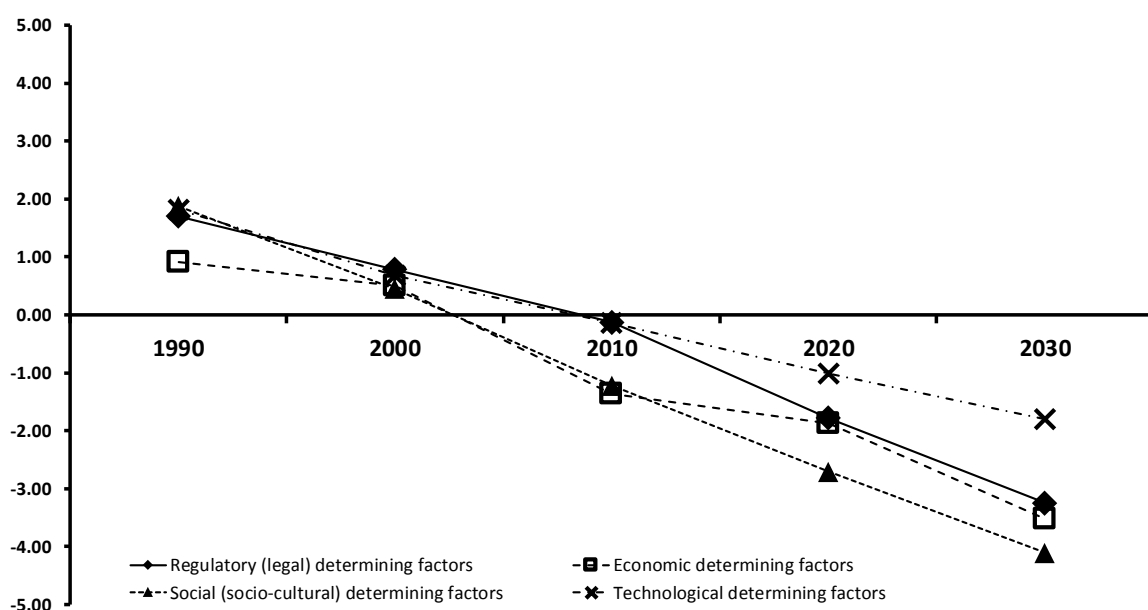


Figure 5. Weighted PEST assessment of coal mining and coal power generation market development – years 1990-2030.

Source: own elaboration.

In summary, the PEST analysis entailed an observation of the current state of Europe's hard coal market over more than thirty years, incorporating a forward-looking vision of changes over the coming decade. The regulatory (legal), economic, social (socio-cultural) and technical (technological) determining factors all have exhibited a destimulating effect on the development of the hard coal mining and coal power generation market. The strongest impact is exerted by social factors. The impact of legal as well as economic determinants is similar. Technical factors show the weakest yet still negative impact. In 1990 and 2000, the strength of the impact of all factors analyzed under the PEST analysis carried out yielded a positive result, which means that the variables' impact was of a market-stimulating nature. In 2010, 2020 and 2030, in turn, negative impact of individual determinants on the development of the European hard coal market was observed. Generalizing from decade to decade, the intensity of the adverse impact strength increases. It should be emphasized that all activities carried out as part of the PEST analysis have been presented from the perspective of the players on the European Union hard coal mining and coal power generation market. In conclusion, the process of the empirical study resulted in an answer to the research questions posed earlier. The following were singled out (RQ1) as significant regulatory developments in the mining, transportation and processing of hard coal in Europe (RQ1): the energy mix – the role of hard coal substitutes, the CO₂ emission rights market, the geopolitical determinants of hard coal distribution, as well as the level of state interventionism and the level of intra-community law harmonization the level of autonomy in shaping the energy policy of member states. The economic factors most strongly driving the development of the hard coal market in Europe were identified as (RQ2): the sector's profitability, the level of hard coal mining concentration significance for the labor market, the share of the hard coal mining sector in the GDP of member states, the level of investment in mining and logistics infrastructure, CSR relevance and cost - internalization of external costs. The social factors to be taken into account in terms of the hard coal market development in Europe (RQ3) are (RQ3): absorption alternative energy sources by consumers, awareness of the health implications of hard coal use, awareness of the impact of hard coal use on environmental changes, the formation of labor market supply, and the role of the carbon footprint in consumer purchasing decisions. The relevance of technology, in the context of hard coal mining and processing in Europe is dependent on (RQ4): the impact of energy sources alternative to hard coal, technological depreciation versus asset replacement expenditures, R&D expenditures on technologies supporting the coal mining process, the impact of clean-coal technologies, as well as the technical devices and machinery.

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ICT-BASED RECRUITMENT AND SELECTION TOOLS: THE RECRUITERS' PERSPECTIVE

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Purpose: Earlier studies on the use of ICT-based recruitment & selection tools focused primarily on two perspectives: the organizational (predictive validity of the tool) and the candidate's (fairness of selection process using the tool), leaving aside the third one – recruiter's assessment of different aspects of tool usage. The aim of this study is to investigate this third perspective through studying Polish recruiters' opinions about different aspects of four ICT-based recruitment & selection tools.

Design/methodology/approach: On the basis of data collected using an e-questionnaire from 120 Polish recruiters, four hypotheses concerning the assessment of three aspects (functionality, candidate experience, and predictive validity) of various types of ICT-based tools used in employee selection processes were statistically verified.

Findings: Recruiters, regardless of the length of professional experience, notice differences in how each of the tools contribute to the three dimensions of the recruiter's role. These dimensions are: the recruiter as a person providing the organization with accurate predictions as to the likely success of the candidate in the job offered; the recruiter as a representative of the organization responsible for the efficiency of recruitment and selection processes; and the recruiter as a person who takes care of the company's image. Recruiters rated competence games and VR as the highest on candidate experience, while they value bots primarily for their functionality.

Research limitations/implications: The sample was unrepresentative, as it was created using the snowball methodology. The scales constructed for this study are of a pilot nature and further research is needed to assess and improve their psychometric values.

Practical implications: The study suggests that none of the three aspects investigated (i.e. functionality, predictive validity, and candidate experience) should be neglected when new tools are introduced to HR departments.

Originality/value: The study is a rare attempt at conducting a multidimensional investigation of acceptance of ICT-based recruitment/selection tools from the recruiter's perspective.

Keywords: recruitment, selection, recruiters, ICT-based selection tool, candidate experience.

Category of the paper: Research paper.

1. Introduction

The use of information and communication technologies (referred to in this article as: ICT) in human resource management, and in employee selection processes in particular, has become a standard of good practice in the 21st century. The reason for this phenomenon is undoubtedly the fact that these applications lead to the automation of many HR activities (reducing implementation costs and at the same time increasing their quality) (Lepak, Snell, 1998). ICT can also effect in changes in HR processes themselves, and thus create resistance as is the case with every innovation. The approaching wave of new ICT-based solutions, especially in the field of Artificial Intelligence (AI), such as Chatbot GTP, raises the question of whether the older ICT-based recruitment tools have been fully accepted, not only by potential employees, but also by employees of HR departments, for whom dealing with new technological solutions may prove to be an excessive challenge.

Research on the use of ICT in employee recruitment and selection processes has been conducted for years (see reviews in: Breaugh, 2013; McCarthy et al., 2017; Woods et al., 2020), but they are currently dominated primarily by two perspectives. Firstly, this is the organizational perspective, understood as determining the usefulness of a specific tool in predicting which of the candidates may succeed at work (Ryan, Ployhart, 2000; Potosky, Bobko, 2004; Van Iddekinge et al., 2016). Secondly, this is candidates' perspectives, understood as attitude to being recruited with these tools (Ryan, Ployhart, 2000; Anderson, 2003; McCarthy et al., 2017; Nikolaou et al., 2019; Balcerak, Woźniak, 2020). The third perspective – namely the attitude of recruiters to the use of these tools – is less frequently present in the scientific literature (Albert, Aggarwal, Silva, 2019; Koivunen et al., 2021; Mirowska, Mesnet, 2021; Ore, Sposato, 2021), although for many years it has been repeated that it is necessary to take this perspective into account (Roth et al., 2013; Black, Stone, Johnson., 2015; Van Iddekinge et al., 2016; Wheeler, Dillahunt 2018; Lu, Dillahunt 2021). We are also not familiar with Polish research on this third perspective, hence the goal of this text is to commence analyses that will start filling this gap.

The aim of this text is to analyze the perception by Polish recruiters of 3 well-known ICT-based recruitment/selection tools, namely: ATS (Applicant Tracking System), i.e. programs for managing a database with applications, the use of computer games to assess the competencies of job candidates, further called competence game, and simple dialogue programs based on decision trees (hereinafter referred to as bots), as well as one solution that is not yet used in recruitment processes in Polish practice, virtual reality systems (hereinafter referred to as VR). On the basis of an e-questionnaire study of a group of 120 respondents working in HR departments of Polish organizations, relationships were verified between chosen personal factors (employment in new technology industries, professional experience) and the assessment of three aspects (functionality, candidate experience, and predictive

validity) of various types of ICT-based tools used in employee selection processes. The hypothesis concerning the convergence of assessments of various aspects was additionally verified. This allowed for the formulation of several practical recommendations and postulates for further research.

The text is structured as follows. The first part discusses the issues of new ICT-based selection tools and the consequences of their relationship to standard tools (interview, job samples) for the assessment of the attitude of three stakeholders of the selection process, i.e. candidates, companies and recruiters. The second part (section 3) presents a preliminary empirical study checking how selected factors affect the acceptance of new selection tools by recruiters. The next sections present the results of the study and their discussion, including a discussion of practical consequences.

2. Theoretical background and hypotheses development

Staffing is a key HR process that enables an organization to fill vacancies, and thus determines its ability to succeed. Scientific research on this process shows that it is subject to constant improvement and is in the center of attention of managers. Filling positions with the right people requires communication with the relevant segments of the labor market and encouraging certain people to apply (the recruitment process), and then assessing candidates' competencies in terms of their suitability for the position to be filled (so-called selection). Recruiters, as the employees of the HR department (or consulting companies who take over some of these tasks when outsourced) who perform these tasks are called, use various tools in these processes. Some of these tools are used to facilitate administrative and communication activities, some to assess the competencies of candidates, and some create communication channels enabling interaction with candidates, including auto-selection. The development of information and communication technologies allows some of these tasks to be fully automated (which reduces their costs while improving quality), and to partly change the traditional methods of carrying out activities in a manner adapted to the expectations of stakeholders.

The selection of employees is a HR process in which the influence of ICT is particularly noticeable (Nikolaou, 2021). Extensive use of data from virtual spaces, such as social networks, as an additional source of information about job candidates, whether in the area of searching for potential people who meet the company's expectations and encouraging them to apply or at the stage of assessing the competence of people applying to the company, has already become a standard (Balcerak, Woźniak, Zbucnea, 2023). However, the use of ICT-based tools, intended to automate several activities carried out in the process of acquiring employees, goes far beyond the analysis of social media content and began before the social media gained any significance.

Historically, the earliest tool commonly used in this area was the ATS (Applicant Tracking System), i.e. programs for managing a database with applications, which grew out of the need for efficient recruitment communication with potential candidates in recruitment portals (e.g. Monster, and in Poland – pracuj.pl) and facilitating data management from collected applications (Fresher, 2016). Currently, tools of this type not only allow you to analyze the applications stored in the database, or handle communication with candidates (in terms of arranging meetings or sending feedback), but they also search for suitable candidates in social media, track signals about their readiness to be activated, and stimulate their willingness to apply to a specific company (cf. review in: Woźniak, 2020). However, Polish companies are most likely dominated by older generations of these tools (cf. argumentation in: Woźniak, 2020). Already at the beginning of the 20th century, data showed that Polish companies were highly saturated with these tools (Woźniak, 2013), so from the perspective of a Polish recruiter, these are well-known tools for managing databases and automating some other activities.

Computer games (competence games) also have been used for years as a recruitment and selection tool. It grew out of the astonishment of people's involvement in playing computer games, and selection processes have used them as far back as 2002 when the US Army created a computer game for the purpose of vocational pre-orientation (and also to improve the image of military work) (Michael, Chen, 2006). The actual inclusion of computer games in recruitment processes took place in 2011, when Marriott made available a computer game for vocational pre-orientation, but combined with the possibility of direct application for a given type of job (Freer, 2012).

Since the early 2000s, there was an expectation that actions during a game could be equivalent to actions in real situations, so that games could replace simulated work samples or even an Assessment Center (cf. Kapp, 2014; Armstrong et al., 2016). One of the authors of this text is an antagonist of the use of computer games in the employee selection (Woźniak, 2013; 2015; cf. arguments in: Woźniak, 2020), and receives invitations from Polish consulting companies to test various games created for the use of HR departments. This allows us to state that the use of games in the employee the selection in Polish large companies is so frequent, that HR employees of such companies know this tool at least by hearsay.

It can also be assumed that dialogue programs built on the basis of decision trees, called dialogue bots, are a similarly well-known tool. They are used to collect preliminary information from candidates in a 7/24 format, but also to provide them with feedback on excessive financial expectations or inadequacy of their qualification profile to the profile of the desired candidate in recruitment. The first programs of this type in Poland were already operating in the second decade of the 21st century and their creators were Budimex (in 2017) and Santander (in 2018) (Woźniak, 2020). They are built on the principles known since the 1960s, when decision trees were searched for a way to reflect potentially possible dialogue

scenarios. In the practice of the selection process, the use of such tools requires recruiters to prepare all texts for the dialogue for the bot (Koivunen et al., 2021). It is worth noting that although bots are typologized more broadly, so that this group includes intelligent assistants such as Apple's Siri (i.e. recognizing content in voice statements thanks to the use of AI), only the simplest bots, the so-called button-bots (also known as menu bots or flow bots), are used in the selection processes in Poland. They are built like a decision tree where the user follows the prepared conversational path by clicking on the options provided by the bot. The use of bots in the selection processes that recognize key words in the written text (e.g. in the analyzed CVs), which have their sources in the ELISA dialog program from the 1960s, is also known to Polish recruiters, but the use of speech recognition programs (which creates the third type of bots after button-based and responding to keywords, an example of which is the aforementioned Siri, and in Poland Max by Orange) is limited in Poland to customer service.

These new types of tools, such as bots that analyze spoken natural language, are already making extensive use of AI-based solutions. Among the tools analyzed here, these AI techniques are sometimes used in the preparation of competency assessment based on activity in computer games, and are particularly visible in the last of the types of ICT use in selection processes discussed here, i.e. VR.

J. Jerald (2015, p. 9) defines VR as “a computer-generated digital environment that can be experienced and interacted with as if that environment were real”. The most common output devices for VR include visual displays (for example head-mounted display), speakers, haptics (devices that stimulate the senses of touch and motion), and motion platforms. In this paper we use the term VR in a broad sense, including not fully-immersive VR systems like augmented reality systems (AR). VR and AR are successfully applied in the entertainment industry, therapy, architecture, education and training. VR prototypes and applications in the selection process include, for example, the identification of candidates with a fear of heights (Winarsim, Amaliah, 2021), or for recognizing the skills of immigrants to work in restaurants despite poor language skills (Kauppinen, Drake, 2020), so they are based on simulated samples work and allow conclusions from candidates' behaviour.

Investments in the development of these programs will soon result in the possibility of implementing a simulated Assessment Center or computer games in which immersion in "physical" reality will reduce the strength of one of the arguments against the adequacy of action in a computer game as an equivalent of action in a simulated sample of work, i.e. the conventionality of the simulated environment. Therefore, potentially greater accuracy of predictions based on "work samples" implemented in VR can be expected, but – as far as we know – they are not yet used for this purpose in Poland. It can be expected that VR will be used for selection interviews earlier in order to increase the range of communication media beyond what is possible through communication via communicators such as Skype. So in Poland, the use of VR in selection is still in the form of postulates and first attempts,

and the value of this tool for selection processes will depend not only on its capabilities as a space enabling a richer communication, but on the selection tools in the strict sense that will use this wealth forms of communication, i.e. an interview or various simulated work samples.

This short presentation of selected ICT-based tools used in the recruitment/selection process was intended to bring the reader closer to the tools covered by the study, but also to indicate what level of everyday familiarity with them can be expected from Polish recruiters. It should be clearly emphasized once again that a recruitment/selection tool is understood here more broadly than in the literature on employee selection, where it is usually identified with a tool for assessing the candidate's competencies in a certain way (Listwan, 2010; Woźniak, 2013). Out of the 4 tools analyzed here, only competence games and bots are selection tools in the narrower sense. Bots collect data from candidates and reject some of them on the basis of criteria previously prepared by the recruiter, while games can verify chosen competencies based on simulated work samples. VR and ATS are recruitment/selection tools in this more general sense (referred to below as “broader sense”), because they facilitate the implementation of activities by recruiters as they use other selection tools (in the narrow understanding). E.g. with VR (as a broader tool) – recruiters can use selection interviews or simulated work samples, and with ATS – mainly documentation management (ATS is “invisible” from the candidate's perspective, hence it will be excluded from candidate experience analyses). Hence, some of the conclusions from the research on the perception of selection tools by candidates will be based on inference by double analogy, not only as inference about the opinion of recruiters from the results of the candidates' opinion, but also as inference from the opinion about selection tools in the narrower sense, to the opinion about selection tools in the broader sense. In addition, one of the tools in the broader sense (ATS) is widespread, while the other (VR) is not. A summary of the characteristics of the tools presented above and a specification of the aspects of their assessment is presented in Table 1.

Table 1.

Characteristics of the examined ICT-based recruitment and selection tools

Tool	Type of selection tool	Widespread use in Polish HR	Technical complexity level	Tool evaluation dimensions (studied in this paper)
Applicant Tracking System	the broader sense	very large	low	Functionality
Competence game	the narrow sense	large	high	Functionality, predictive validity, candidate experience
Bot (bottom-down)	the narrow sense	large	low	Functionality, predictive validity, candidate experience
VR systems	the broader sense	small	high	Functionality, predictive validity, candidate experience

Studies on the reception of ICT-based selection tools indicate that candidates familiar with a given type of tool (Snyder, Shahani-Denning, 2012) or having their own experience with a similar tool (Woźniak, 2019; Balcerak, Woźniak, 2020) have a more favorable attitude towards using this tool in the selection processes. It can therefore be expected that a similar mechanism applies to recruiters – good past experience with the use of a specific tool (or a tool of a given type) will favor its use in the future, but also a good opinion about a given tool.

The starting point of our study is the statement that the assessment of a specific tool depends not so much (or only) on the tool as such, but on the aspect that is assessed in the use of this tool. From the perspective of the recruiter's role as a person carrying out the tasks assigned to him by the organization, the decision which of selection tools should be chosen requires taking into account several – unrelated – criteria: predictive validity of a given tool, effectiveness and efficiency of its use, and the image-related consequences that the use of a given tool in the selection process leads to. They result from the various roles that the recruiter performs: he/she is to select the right employees for the organization (the role of the recruiter in the strict sense), he/she is to do it effectively (the role of a corporate employee) and he/she is to do it in a way that maximizes the good image of the company, i.e. taking care of the quality of candidate experience (marketing role of a person who cares about the company's image). In our study, we will take into account the three aspects mentioned above in terms of which the recruiter must evaluate a given selection tool in order to make a difficult choice which tool to choose for selection, i.e. predictive validity, effectiveness and efficiency of using a given tool (estimated by evaluating the functionality of this tool i.e. the presence of attributes that make a tool useful for its intended purposes), and candidate experience.

The interpretation of effectiveness (including cost-effectiveness and efficiency) adopted in the study requires a few words of comment. We assume that if the tool has already been purchased for the organization and is functional, i.e. useful for its intended purposes and user-friendly, then its use contributes to streamlining the recruitment process, saving time and costs. It should therefore be expected that well-known tools with known benefits from their use, i.e. ATS and bots, should be rated higher due to their functionality than tools that are more complicated, less known and with less known benefits.

An argument for this order may be the results of the study, which showed that the more technically complex the tool, the worse its assessment – by students as a job candidate – as a useful tool for assessing the suitability of a job candidate (Schick, Fischer, 2021). Since ATS and bots should be included in the lowest complexity group, and games and VR in the higher group, it should be expected that their evaluation in terms of functionality will correspond to this order (i.e. ATS and bots will be rated higher than games and VR).

On the other hand, a number of earlier studies indicated that the attitude towards ICT-based selection tools depended on the directly or indirectly measured computer competence. Previous research has shown that ICT familiarity sometimes promotes higher

acceptance of its applications in selection processes (Langer et al., 2019), but sometimes it works the other way around (Langer, König, Fitali, 2018; Zacny, Kania, Sołtysik, 2019; Woźniak, 2019; Langer, Landers, 2021). We will test the differences in the perception of various aspects of the impact of these 4 tools due to ICT familiarity measured by respondent's employment in companies from the new technologies sector, as 1/3 of the HR employees surveyed by us work in companies from the new technologies sector. So, we formulate a clause in hypothesis 1 that introduces a difference assessment of tools as to their functionality by the respondents employed in the new technology industries.

Hypothesis 1. *Respondents employed in new technology industries will assess the functionality of the surveyed tools similarly. Others will rate the functionality of less technically complex tools (ATS and bots) higher.*

The second criterion that recruiters must take into account when choosing a tool is the effect of its use on candidate experience. Candidate experience – understood in recruitment research along the lines of customer experience studied by marketing – is a broader concept than just assessing the fairness of the selection process, and is sometimes defined as “an applicant's overall cognitive and affective perceptions based on multiple interactions with a hiring organization over the course of the entire recruitment and selection process” (McFarland et al., 2022, p. 5). This means in particular that recognizing a specific tool as unfair obviously evokes negative feelings (candidate experience), but this construct will also include other factors, e.g. considering the company using a given recruitment tool as modern.

However, the main source of scientific findings in this area is still the 30 years tradition of research on the perception of fairness of selection tools (Steiner, Gilliland, 1996; Ryan, Ployhart, 2000; Anderson, 2003; McCarthy et al., 2017; Balcerak, Woźniak, 2020). It brought several well-established findings regarding candidates' perception of particular tools, which brought practical recommendations for recruiters. Candidates better accept (assess it more fair) selection that uses tools that are understandable for them and related to the job they are to perform, and give them the opportunity to present themselves in contact with the recruiter (Truxillo, Steiner, Gulliland, 2004). In practice, this means that it is more desirable for recruiters – who fulfill their professional role as an employee of the company who cares about its image – to choose tools that are the best equivalent of those that candidates evaluate the highest on the fairness scale, i.e. selection interviews and work samples (Anderson, Witvliet, 2008; Anderson, Salgado, Hülshager, 2010; Woźniak, 2013; 2019), wherever they carry sufficient information to predict success at work in a given company. Research on tools analogous to traditional selection tools, but being their ICT-based equivalents (Woźniak, 2019; Balcerak, Woźniak, 2020; 2021; Woods et al., 2020), confirms these findings, so the more an ICT-based tool resembles an interview or (simulated) work sample the more it is accepted by candidates as fair (although it is usually rated lower than an analogous traditional tool – Woźniak, 2019; Balcerak, Woźniak, 2020; 2021). In this sense, all three tools (without ATS) analyzed here belong to one group from the fairness perspective, and they differ only in

the way they are implemented and in the richness of communication channels that are used for dialogue, or in accuracy and fidelity of simulated “work sample”. This suggests that the fairness dimension in relation to the three tools that will be analyzed here can be considered not very differentiating, i.e. their use should not – in accordance with current scientific findings – have a significantly different impact on the candidate experience by shaping the company's image and the recruitment process as not very honest.

However, from other studies, i.e. studies on communication channels (Potosky, 2008), it is known that communicating with a candidate in a richer communication channel increases his/her satisfaction with the selection process. It should therefore be assumed that communication-rich tools, i.e. competence games and VR, should be rated higher (assuming *ceteris paribus*) in terms of candidate experience than bots – a more well-known but with poorer communication (still assuming that they have the same level of fairness). This means that it is possible to formulate a hypothesis that in terms of candidate experience, bots will be rated the lowest, while competence games and VR will be rated higher.

One of the components of the assessment that forms the candidate experience measure is the recognition of the company as modern, thanks to the observation of the tools used by recruiters. The importance of using modern selection tools for recognizing a company as modern and innovative was confirmed in early scientific research, which indicated that – at a time when ICT-based recruitment and selection tools were still novelties – their use was conducive to assessing the company as modern (Blacksmith et al., 2016).

This component probably has a different weight in the overall assessment, depending on the company candidates aspire for – the more technologically sophisticated the company, the more important this factor may be. Hence, there should be differentiation due to the respondent's belonging to the group employed in the new technology industries, because employees of such companies should pay more attention to the aspect of modernity and innovativeness than employees of traditional organizations. From this perspective, respondents employed in the new technology industries should rate competence games and VR higher than respondents from other companies. This allows us to formulate the second part of Hypothesis 2.

It should be remembered that there is currently no data that can objectively measure the impact of the use of a given type of tool on the opinion of a company as modern and innovative, although it can be assumed that more well-known tools, i.e. competence games and bots, will be rated lower in this respect than VR, which is not only technologically more demanding, but has also been publicized by the significant investments of Meta (Facebook) in this ICT segment (Jamroz, 2022). Therefore, it can be said that the order of setting the tools in companies that highly value modernity, as proposed here, may be different, as it can be assumed that competence games will be treated by respondents employed in the new technology industries as tools whose candidate experience level is the same as bots.

On the other hand, one should remember about candidates' reluctance to be assessed using AI (Zacny, Kania, Sołtysik, 2019; Mirowska, 2020). Therefore, it can be suspected that also for candidates for new technology companies, the use of AI – which is necessary to create VR – may negatively affect the evaluation of candidate experience caused by using this method, and thus the entire candidate experience (which makes hypothesis 2 not trivial in this matter).

Hypothesis 2. *In terms of perceived candidate experience bots will be rated the lowest. Respondents employed in the new technology industries will rate candidate experience of competence games and VR higher than others.*

Another aspect due to which recruiters should evaluate each tool used in employee selection is its predictive validity, i.e. the ability to separate people who will succeed at work in a given position from others. The recruiters' opinion about this aspect is always the result of experience with specific representatives of a given class of tools and/or conclusions from scientific research on a given class of tools, and – or maybe even above all – the effects of marketing activities of consulting companies.

Being aware of this multiple impact on the formation of recruiters' opinions, we believe that competence games will be rated the highest in terms of predictive validity as tools that are closely related to work samples, enabling the examination of many competences and for years being the object of many promises of consulting companies as an ideal tool for diagnosing competences. Bots, although undoubtedly more widespread than games, are better known as pre-selection tools (and self-selection carried out by the candidate), but they examine qualifications, not competences. Since recruiters tend to base selection on competencies rather than qualifications, it should be assumed that games will be rated higher than bots in terms of predictive validity.

VR, as a tool in the broader sense, not very popular and little researched, should be rated definitely the lowest in this respect, unless the opinion on predictive validity is influenced (through the "halo effect") by opinions on its other advantages, such as a positive impact on building image of a modern company. Nevertheless, we formulate the third hypothesis as follows:

Hypothesis 3. *Perceived predictive validity will be the highest for competence games, lower for bots and the lowest for VR.*

As we have already mentioned, the distinction between the three aspects of the assessment, or the criteria on the basis of which recruiters should evaluate a given selection tool when deciding on a particular method of assessing candidates, is clearer in theory than in practice. These three perspectives adopted by recruiters may not be so clearly separated in the minds of a single recruiter. The influence of the halo effect cannot be ruled out either – the assessment of one aspect can be transferred to the others. This effect is even more likely for less experienced recruiters. Therefore, we formulate the following hypothesis:

***Hypothesis 4.** Evaluations of individual tools in three examined aspects (functionality, candidate experience, and predictive validity) of respondents less experienced in work in the HR area (working at most 5 years in this area) will converge. The evaluation of more experienced employees will vary.*

3. Method

3.1. Respondents' characteristics

The study was conducted using an online questionnaire posted on a discussion forum for HR employees, i.e. mainly LinkedIn, supplemented by personal invitations in private social media by Mrs. M. Kisiel – an employee of the HR department and the data was made available to the authors for the purposes of this article. A snowball sampling method was used and 120 responses were obtained from people operating in the HR area. The respondents were experienced HR employees, only 12% of them worked for less than 1 year in this department, and another 27% of the respondents had an internship of 1 to 5 years. 33% of the respondents had more than 11 years of service.

The group was also diverse in terms of age: 18% of the respondents were under 25, 38% were aged 26-35, 44% were aged 36-45, and only 16% of the respondents were over 46 years of age. Due to the type of work, higher education prevailed among the respondents: 68% had a full master's degree and the rest had a bachelor's degree and were still studying, and for the same reasons women constituted 3/4 of the sample. 52% of people worked in companies with more than 500 employees, and only 13 people in companies with less than 50 employees (the others worked in companies with 51-500 employees). 37.5% of the respondents worked in the new technology industry (industry based on new technologies, services based on new technologies and technology companies in the area of ICT and biotechnology) – the rest were classified as working in traditional industries.

The study used a questionnaire consisting of 4 blocks of questions concerning each of the 4 tools, each of which was preceded by a short definition of a given tool. The definition was followed by a series of detailed statements rated on a 5-point Likert scale (1 – totally disagree; 5 – totally agree). Questions that make up different measures have been mixed to minimize response bias.

3.2. Measures

Functionality i.e. a set of attributes that make a tool useful for its intended purposes was measured differently for each tool, because for each of them there was a different set of key attributes. Sample questions include (Cronbach's alphas in brackets):

- For ATS: *ATS connected with the recruiter's calendar make arranging appointments much easier. Generating reports from the ATS system allows for ongoing and effective monitoring of processes (0.89).*
- For competence games: *A competence game enables the appropriate selection of tasks for testing the competences needed for a given position. A competence game enables a personalized selection of tasks for assessing the candidate's competencies (0.74).*
- For bots: *Bots doing pre-interviews do it faster than a human. The use of bots and chatbots shortens the implementation of selection processes (0.81).*
- For VR systems: *VR reality allows a person to experience situations almost in line with real ones, thanks to which the assessment of the candidate's behaviour is more reliable. Virtual reality allows candidates to be shown their future work environment (0.81).*

Candidate experience (understood in recruitment research as the equivalent of a comprehensive assessment of the customer service process, i.e. on the model of customer experience) of VR, competence games and bots was measured using six items:

- *[This tool] makes candidates more involved in the recruitment process.*
- *[This tool] makes candidates more satisfied with the recruitment process.*
- *[This tool] makes candidates believe that the selection tests in this process give a good assessment of suitability for the job being filled.*
- *[This tool] makes candidates less likely to drop out during the selection process.*
- *The use of [this tool] contributes significantly to a positive candidate experience.*
- *The use of [this tool] in recruitment and selection processes builds the company's image as a modern one.*

The current state of scientific knowledge is based on such ad hoc scales (McFarland et al., 2022), and factor analysis showed that the scale proposed in our study creates one factor. Cronbach's alpha was 0.91.

Perceived predictive validity of VR, competence games and bots was measured using five items:

- *[This tool] makes it possible to accurately predict whether a candidate is able to perform only some tasks within the scope of duties for a specific position.*
- *[This tool] makes it possible to accurately predict whether a candidate is able to perform all tasks within the scope of duties for a specific position.*
- *[This tool] makes it possible to accurately predict whether a candidate is a suitable candidate for the job being filled.*
- *[This tool] makes it possible to accurately predict whether a candidate has the appropriate social and interpersonal skills to work in the position being filled.*
- *[This tool] makes it possible to accurately predict whether a candidate is a suitable candidate for cooperation with the manager of the position being filled.*

Cronbach's alpha was 0.87.

Technical complexity of the tool was a dichotomous variable with a value of 0 for ATS and bots, and a value of 1 for Competence Games and VR.

IBM SPSS Statistic software (ver. 28) was used to conduct all statistical analyses. The criterion for statistical significance was set at 5%.

4. Results

Table 2 presents the means, standard deviations, and correlations among the variables used in this study.

Table 2.
Means, standard deviations and correlations

Measure	M	SD	Correlations								
			1	2	3	4	5	6	7	8	9
Functionality											
1. ATS	4.23	0.71									
2. Competence games	3.83 ^{A,B}	0.61	0.61								
3. Bots	3.91 ^A	0.87	0.73	0.48							
4. VR	3.72 ^B	0.73	0.68	0.44	0.75						
Candidate experience											
5. Competence games	3.96 ^C	0.69	0.66	0.85	0.55	0.56					
6. Bots	3.29	0.90	0.56	0.45	0.72	0.59	0.51				
7. VR	3.96 ^C	0.86	0.63	0.51	0.70	0.80	0.60	0.62			
Predictive validity											
8. Competence games	3.49 ^D	0.70	0.60	0.73	0.49	0.43	0.81	0.54	0.57		
9. Bots	2.93	0.99	0.54	0.50	0.66	0.59	0.57	0.81	0.66	0.63	
10. VR	3.39 ^D	0.75	0.48	0.43	0.62	0.62	0.47	0.60	0.62	0.45	0.77

Notes. Means with the same superscript are not significantly different at the 0.05 level. All correlations are significant at the 0.05 level

To investigate differences in functionality ratings, a two-way repeated measures ANOVA with one between-subject factor (employment in the new technology industry) was performed. Because of sphericity violation (Maluchy's $W = 0.785$, $p < 0.001$), and Greenhouse-Geisser $\epsilon = 0.852$, Huynh-Feldt correction was applied. Levene's statistics (based on means) for all functionality scores are nonsignificant ($p > 0.05$), so the assumption of homogeneity of variance is met.

The analysis indicated that interaction effect tool \times (employment in the new technology industry) is not significant ($F_{(2.64, 311.49)} = 0.698$, $p = 0.536$). The main effect of the between subjects factor (employment in the new technology industry) is also not significant ($F_{(1, 118)} = 0.057$, $p = 0.811$). The main effect of tool (a within-subjects factor) is statistically significant ($F_{(2.64, 311.49)} = 25.801$, $p < 0.001$) and large (partial eta-squared = 0.179). Estimated marginal means of functionality ratings are presented in Figure 1.

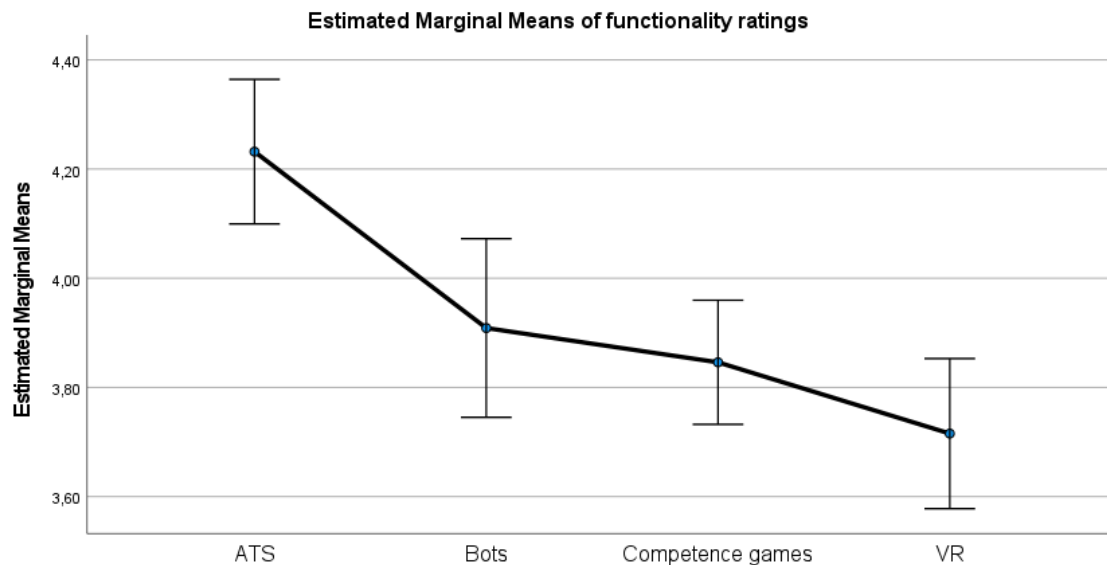


Figure 1. Estimated marginal means of functionality ratings of ATS, bots, competence games, and VR systems.

The pairwise comparisons with Bonferroni correction revealed that perceived ATS functionality is significantly higher rated than functionality of games ($p < 0.001$), boots ($p < 0.001$), and VR ($p < 0.001$), functionality of bots are significantly higher rated than functionality of VR ($p = 0.004$), and differences between ratings of games and bots, and between ratings of games and VR are not significant. This results indicate that the first hypothesis is partially supported.

To investigate differences in candidate experience ratings, a two-way repeated measures ANOVA with one between-subject factor (employment in the new technology industry) was performed. Sphericity assumptions was met (Maluchy's $W = 0.978$, $p = 0.267$). Levene's statistics (based on means) for all candidate experience scores are nonsignificant ($p > 0.05$), so the assumption of homogeneity of variance is met.

The analysis indicated that interaction effect (tool) x (employment in the new technology industry) is not significant ($F_{(2, 236)} = 0.303$, $p = 0.739$). The main effect of the between subjects factor (employment in the new technology industry) is also not significant ($F_{(1, 118)} = 0.026$, $p = 0.871$). The main effect of tool (a within-subjects factor) is statistically significant ($F_{(2, 236)} = 54.157$, $p < 0.001$) and large (partial eta-squared = 0.315). Estimated marginal means of functionality ratings are presented in Figure 2.

The pairwise comparisons with Bonferroni correction revealed that candidate experience of bots is significantly lower rated than candidate experience of competence games ($p < 0.001$), and VR systems ($p < 0.001$). The differences between perceived candidate experience of competence games and VR systems are not significant. This results indicate that the second hypothesis is also only partially supported.

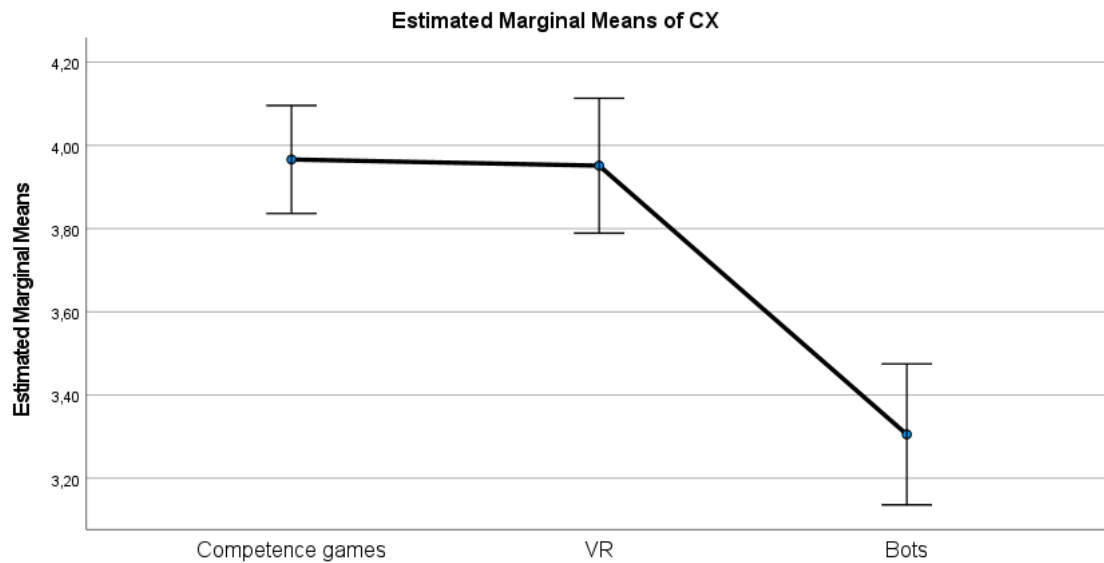


Figure 2. Estimated marginal means of candidate experience ratings of competence games, VR systems, and bots.

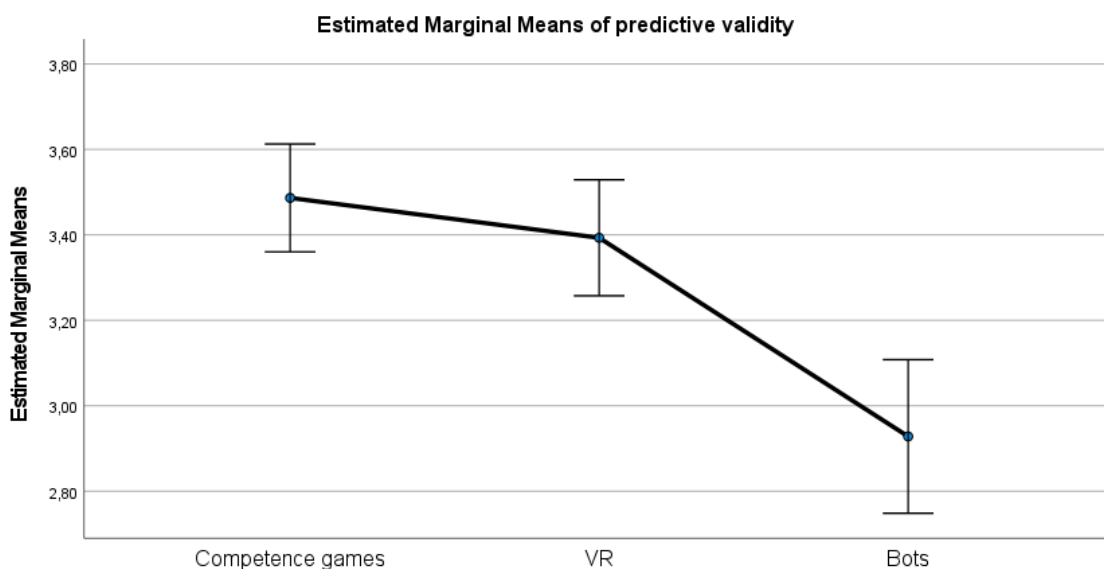


Figure 3. Estimated marginal means of predictive validity ratings of competence games, VR, and bots.

To investigate differences in perceived predictive validity, a repeated measures ANOVA was performed. Because of sphericity violation (Maluchy's $W = 0.939$, $p = 0.025$), and Greenhouse-Geisser $\epsilon = 0.943$, Huynh-Feldt correction was applied.

The analysis indicated that there were significant differences in perceived predictive validity ratings ($F_{(1.915, 227.881)} = 40.68$, $p < 0.001$). The main effect is large (partial eta-squared = 0.255). The pairwise comparisons with Bonferroni correction revealed that perceived predictive validity of bots is significantly lower rated than predictive validity of VR ($p < 0.001$), and games ($p < 0.001$), although difference between predictive validity of games and of VR is not significant ($p = 0.551$). Estimated marginal means of predictive validity ratings are presented in Figure 3. The third hypothesis is confirmed only with respect to the highest scores of predictive validity of competence games.

To investigate differences in ratings of three aspects (functionality, candidate experience, and predictive validity) regarding competence games, bots and VR systems three two-way repeated measures ANOVAs with one between-subject factor (professional experience) were performed. Because of sphericity violations and Greenhouse-Geisser $\epsilon > 0.75$, Huynh-Feldt corrections were applied. The ANOVAs' results are given in Table 3. The analyses indicated that interaction effects (aspect) x (professional experience) as well as the main effect of the between subjects factor are not significant. The differences between ratings of three investigated aspects are significant. Predictive validity was the lowest rated aspect for all three types of tools. The highest were rated: candidate experience (in the case of competence games and VR systems) and functionality – in relation to bots.

Table 3.

Differences in ratings of functionality, candidate experience, and predictive validity – the results of ANOVAs and pairwise comparisons with Bonferroni correction

Tools	Tests of effects			Significant pairwise differences
	interaction	between-subjects	within-subjects	
Competence games	$F_{(1.858, 219.23)} = 0.024$; $p = 0.97$	$F_{(1, 118)} = 0.171$; $p = 0.68$	$F_{(1.858, 219.23)} = 72.923$; $p < 0.001$; partial eta-squared = 0.38 (large)	CX > Funct. > PV
Bots	$F_{(1.844, 217.26)} = 0.758$; $p = 0.46$	$F_{(1, 118)} = 0.48$; $p = 0.49$	$F_{(1.844, 217.26)} = 120.135$; $p < 0.001$; partial eta-squared = 0.50 (large)	Funct. > CX > PV
VR systems	$F_{(1.810, 213.542)} = 2.176$; $p = 0.121$	$F_{(1, 118)} = 1.309$; $p = 0.255$	$F_{(1.810, 213.542)} = 44.336$; $p < 0.001$; partial eta-squared = 0.27 (large)	CX > Funct. > PV

Abbreviations: Funct. – functionality, CX – candidate experience, PV – predictive validity.

5. Discussion of the results

The first three hypotheses, which were partially confirmed, show the scale of expectations that recruiters associate with the two latest tools, i.e. competence game and VR. As the data in the charts above show, both in terms of predictive validity and candidate experience, they are rated higher than the tool well-known to recruiters, which is the bot, despite the highest rating of this tool from the perspective of its functionality. Assuming that the respondent's assessment of these two latest tools is based not so much on personal experience of using them, but rather it was influenced by media opinions and the image they were formed in the recruiters' environment, it can be assumed that the surveyed Polish recruiters are open to new solutions based on ICT.

As expected, well-known tools are rated as highly functional, but it may come as a surprise that the bots score is clearly weaker in this respect (insignificantly different from the ratings of the functionality of competence games) in relation to ATS. Such an assessment

of bots may result from the perception of their obsolescence; Polish recruiters, as consumers on the Polish market, have their own experience with bots of the 3rd generation, i.e. they dialogue relatively freely in the colloquial spoken language, compared to which traditional button-down bots do not look modern.

The relatively low – in comparison with other tools – assessment of the functionality of bots could also be caused by the need to spend a lot of work on the construction of texts for the decision tree, but also the need to establish strict qualification criteria for rejecting candidates for a number of positions. It can be concluded that the benefits of using bots based on dialogue trees are the highest for very large companies that conduct mass recruitment for several similar positions, and for smaller companies – which clearly prevail in our sample and on the Polish market – then the benefits of saving the labor of HR employees are smaller. Therefore, we cannot rule out that the low assessment of the functionality of bots is partly an artifact resulting from the nature of the companies from which the respondents come (i.e. not carrying out mass recruitment during which millions of candidates must be rejected using the qualification criteria), and is not an assessment of the low functionality of bots as such.

The collected data do not allow to determine whether the reason for the result obtained here is the specificity of recruitment conducted by the surveyed recruiters or poor knowledge of the usefulness of bots in Poland, which indicates the need for further research in this area. It can be assumed that the first bots used in Poland before the pandemic actually had mainly image purposes and were supposed to increase candidate experience, and were not primarily used to automate the process of assessing qualifications or rejecting people with unrealistic financial expectations. Stopping mass recruitment in most industries during the pandemic could therefore cause bots to be associated more with a tool for building the company's image than with an authentic tool for automating repetitive tasks in the selection process, with which ATS is undoubtedly associated.

As expected, predictive validity ratings for all tools are the lowest, regardless of the recruiter's professional experience. The relatively high rating of predictive validity of VR systems may be surprising, as a tool practically absent in recruitment and selection practice. The average predictive validity of bots ratings is as expected low. Also in line with expectations are the high candidate experience ratings obtained by competence games and VR systems and this rating is maintained even when the component of assessing the company as modern is removed from the candidate experience rating (calculations omitted in the text). This confirms the analogy of the situation on the Polish market of selection among ICT-based selection tools, which was diagnosed at the beginning of the 20th century in the USA – the use of new ICT-based solutions was conducive to good candidate experience and recognition of the company as modern.

The analysis of the order of values of each tool showed that bots are appreciated due to their functionality, and more precisely, that all other bot ratings are lower than the one regarding functionality. From this perspective, it can be concluded that, according to the respondents, bots have ceased to perform primarily an image function, or rather – that in the image function they are even weaker than as a tool facilitating the recruiter's work. Referring to the above reservations regarding the possibility of an artifact related to the nature of the study group, it can be said that recruiters are not very favorable towards the use of bots in the practice of the selection process. In order to decide between these two explanations, further research is necessary, which is important because the first explanation emphasizes rather poor awareness of the role of the recruiter as a representative of the company, and the second – poor management supervision over the work of the HR department, and thus should result in different corrective actions.

From the practical perspective and further research, an interesting result is the lack of differences in ratings between recruiters from high technology companies and from traditional ones. This may result from the nature of the sample obtained with the snowball technique, but it may also be a feature of Polish recruiters as a relatively homogeneous group, regardless of the nature of the company in which they perform their roles.

6. Conclusions

In the 21st century, the use of ICT in the recruitment/selection has become a standard of good practice and a significant area of scientific research. However, earlier studies focused primarily on two areas: analyzing the conditions in which data collected using a specific tool can predict the success of a given person in the job being offered, and candidates' perception that the use of a specific selection tool leads to a fair selection process. Relatively little is known about recruiters' attitudes towards ICT-based selection tools, and this study is one of the first steps to reduce this knowledge gap.

The study analyzes recruiters' opinions concerning three aspects of how ICT-based recruitment and selection tools are evaluated. The assessment of candidate experience and predictive validity of competence games, bots based on a previously prepared dialogue tree and VR systems were examined. The assessment of the third aspect – functionality – included additionally ATS (Applicant Tracking System). On the basis of an e-questionnaire study of a group of 120 respondents working in HR departments of Polish organizations, it was found that the assessments of these three aspects are different. This means that recruiters, regardless of the length of professional experience, notice differences in how each of these tools contribute to the various dimensions of the recruiter's role. These dimensions are: the recruiter as providing the organization with accurate predictions as to the likely success of the

candidate in the job offered; the recruiter as a representative of the organization responsible for the effectiveness and efficiency of recruitment and selection processes; and the recruiter as a person who takes care of the company's image. There were also no differences in detailed assessments between recruiters from technology companies and other recruiters concerning perceived candidate experience.

Recruiters were also shown to rate competence games and VR the highest due to the candidate experience they bring, while they value bots primarily for their functionality.

The study supplemented existing scientific knowledge and allowed us to formulate several practical recommendations and postulates for further research.

In the Polish literature this seems to be the first time that in one study the three aspects of the role of the recruiter in the organization were so clearly separated, and a questionnaire tool was proposed to directly measure these different aspects of the recruiter's role. It has also been shown that these three separate aspects are not only theoretically different, but also recruiters make independent assessments of them.

The study presented the opinions of a diverse group of Polish recruiters on these aspects of the usefulness of chosen ICT-based selection tools, which is a step in scientific research on taking into account the perspective of this actor in the recruitment process. Previous research on the perception of ICT-based selection tools by recruiters used data from small groups of professionals collected through interviews (Albert, Aggarwal, Silva, 2019; Koivunen et al., 2021; Mirowska, Mesnet, 2021; Ore, Sposato, 2021), which did not allow for the verification of quantitative hypotheses.

The most important result of the study is that recruiters assess each of the three aspects of a tool independently. Hence, the results of this study suggest that in future research on the perception of selection tools by recruiters, these three aspects should be taken into account and measured independently, because each of them is treated in this way by recruiters and each of them affects the recruiter's attitude to the usefulness of a given tool in a selection process.

The need for further research results primarily from the limitations of our study, which do not allow more specific conclusions to be drawn for practice. Firstly, the sample was composed of employees of HR departments of Polish companies, but it was unrepresentative, as it was created using the snowball methodology. Secondly, the selection tools chosen for the study were ICT-based ones relatively well described in the media, but not all tools that may already be available to Polish recruiters were included. Since opinions on the usefulness of a given tool may be partly formed in context (i.e. against the background of other tools described in the questionnaire), it is worth expanding the list of the examined ICT-based tools, as well as making a comparison with traditional IT tools on which these tools are based. It can therefore be said that when constructing the questionnaire, we made a compromise between its length (which makes it a nuisance for the respondent) and important research questions, but we remain partially dissatisfied with the decisions taken and encourage further

research. Thirdly, the scales constructed for this study are of a pilot nature and further research is needed to assess their psychometric values and improve them.

Therefore, bearing in mind all the limitations that make it difficult to generalize the results, it is worth pointing out the potential practical recommendations that result from this study, provided that its results are confirmed in subsequent tests.

Firstly, the research showed that recruiters' favor new selection tools for candidate experience. This suggests a relative readiness to reach for new ICT-based solutions, regardless of whether they solve the difficult problem of predicting how successful the recruitment process is, or only improve candidate experience.

Secondly, the results suggest that recruiters are aware of the differences between the three aspects and therefore, none of these aspects should be neglected during the introduction to HR departments of new tools that recruiters are to use in the process of selecting employees.

Although the study was intended as an attempt to describe the multidimensional nature of the acceptance of ICT-based solutions facilitating the process of selecting employees by Polish recruiters, it allows us to suggest several new directions of scientific research.

Widely conducted research on customer experience is gradually reflected in research on candidate experience (McFarland et al., 2022), but scientific knowledge on the diversity of factors determining candidate experience in different types of companies or industries is small. Our study has tried to take some steps in this direction. Undoubtedly, the starting point in such research should be the construction of a tool for assessing the factors shaping candidate experience, for which the starting point may be the proposal contained in this work.

In our opinion, an indication for new research is also the need to consider the hypothesis that the actors of social life, whose opinions we study, see the categorization of the elements that make up their duties differently than it results from the classification made in scientific research. Focusing research on a selected aspect of the recruiter's role may lead to artifacts if recruiters' opinions show cognitive bias such as the halo effect, or their awareness of a specific aspect of the role is low.

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INTELLECTUAL CAPITAL MANAGEMENT OF AN ORGANIZATION SURROUNDING VUCA

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Purpose: The main purpose of the research presented in the article was to diagnose the intellectual capital management process in small and medium-sized enterprises in the Lower Silesian Voivodeship. To achieve this goal, the first part of the article explains the meaning of the term „intellectual capital" based on the scientific literature in the field of management, and then, based on the conducted research, an attempt was made to answer the following questions: which factors determine the process of „intellectual capital management" and what benefits it brings it to companies.

Design/methodology/approach: For the research presented in the article, an analysis of the literature in the field of intellectual capital management, knowledge management and competence management was used. Literature studies also concerned secondary sources, which were messages from studies of a similar scope. The use of various research methods allowed to obtain a broader context of the studied phenomenon and ensured a higher quality of research. This differentiation was aimed at obtaining consistency of empirical grounds for inference. The diagnostic survey was adopted as the leading method. Other methods used in the work performed auxiliary (supplementary) functions.

Findings: „Intellectual capital management" in the global economy is a resource of strategic importance affecting the market value of the organization itself and providing a competitive advantage. Building a significant intellectual capital of an organization in the VUCA environment requires the use of appropriate methods and tools supporting management, systematic measurement, constant comparison with the competition, elimination of barriers to knowledge sharing.

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

Practical implications: The article presents the results of research conducted among several dozen small and medium-sized enterprises in Lower Silesia. The research is of a pilot nature, but the research results are very interesting and encourage research on a larger scale. They are a valuable source of information for managers responsible for creating the intellectual capital of the organization in terms of acquiring and sharing knowledge. In turn, for people responsible for recruiting employees, the results may be useful in developing a candidate profile, in particular when identifying key competences of knowledge workers. The results also indicate the demand of the Polish market (especially medium-sized companies) for IT infrastructure that enables the acquisition, processing and collection of information.

Originality/value Based on empirical research, the article proposes an original set of system solutions in the field of human capital management to improve the functioning of the organization in the VUCA environment.

Keywords: intellectual capital management, knowledge management, human capital.

Category of the paper: Research paper.

1. Introduction

The modern world is developing faster than ever before, and all thanks to modern technologies. Since the end of the 18th century, the world has been experiencing successive industrial revolutions. Currently, the fourth industrial revolution is underway, which can be defined as in-depth digitization, followed by further automation of processes taking place in enterprises through the implementation of advanced IT systems, data analytics and artificial intelligence. Another one appears on the horizon - Industry 5.0.

In recent years, the environment of the organization's functioning is characterized by volatility, turbulence of the environment, ambiguity and uncertainty. The functioning of companies in such an environment turns out to be more and more difficult. We live in a time when companies are constantly outdoing each other in new ideas that will help them gain a competitive advantage. New areas and concepts in management - Industry 4.0 - are beginning to emerge, such as: intellectual capital, human capital, knowledge-based organizations, intelligent organizations, learning, knowledge management, intangible resource management, knowledge workers.

Intellectual capital management in the environment of VUCA and growing competition is a prerequisite for any company that wants to survive on the market. An effective manager should be able to find himself in the turbulent reality known as VUCA. VUCA environment is an acronym introduced by American military strategists from the US Army War College to describe the situation that arose after the end of the Cold War: volatility, uncertainty, complexity and ambiguity. Each of these features of the new reality is a challenge for managers and requires a thoughtful approach. The success of enterprises in the knowledge-based economy requires taking a number of actions in the field of intellectual capital management, which is the main potential of companies.

The process of intellectual capital management primarily consists in identifying its components, measuring and effective use, as well as continuous development of its potential. Skillful management of intellectual capital should include mutually complementary processes of creating and disseminating knowledge, which consist in creating an organizational culture conducive to learning, implementing new technologies, improving existing processes, as well as treating all employees of the organization as the most important and valuable resource of the company.

When starting the research, three research questions were defined:

1. Which factors are a barrier to the development of intellectual capital in small and medium-sized enterprises in Lower Silesia?
2. What features characterize modern organizations based on the concept of intellectual capital in small and medium-sized enterprises in Lower Silesia?
3. Which factors significantly affect the intellectual capital potential of an employee in small and medium-sized enterprises in Lower Silesia?

2. Organization intellectual capital management

In the second half of the last century, the main determinant of the position or success were the possession of material goods in the form of machines, buildings or good financial results. Along with the progressing globalization, it has been noticed that assets such as people and their skills and experience, all kinds of organizational systems, databases, technical facilities, internal relations between employees and external relations with business partners are gaining in importance (Kucera, Dvorakova, 2023, pp. 296-315). Considerations have begun on what is in fact invisible and intangible.

At the end of the 20th century, two research trends concerning the concept of intellectual capital could be distinguished. The first emphasizes the need for accurate measurement of non-financial data and the study of the relationship between them and financial data. The second trend mainly concerned the creation and storage as well as the improvement of knowledge and the relationship between knowledge and value creation (Gross-Gołacka et al., 2019, p. 15; Claver et al., 2013, pp. 121-128).

In the management science literature, a term often used in the context of intellectual capital is „hidden assets”, that is „the difference between the market value and the book value of the organization” (Pobrotyn, 2012, p. 122; Edvinsson, Malone, 2001, p. 39).

Intellectual capital consists of two factors: human capital and structural capital. Human capital is, of course, the knowledge, skills and talents of the organization's employees. M. Armstrong presented human capital as knowledge, skills, scope of capabilities and possessed potential for the development and implementation of innovative processes by individuals working in the organization (Armstrong, 2016, p. 19). Human capital in its scope concerns the competence of employees, the ability to solve problems, leadership and managerial skills (Balcerzyk, 2021, p. 231). B. Hamm believes that human capital is „all the features and abilities that can be attributed to a single person" (Hamm, 2004, pp. 52-53). People are the main driving force behind all innovation (Wijava, Utama, 2023, pp. 328-342).

Structural capital consists of hardware, software, technologies, databases and patents. It is owned by the company and can be sold (Edvinsson, Malone, 2001). It should be emphasized that all components of intellectual capital are closely related. The separation of human and structural capital will not bring the desired results and will prevent the creation of intellectual capital. Its strength stems from the integration and interaction of individual elements (Beyer, 2013).

K. Beyer noted that „structural capital is the result of the actions of employees and, unlike human capital, can be owned by the company" (Beyer, 2013, p. 17). It is a philosophy that accelerates the flow of knowledge, both inside and outside the organization (Aryanto et al., 2015, pp. 874-879; Hajro et al., 2017, pp. 345-372). It refers to more specific elements of the organization (Claver-Cortés, 2018). It consists of the organizational structure, relations with the environment in the form of supply chains, knowledge stored in databases, documents (procedures, regulations, data), IT systems (Hajro et al., 2017, pp. 345-372).

L. Edvinsson, developed a model that assumes that intellectual capital consists of human capital and structural capital, which in turn consists of customer capital, also known as relationship capital (Kaczmarek, 2005). By interacting with each other, they create the company's vision and organizational culture. The organization is mainly created by interpersonal relations (Pawłowska, 2015, pp. 167-176).

It should be noted that intellectual capital in the context of the organization's value is its immeasurable part, creating „added value" (Kalkan et al., 2014, pp. 700-707). This capital is therefore an important organizational asset (Libertowska, 2018, p. 91). Intangible assets are difficult to identify, and the values of its individual components are difficult to add up. Therefore, it seems accurate to say that the potential of an organization is evidenced by the „strength of minds" of its employees (Berzkalne, Zelgalve, 2014, pp. 887-896).

Human intellectual capital “is a combination of genetic heritage, education, experiences, attitudes towards life and business. Thus, it includes the psychological capabilities of a human being, knowledge acquired and attitudes shaped in the process of learning, upbringing and practical activity, developed skills and outstanding special abilities that are talents” (Mikula et al., 2002, p. 47). Sustainable resource management (SRM) should be understood as activities of a strategic nature, the basis of which is the effective protection of resources necessary for, depending on the adopted strategy, stability or growth of the organization (Czainska, 2020, pp. 12-13). The right configuration of human capital (employees) is the key to the success of the organization.

Employees in the sense of human capital should develop together with the organization, creating an intelligent organization (Žukowska, 2019, p. 65). Employee development is a form of joint investment of employees and employers. People are profit levers. Personal development is also dependent on the impact on personality changes; the more it affects the transformation of attitudes, the more difficult it is, and the effects are delayed in time.

3. Methods and characteristics of the research sample

The literature research presented in the article was based on an analysis of the literature on the subject of managing the intellectual capital of an organization, a „learning" organization. The literature studies also included secondary sources, which were reports from studies of a similar scope.

The diagnostic study, analysis of the literature and secondary sources allowed to obtain a broader context of the researched phenomenon and ensured a higher quality of the conducted research. The variety of methods was aimed at achieving consistency of the empirical basis for inference. A diagnostic survey was adopted as the leading method. Other methods used in the article were auxiliary (complementary).

The diagnostic survey was conducted using a questionnaire. It was developed on the basis of literature analysis. Questionnaire The survey was intended for employees of companies in Lower Silesia. In the study, the following independent variables were assumed: the sex of the respondents, the age of the respondents, the size of the company (place of work), place of residence and the industry of the company's activity.

The research was conducted in the second half of 2022 on a random sample of people employed in small and medium-sized enterprises. 335 people took part in the research. The study group was evenly divided by gender. Women constituted 46,87% of the study group, and men 53,13%.

About 65,37% of the respondents are young people aged 19-29. 24,78% of the respondents were between 30 and 40 years old. The least numerous group were employees over 40 (9,85%). When analyzing the structure of the study group in terms of age, it should be noted that the respondents were young people at the stage of early professional career, during which crystallization occurs, narrowing the field of exploration and finalizing the choice of profession.

The respondents are employees of small and medium-sized companies employing up to 200 people. Over 26,56% of the respondents were employed in small companies (up to 20 employees) and 38,21% were employed in companies with 21 to 50 employees. About 35,22% of the respondents are employees of larger companies employing from 51 to 200 employees.

About 57,02% of the respondents are residents of villages and small towns of up to 5000 residents. A relatively large group of respondents were residents of towns of 6-25 thousand (34,03%). The rest are mainly inhabitants of towns up to 50 000 (approx. 8,96%).

The largest group of employees were people employed in production companies (45,87%). A large percentage of respondents are employees in the trade industry (14,43%) and transport (7,16%). The rest are people employed in the financial industry, construction, etc.

4. Managing the talented competitors

In the literature in the field of management and quality sciences, human capital is presented as a combination of such features as intelligence, analytical thinking, inspiration to act, creativity, imagination, reliability, honesty, credibility, consistency in action, and the ability to work in a team. Thanks to the capital held, the organization is able to easily react to changes in the VUCA environment, anticipates the upcoming changes, and sometimes even creates them. An organization based on intellectual capital is characterized by openness, flexibility and adaptability. Respondents were asked to interpret the concept of the organization's intellectual capital (Table 1).

Table 1.

Interpretation of the concept of the organization's intellectual capital

No.	Response category	n	%
1	the value of knowledge, skills and abilities that enable people to produce goods and services	131	39,10
2	a combination of genetic heritage, education, experiences, attitudes towards life	47	14,03
3	therefore, it consists of the psychological capabilities of a human being, knowledge acquired and attitudes shaped in the process of learning, upbringing and practical action, developed skills and outstanding special abilities that are talents	37	11,04
4	above all, the clarity of minds of employees, their creativity and innovation, is cooperation with the best	110	32,84
5	a combination of such features as intelligence, analytical thinking, inspiration to act, creativity, imagination, reliability, honesty, credibility, consistency in action, ability to work in a team	7	2,09
6	non-financial capital, reflecting the hidden gap between the book value and the market value of the company	3	0,90
	Together		100

Source: Author's own analysis.

The research shows that over 39,10% of the surveyed employees identify the meaning of the concept of the organization's intellectual capital with the resources of knowledge, skills and abilities that enable people to produce goods and services. About 32% of respondents perceive this capital as above all the clarity of minds of employees, their creativity and innovation, as cooperation with the best. Such an interpretation may indicate that employees see the need for staff development in the organization by creating an intelligent organization. Therefore, it becomes important to efficiently manage the competencies of employees, which also involves the need to finance them. Continuous development and professional development is a form of investment for both employers and employees. Over 25% of respondents believed that intellectual capital is knowledge, skills acquired and attitudes shaped in the process of learning, upbringing and practical activity, as well as outstanding special abilities that are talents. Less than 1% see a hidden gap between the book value and the market value of the company. Intellectual capital determines the market value of an organization, and at the same time it should be remembered that it is the employees who own this capital, not the organization itself.

The intellectual capital of the organization consists of human capital and structural capital, which in turn are organizational capital and capital in the form of customers. Human capital is a combination of the competences of employees and managers. It becomes important to properly understand the essence of human capital by the managerial staff. This determines the way the organization is managed, the company's strategy and the company's vision. In practice, there are fundamental differences between the functioning of companies based on intellectual capital and traditional organizations. In the survey, the respondents were asked to indicate the forms characteristic of their organizations.

Table 2.*Modern forms of organization*

No.	Response category	n	%
1	the dominant role of human and intangible resources	32	9,55
2	coordination, cooperation, advising	63	18,81
3	close cooperation between departments, effective flow of information	86	25,67
4	organizational culture based on trust, cooperation and co-creation	45	13,43
5	constant reconstruction of the external and internal world of the organization, rejection of stereotypes	23	6,87
6	flat organizational structure, in the form of cooperative networks of self-managing connections, focused on processes	36	10,75
7	none of the factors listed above	50	14,93
	Together		100

Source: own study.

Respondents recognized that close cooperation between departments, effective flow of information (25,67%) and coordination, cooperation, advising (18,81%) are the preferred forms of functioning in their organizations. They also see the importance of an organizational culture based on trust, cooperation and co-creation (13,43%). Such answers may suggest a departure from the traditional form of organization and functioning in intelligent knowledge-based organizations. They focus on close cooperation between employees and departments through efficient communication and good flow of information combined with a friendly working atmosphere based on trust and teamwork. They appreciate the dominant role of human and intangible resources (8,55%) and strive for a flat structure of the organization in the form of a network of self-managing cooperative links focused on processes (10,75%). It can therefore be assumed that the managerial staff identifies with the essence of human capital. It moves away from management based on fixed procedures, rigid hierarchical structures focused only on formal information exchange and communication. Managers are more flexible than in traditional organizations, which results in no difficulties in adapting to the VUCA environment, characterized by volatility, volatility, uncertainty, complexity, and ambiguity.

The analysis of the literature shows that the most valuable intellectual capital of an employee in professional work are socio-professional competences. It is thanks to them that the employee is able to meet the expectations of his superiors and socialize with other members of the group. So the question arises: Which factors determine the potential of human intellectual capital? (Table 3).

According to the respondents, the intellectual capital of a person is influenced primarily by the level of his awareness (42,09%) and the surrounding reality, the environment in which he functions (28,36%).

Table 3.
Factors affecting the potential of intellectual capital

No.	Response category	n	%
1	his level of consciousness	141	42,09
2	level of education	39	11,64
3	the surrounding reality, the environment in which it operates	95	28,36
4	level of civilization (existential) development	15	4,48
5	his personality traits	45	13,43
	Together		100

Source: own study.

The selection of the most important factors suggests that, in the opinion of the respondents, intellectual capital is determined by employees' knowledge of cause and effect relationships, dependencies, as well as the ability to interpret certain phenomena on the basis of professional experience. It is the awareness of the continuous acquisition of new competences while learning and the ability to self-reflection. Capital is also professional knowledge, both explicit and tacit. The surrounding reality and operating environment takes the form of a network of contacts within the organization and outside, mutual obligations and relations with the VUCA environment.

The employee's personality traits are also important (13,43%) in the form of innate genetic predispositions and acquired dispositions resulting from individual life and professional experiences. They determine the stability and permanence of an individual's behavior, especially in crisis situations that we have been experiencing for the last few years while functioning in the VUCA environment.

Education (11,64%) and the level of civilization development (4,48%) were considered less important. In the opinion of employees, graduating from higher education in a given field does not guarantee good preparation for the profession. It is also obvious that in today's labor market, employers value the employee's experience more than their education. The implementation of an experienced employee significantly shortens the professional adaptation time and generates much lower costs.

According to the respondents (26%), the main factor determining the management's approach to the organization of „the knowledge management" process is the previous experience and acquired skills in the implementation of „knowledge management". First of all, it is about managers who should have information about who in the company has the necessary knowledge to ensure competitiveness, what knowledge about project implementation must be possessed by other employees, how to shorten the time of task implementation and avoid mistakes, know how new knowledge is created and who creates.

Modern organizations naturally create friendly conditions for managing intellectual capital. Organizations of this type see the sources of their success in intangible resources, assigning them a dominant role, and their activities aim at increasing the value of intellectual capital. Respondents are convinced that efficient intellectual capital management brings measurable effects to the company, which take the form of an increase in the value of intellectual capital, the possibility of eliminating errors, increasing innovation, developing intellectual resources, promoting knowledge, increasing creativity and competitiveness (71,04%). Only about 9% are of the opposite opinion (Table 4).

Table 4.

Opinions of respondents regarding the benefits of intellectual capital management

No.	Response category	n	%
1	definitely yes	72	21,49
2	yes	166	49,55
3	no	51	6,27
4	definitely not	10	2,99
5	I don't know	36	10,75
	Together		100

Source: own study.

In a modern organization, the human-employee is at the center of its activities. He is the initiator of efforts to generate, process and disseminate the organization's resources within the organization. This makes it possible to create appropriate conditions for efficient communication between employees, departments, blurring boundaries both in terms of the scope of activity (space) and the use of resources and instruments. This is possible thanks to mutual trust, openness to change and flexibility of staff. This allows you to anticipate the following changes in the VUCA environment and take appropriate corrective actions. Thanks to employees' awareness of the importance of intangible capital that creates an intelligent company, a large part of employees declare their readiness to learn, acquire new qualifications, create new procedures and the need to share knowledge and skills with other employees.

The management of the intellectual capital of an organization is also associated with certain factors constituting a barrier to its development (Table 5).

Table 5.

Factors constituting the greatest barrier to intellectual capital management in the opinion of respondents

No.	Response category	n	%
1	problems with monitoring the effectiveness of training, i.e. checking to what extent the employee's knowledge increased after the training and to what extent it was used	70	20,90
2	high cost of introducing modern technologies	54	16,12
3	employees not noticing the importance of knowledge in the context of increased intensity of competition	36	10,75
4	problems with sharing knowledge among the oldest and longest-serving employees	75	22,39
5	insufficient assimilation of technological innovations by employees	28	8,36
6	lack of formalized procedures and standards for knowledge management and systematic replenishment of knowledge resources	72	21,49
	Together		100

Source: own study.

According to the respondents, the development of intellectual capital is limited by factors related to knowledge management. These limitations are problems with sharing knowledge among the oldest and longest-serving employees (22,39%), as well as the lack of formalized procedures and standards for knowledge management and the systematic replenishment of knowledge resources (21,49%). This state of affairs is influenced by the organizational culture that hinders the transfer of knowledge in the surveyed companies. The oldest employees (and at the same time with the most experience) are reluctant to share their knowledge for fear of losing their job, position or prestige. They lack a sense of security and trust in their colleagues and management.

A feature that hinders the flow of knowledge in the organization is the lack of executive processes specified in procedures, rules or regulations. Their absence is not conducive to the transfer of knowledge and creates problems with monitoring the effectiveness of training, i.e. checking to what extent the employee's knowledge has increased after the training and to what extent it was used (20,90%). In the surveyed organizations there is excessive and unjustified freedom of action in knowledge management, which is associated with certain dangers. Another potential reason for the lack of team knowledge sharing may be the lack of preparation of the managerial staff to lead such teams. Managers are unable to ensure effective communication and synergy in the group. They cannot encourage employees to think creatively or conduct such meetings. They do not create a climate conducive to knowledge sharing and creative thinking.

A barrier to the introduction of modern technologies is the high cost of their implementation (16,12%) and employees not noticing the importance of knowledge in the context of increased intensity of competition (10,75 %). Polish companies are still not as innovative as Western companies. Therefore, they achieve poorer financial results, which in turn translates into a reduction in investments in development projects and training. The process of developing a learning organization takes time and capital. Therefore, there is a need to support small and medium-sized enterprises with the possibility of using external sources of financing.

5. Conclusions

The conducted research shows that the surveyed employees identify the meaning of the concept of the organization's intellectual capital with the resources of knowledge, skills and abilities that enable people to produce goods and services. They perceive intellectual capital as, above all, the clarity of minds of employees, their creativity and innovation. Therefore, in the literature, intellectual capital is called „the wealth of the organization" or „the treasure of the organization". It is seen as an ingredient that drives the economy and is a path to success. The intellectual capital of an organization affects its market value. The uniqueness of this capital lies in the fact that it is the employees who own it, not the organization itself.

A modern organization is characterized by a high degree of openness to change, and the permeation of company boundaries is indispensable. It consists in close cooperation between departments, effective flow of information, cooperation and advice. The organizational culture is based on trust and flexibility. The research shows that the managerial staff understands the essence of human capital. It moves away from management based on fixed procedures, rigid hierarchical structures focused only on formal information exchange and communication. All these features make it possible to react relatively early and even anticipate certain events in the VUCA environment. Organizations based on intellectual capital see the sources of their success in intangible resources. They attribute a dominant role to them, and all actions taken are aimed at increasing the value of intellectual capital. The employee is at the center of a modern organization. It is thanks to the actions taken by employees that intangible resources are generated, processed and disseminated within the organization.

The analysis of the literature shows that social and professional competences are the most valuable intellectual capital of an employee. The level of awareness of employees and the reality surrounding them, the environment in which they operate are factors that determine the development of the organization's intellectual capital. The readiness of employees to constantly learn, acquire new competences, change old habits and procedures, share knowledge with others, exchange information determine the effectiveness of an intelligent company. The surveyed employees are aware of the need to constantly acquire new competences through learning and the ability to self-reflection.

According to the respondents, the development of intellectual capital is limited by factors related to knowledge management. They constitute a significant barrier to the increase in the value of intellectual capital. The biggest barrier is the problems with sharing knowledge among employees with the longest seniority. Sharing knowledge is also hindered by excessive formalization, lack of interdepartmental teams established to implement specific processes or projects, and an extensive hierarchy.

Despite the fact that the issues related to intellectual capital „fit" a learning, intelligent, virtual or fractal organization, they are organizations of an „emerging" nature, constituting a minority of enterprises operating in Poland.

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SAFETY CULTURE IN GLOBAL RESEARCH: A SYSTEMATIC LITERATURE REVIEW

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Purpose: The article presents the results of research related to the development of safety culture (SC) around the world. In particular, attention was focused on the search for trends that set the direction of SC development. Research gaps were identified as the basis for addressing new cognitive challenges, particularly in the area of SC modeling in manufacturing companies, to improve workplace health and worker productivity.

Design/methodology/approach: A systematic literature review (SLR) of a total of 22,199 scientific articles on SC culture available in three databases was adopted as the research method: Elsevier Science Direct, Springer Link, and Wiley Online Library, published between 2013 and 2023 based on defined keywords.

Originality/value: A new research task has been formulated, the implementation of which would be an important addition to the existing body of work on the formation of safe working conditions based on a human-centered approach.

Keywords: safety culture, Systematic Review, safety culture implementation, safety culture model.

Category of the paper: Literature review.

1. Introduction

The most compelling argument for developing a safety culture (SC) in companies is its impact on reducing accidents and disasters. Barry Turner's pioneering safety book, "Man-Made Disasters," described three disasters in the late 1970s and their causes. The purpose of the book was to present ways to formulate general rules and principles for the occurrence of disasters, derived from an analysis of available evidence from previous disasters and serious accidents (Turner, 1978). The term "safety culture" first appeared in 1987 in a report by the OECD Nuclear Agency (IAEA, 1991) on the 1986 Chernobyl disaster. Since then, a large community

of safety scientists has started to frequently use the word (Reason, 1998; Borys et al., 2009; Waterson, 2017; Nunen et al., 2018).

The progressive humanization of work, which became especially apparent after World War II, has been a major factor in the significant rise in interest in "safety culture" around the world. This interest is linked to company management's conscious focus on managing employee safety and maintaining employee health (Cooper, 2000; Cox et al., 2000), as well as managing the company through the lens of risk and safety (Ramos et al., 2020; Dahler-Larsena et al., 2020). We have created a statistical compilation that reflects the true level of interest in safety culture among scientists because safety culture is developing as a research topic among scientists around the world and is currently enjoying a great deal of interest and a multitude of scientific reports. Based on the results obtained (Figure 1), it can be said with certainty that interest in safety culture is growing significantly from year to year. The trend line of the graph is a linear function and explains 97% of the data ($R^2 = 0.9726$), which indicates a very good fit of the values and regularity of the trend. This carries a high probability that companies will develop increasingly effective occupational health and safety management systems, improving the safety of their employees (Reason, 2016; Li et al., 2018; Kim et al., 2019).

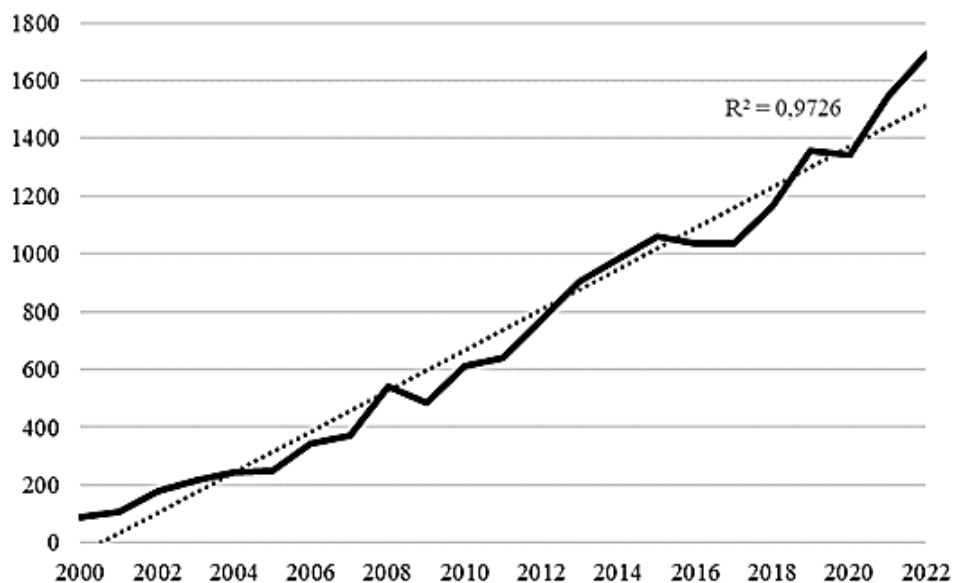


Figure 1. Number of papers on "safety culture" in particular years.

Source: own study based on Elsevier (Science Direct).

Overall, the findings suggest that there have been numerous studies on safety culture conducted in the 21st century, and that number is increasing rapidly. The safety culture construct has received a number of criticisms from researchers in the interim. For instance, Antonsen (2009) used qualitative and quantitative comparisons to compare the degree of safety culture in one organization. Based on his research, he discovered that the results were inconsistent, which made him doubt the validity of measuring safety culture. In addition, Henriqson et al. (2014) thought that the proliferation of safety-related systems and standards in

businesses largely overshadows disagreements between employees and managers that have a direct bearing on safety.

Taking the above considerations as the background of the study, the goal was to diagnose the current directions of safety culture development and also identify research gaps in this area. Consequently, the result of this study is an attempt to formulate a new research task, whose implementation would significantly complement the current achievements in the formation of safe working conditions.

2. Material and method

A systematic literature review (SLR) was adopted as a research method. The procedure for SLR was mainly consistent with Mengist et al. (2020). Particularly, five main stages were implemented during the study: (s_i) definition of the research question that the study would answer; (s_ii) definition of clearly stated objectives; (s_iii) a searching strategy including all related papers that would meet the eligibility criteria; (s_iv) presentation and synthesis of the data; (s_v) formulation of the study findings.

The research question concerns the dominant examination streams of SC within the last 10 years, i.e., from 2013 to 2023 (s_i). Finding an answer to such a question would support obtaining the study objective, which is the recognition of the research gaps intended for future explorations aimed at consolidating SC into any occupational activities (s_ii).

The searching strategy (s_iii) includes sixteen keywords associated with SC: model, implementation, factors, measurements, education, training, work effectiveness, productivity, ergonomics; cognitive ergonomics; Occupational Health and Safety (OSH); green management; sustainability; artificial intelligence; work behavior; innovation. The keywords have been aggregated into the following homogenous groups of study problems:

- 1) SC in formal description with keywords: model, factors, measurement, implementation.
- 2) SC in education with keywords: education, training.
- 3) SC in working processes with keywords: work effectiveness, productivity, work behavior.
- 4) SC in safety and health with keywords: ergonomics, cognitive ergonomics, OSH.
- 5) SC in sustainability with keywords: sustainability, green management.
- 6) SC in innovations with keywords: innovation, artificial intelligence.

Table 1 contains boolean operators and various combinations of phrase searches in order to obtain as many appropriate papers to explore as possible. The obligation was to find a particular phrase within the title or abstract of a paper.

Table 1.*A way of defining keywords*

Key words	Boolean operators and phrase search
SC+model	"safety culture model"
	"model of safety culture"
SC+implementation	"safety culture implementation"
	"implementation of safety culture "
SC+factors	"safety culture factors"
	"factors of safety culture"
SC+education	"safety culture" AND "education"
SC+trainings	"safety culture" AND "training"
SC+measurement	"safety culture measurement"
	"measurement of safety culture"
	"safety culture" AND "measurement"
SC+work effectiveness	"safety culture" and "work effectiveness"
	"safety culture" and "work efficiency"
SC+productivity	"safety culture" and "productivity"
SC+ergonomics	"safety culture" and "ergonomics"
SC+cognitive ergonomics	"safety culture" AND "cognitive ergonomics"
SC+OHS	"safety culture" AND "Occupational Health and Safety"
SC+green management	"safety culture" AND "green management"
	"safety culture" AND "green economy"
SC+Sustainability	"safety culture" AND "sustainability"
SC+AI	"safety culture" AND "artificial intelligence"
SC+work behaviour	"safety culture" AND "work behavior"
	"safety culture" AND "work behaviour"
SC+innovations	"safety culture" AND "innovations"

Source: own study.

Three online library databases from Elsevier—Science Direct, Wiley Online Library, and Springer Link (3LD)—have been incorporated into this study. The criteria for the inclusion of a particular paper in the analysis was the paper type, such as a research paper or review paper. At the same time, a simplification has been adopted by taking all records returned to the study without examining their possible repetition.

The descriptive statistics methods were used (s_{iv}) to summarize a set of papers and extract the conclusions or generalizations in accordance with the research questions and objectives (s_v).

3. Results and discussion

Based on the SLR methodology, a quantitative summary was compiled. Table 2 presents the safety culture dataset spanning from 2013 to 2023, available in 3LD. The dataset includes a number of papers that covered the research criteria for searching, safety culture, and all defined keywords.

Table 2.*Numbers of papers with the division on library databases*

Key Words	Springer Link	Wiley Online Library	Elsevier - Science Direct
SC+model	33	24	173
SC+implementation	2	5	82
SC+factors	19	13	167
SC+education	0	759	2372
SC+trainings	11	1424	3190
SC+measurement	7	1805	4513
SC+work effectiveness	0	0	51
SC+productivity	0	105	1040
SC+ergonomics	1	55	616
SC+cognitive ergonomics	0	8	28
SC+OHS	0	138	644
SC+green management	0	0	10
SC+Sustainability	0	315	2404
SC+AI	0	83	279
SC+work behaviour	0	44	150
SC+innovations	0	244	1385
Total	73	5022	17104

Source: own study.

The findings indicate the high number of papers that take into consideration the studies on SC. Two library databases from Elsevier, Science Direct and Wiley Online Library, dominate with 17104 and 5022 papers reported, respectively. The Springer Link database reported only 73 papers in total. The above-mentioned dominance concerns all keywords apart from the combination of SC and model, where the Springer Link returned 33 records, which is higher than the Wiley Online Library. Elsevier Science Direct returned the highest number of studies on SC, regardless of a particular keyword. The following analyses included in this study concern the summative results of the 3LD.

However, there are some interesting conclusions regarding topics associated with SC that are presented in Figure 2.

The percent of papers available in Figure 2 demonstrates that the highest number of them were published on topics connected to training and education in SC: 28,49% and 20,83%, respectively. The rest of the results do not exceed 20%. In this group of papers, *measurement* in the context of SC was the subject matter of a relatively high number of reports.

Surprisingly, *ergonomics* and *cognitive ergonomics* are not at the forefront of SC studies, even if these are obviously related to SC.

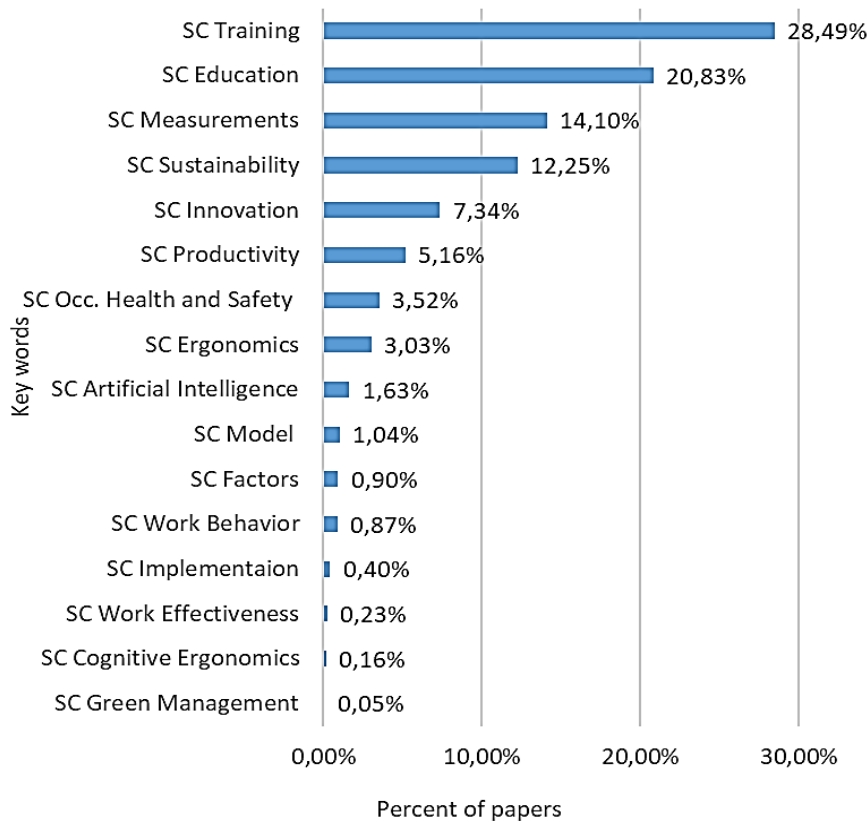


Figure 2. The percent of papers on SC taking into consideration keywords.

Source: own study.

Similarly, a topic not taken up widely was the *SC model* (only slightly more than 1% of the total dataset). This important result indicates a large research gap in the study of the relationships and interdependences between such important elements affecting the formation and maintenance of SC as methods, conditions and limitations, constraints, consequences for employees and the organization, etc. A lack of verified and validated SC models makes it difficult to find possible ways or simplified representations of conduct patterns for enterprises intending to implement SC successfully.

Moreover, *green management*, which is also a trendy and important aspect, was not focused on much, and the lowest number of articles were published in all 3LD.

Topics on global trends, including long-term ONZ policies related to *sustainable development*, proved more attractive. Sustainability is promoted by sustainable business that takes into account its impact on the worker and respects workers' rights, among other things. Therefore, the social cost of business activity, which is not considered in traditional business analysis, becomes an important element. On the other hand, conducting sustainable business is supported by adequate financing that has been provided by the European Commission.

After aggregating the keywords into the homogenous groups of study problems, the chart of it is available in Figure 3, several new findings to discussion can be added.

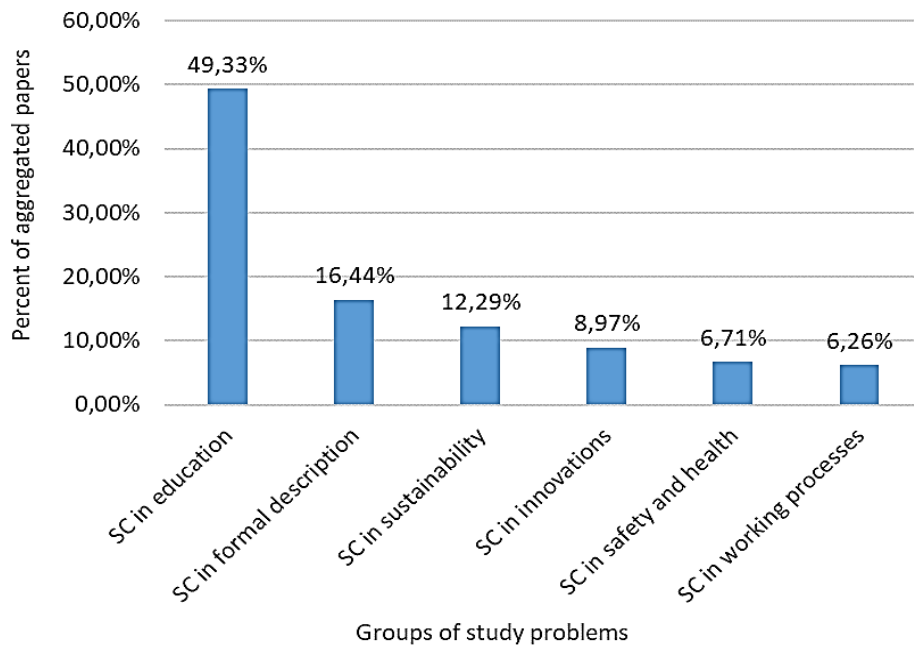


Figure 3. The percent of papers on SC taking into consideration the homogenous groups of study problems.

Source: own study.

Considering the homogenous groups, almost half of all studies touch on the educational aspects of SC.

In turn, the smallest set of papers was devoted to such problems as SC in working processes.

Taking into account these two homogenous groups, it is worth highlighting the high disproportion between the number of studies in both. When discussing the reasons, two interrelated aspects could be analyzed: (i) the nature of studies that are understood as theoretical or practical; and (ii) the location of studies that are understood as the incorporation of researchers into work activities inside an entity (the research subject) or without such incorporation.

It can be observed that the lack of skills in cooperation between the scientific sector and business influences both the nature and location of studies. The papers on SC in work processes contain the results of research conducted in enterprises. Unfortunately, conducting research in such an environment brings with it a number of inconveniences related to gaining permission from the enterprise to conduct certain research, devoting time by the enterprise's employees, and meeting the enterprise's requirements for researchers related to occupational health and safety. All this can discourage scientists from conducting research of a practical nature. The articles on SC in education are more theoretical in nature so they are easier and faster to produce and mainly deal with methods of conducting training and curricula.

In order for there to be a possibility of changing the proportion of articles and for the process related to the implementation of research results to proceed properly, both the scientists conducting the research and the companies that could translate the results into success should actively participate in it. Researchers should not just stop at theoretical research but also take on the challenges of furthering their achievements on the road to the success of the enterprise, especially related to improving safety in the enterprise and minimizing accidents at work (Furman, Małysa, 2023; Nedeliaková et al., 2022, Bartnicka et al., 2020). Therefore, in order for there to be an opportunity to implement the results of the researchers' research, their knowledge of work processes in enterprises is essential (Anvari et al., 2011; Cordeiro et al., 2020).

It is worth mentioning that the second group of interest to researchers was *SC in the formal description*. However, the study efforts are mostly directed at particular problems, especially those connected to measurements of SC. Therefore, they are focused on the evaluation of SC effects rather than on a formal holistic view of SC-based emergence and management issues.

In Figure 4, the chart compares the datasets among Elsevier—Science Direct, Wiley Online Library, and Springer Link from 2013 to 2023 for different safety culture keywords. These include the safety culture model, safety culture implementation, safety culture factors, safety culture measurements, safety culture and education, safety culture and training, safety culture's impact on work effectiveness, safety culture and productivity, safety culture and ergonomics, safety culture and cognitive ergonomics, safety culture and occupational health and safety, safety culture and green management, safety culture sustainability, safety culture and artificial intelligence, safety culture and work behavior, and safety culture and innovation. Based on the chart, Elsevier has published 173, 82, 167, 2372, 3190, 4513, 51, 1040, 616, 28, 644, 10, 2404, 279, 150, and 1385, respectively, on the above-mentioned parameters, whereas Springer has published 33, 2, 19, 0, 11, 7, 0, 0, 0, 0, 0, 0, 0, 0, 0, and 0 articles on these respective keywords, while Wiley Online Library has only published 24, 5, 13, 759, 1424, 1805, 0, 105, 55, 8, 138, 0, 315, 83, 44, and 244 articles. The percentage breakdown of published data in Elsevier is 1%, 0.5%, 1%, 13.9%, 18.6%, 26.4%, 0.3%, 6.1%, 3.6%, 0.2%, 3.8%, 0.1%, 14%, 1.6%, 0.9%, and 8.1%, respectively, whereas the percentage of published articles in the Springer database is 45.2%, 2.7%, 26%, 0%, 15.1%, 9.6%, 0%, 0%, 1.4%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, and 0%, while the percentage in the Wiley Online Library database is 0.5%, 0.1%, 0.3%, 28.4%, 36%, 0%, 0%, 0%, 2.1%, 1.1%, 0.2%, 2.7%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%, 0%. Based on the findings, it can be concluded that Springer has published the most articles related to the safety culture model. On the other hand, Elsevier and Wiley Online Library have published the highest number of articles on safety culture training. Comparing the publications of Elsevier, Springer, and Wiley Online Library, it appears that Elsevier has published the fewest articles on Safety Culture and Green Management, while Springer has not published any or has the lowest number of articles on several topics such as Safety Culture Measurement, Safety Culture and Work Effectiveness, Safety Culture and

Productivity, Safety Culture and Cognitive Ergonomics, Safety Culture and Occupational Health and Safety, Safety Culture and Green Management, Safety Culture and Sustainability, Safety Culture and Artificial Intelligence, Safety Culture and Work Behavior, and Innovation. Similarly, Wiley Online Library has not published any or has the lowest number of articles on safety culture and work effectiveness, as well as safety culture and green management, over the past few decades.

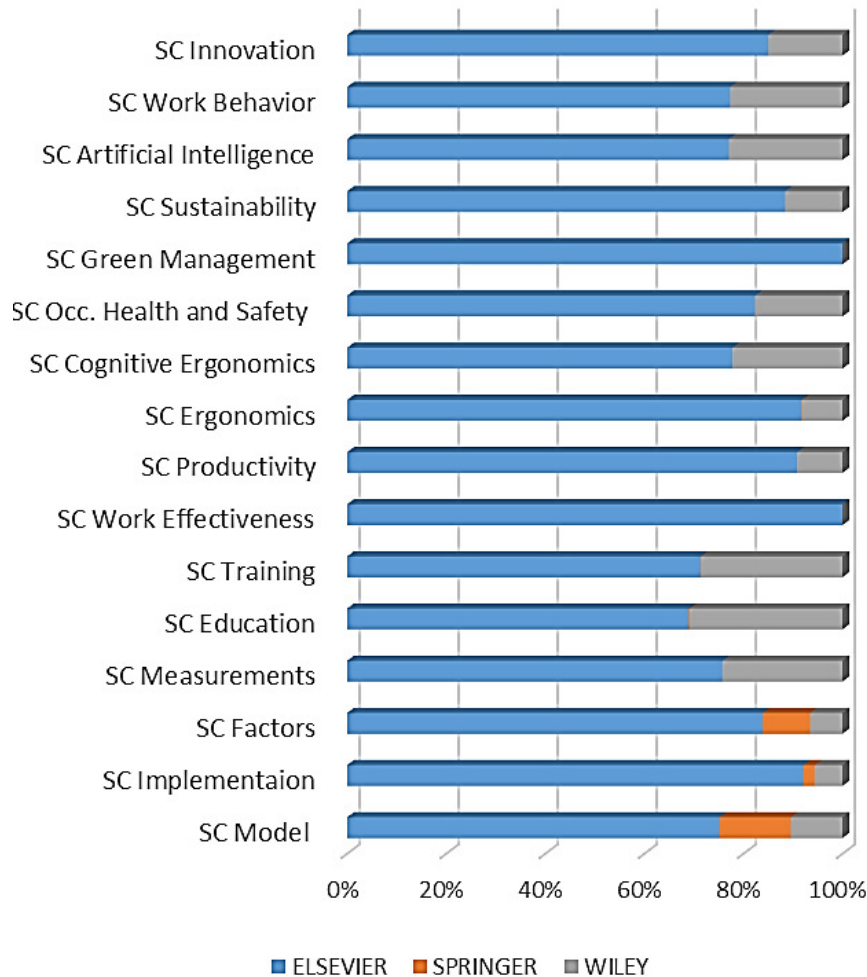


Figure 4. Comparative Analysis of SC among three databases i.e. Elsevier, Springer, and Wiley Online Library.

Source: own study.

4. Summary and conclusion

A systematic literature review was used to find the dominant examination streams of SC within the last 10 years, i.e., from 2013 to 2023. Training and education were the vast majority of topics within the explored literature, almost half of them.

A clear difference in research was recognized between theoretical aspects (which were the vast majority of them) and practical ones, including those related to such important elements as ergonomics, human behavior at work, or working processes. Also, the important literature research outcome is that studies were focused rather on particular aspects of SC, like measurement, implementation, and factors, than on a holistic approach that, among other things, is the SC model.

Taking into account all the findings, it can be concluded that the study objective, which was the recognition of the research gaps, was achieved, and future explorations should be oriented toward developing a comprehensive SC model. Such a model should include both practical and theoretical aspects of SC and be flexible enough to be used in any occupational activity.

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GENDER OF THE CONSUMER AND THE ROLE OF ORGANIZATIONS IN PURCHASING DECISIONS

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Purpose: The aim of the article is to present the role of the organization and its impact on the process of making consumer purchasing decisions on the example of Poland and to explain how gender differentiates behavior.

Design/methodology/approach: In order to achieve the goal set in this article, first a literature review was used, then the diagnostic survey method was used. As a research tool, a questionnaire was used, which concerned the purchasing process and consumer behavior towards marketing activities undertaken by the organization. 199 consumers took part in the study.

Findings: The conducted research shows that Polish consumers are aware that companies influence them during the shopping process. Organizations use a variety of marketing activities to influence the consumer in the purchase decision process, both in-store and online. The answers obtained varied depending on gender (these differences are not statistically significant). The results indicate that despite the awareness of consumers related to the influence of the organization on them in the purchasing process, they are often affected by this influence.

Practical implications: Modern marketing departments should pay attention to the gender of the consumer, as it is one of the determinants in the purchase process. Therefore, it is necessary to adapt appropriate marketing communication tools that will highlight the needs of a specific target group. On the other hand, awareness of the factors affecting the customer's purchasing process will allow the organization to achieve greater sales effectiveness.

Originality/value: This article extends the current research by explaining the differences between genders and the marketing activities undertaken by the organization in the process of making purchasing decisions by the consumer.

Keywords: consumer gender, consumer behavior, purchasing decisions, marketing activities, Poland.

Category of the paper: Research paper.

1. Introduction

For many years now, issues of primary diversity regarding consumers' purchasing decisions have been considered in theory and practice (Hudgens, Fatkin, 1985; Johnson, Powell, 1994; Powell, 1990). They reveal how gender influences consumers' approach to decision-making (Lipowski, Anganowski, 2016; Mitchel, Walsch, 2004) and highlight the differences in this process that occur. Research addresses issues related to consumer risk-taking (Brzezinska, Maciejewski, 2015), product and service segmentation (Angowski, 2017; Putrevu, 2001), online shopping decisions (Perju-Mitran, Budacia, 2015; Lin et al., 2019), advertising effectiveness and its impact on the consumer (Wolin, Korgaonkar, 2003), perceived enjoyment in the purchasing process (Kotzé et al., 2012), determining the degree of congruence between decision-makers' perceptions of customer needs (Mohsen, Shekarchizadeh, Shahin, 2021) and consumers' purchasing decisions in the context of the organization's image (Rybaczewska, Sparks, Sulkowski, 2020).

Organizations, too, are constantly looking for ways to meet consumers' needs based on their knowledge of their decision-making processes, especially as they are nowadays informed and active market participants. In turn, following the impact of new technologies, consumers are becoming prosumers - believing other consumers more often than experts and companies (Bajdak, 2013).

In this situation, organizations need to undertake a variety of marketing activities using the known techniques of influence available (Cialdini, 2020). Their selection is dictated not only by economic and non-economic factors of consumers (Jurowczyk, 2013), but also based on their gender identity. In turn, knowledge of consumers' gender forms the basis of so-called gender marketing. It is oriented towards an organization that uses cultural/psychological gender codes of communication on the basis of research results and the knowledge gained in order to effectively reach a selected group of consumers (Pawlikowska, 2011). The basis for the distinction of gender marketing is the differentiated behavior of consumers in the market on the basis of gender and its manifestation in relation to the activities and marketing messages used. Recognition of this phenomenon by organizations makes them increasingly make conscious use of, among other things, the technique of neuromarketing, which is treated as a potential tool for commercial marketing (Perrachione, Perrachione, 2008). It is also a tool of this area to show rational and emotional responses to marketing stimuli. It also aims, by combining knowledge from marketing with knowledge about the brain, to better understand the consumer when making decisions in the purchasing process and to help shape marketing strategies (Senior, Lee, 2008). Finally, it helps to determine which product attributes affect the consumer positively and which negatively. It is also a group of techniques that aim to identify the areas of the brain activated by the action of a marketing stimulus and the cognitive processes taking place in them, relating to a range of different stimuli including hearing, sight, touch or the sense

of smell (Senior, Lee, 2008). The inclusion of neuromarketing by organizations in their marketing strategies contributes primarily to building a positive impression and relationship with customers, influences their attitudes and needs and determines the sales performance of the organization (Tarapata, Szadkowska, 2014).

At the same time, the literature most often shows the influence of gender on individual purchasing decisions (Putrevu, 2001; Meyers-Levy, 1986). In contrast, there is little empirical evidence on the influence of organizations on consumer decision-making and the findings of this influence by gender. This article extends the strand of research by explaining the differences between gender and the organization's marketing efforts in the purchase process. Therefore, the aim of this article was to show the role of the organization and its influence on the consumer's purchase decision-making process using the example of Poland and to explain how gender differentiates this behavior. In addition, answers were sought on the consumer behavior undertaken in the purchasing process.

2. Theoretical background

2.1. Influence of organizations on consumers' purchasing decisions

Influencing is an intrinsic part of social life. People influence each other in order to achieve personal goals, in an effort to satisfy their needs or because of the need to maintain an appropriate level of cooperation. Influence takes place in every human interaction and in every social setting (Winkler, 2011). It is most often analyzed in the context of the consciousness of the person or group of people being influenced. In this perspective, a distinction should be made between direct and overt influence and covert influence, which is based on social mechanisms and human behavior. Direct and overt influence exerted on human behavior and thinking is done by means of pressure (power, force) or persuasion. The person being influenced may therefore be aware that someone is trying to influence his or her behaviour or thinking, or persuade him or her to do something. It is also sometimes the case that the person is completely unaware that they are being influenced and that they are just being influenced. As Richard Nisbett and Timothy Wilson have shown, recipients of influence are unaware of the relationship between the behaviour of others and their own reactions, the mental process that creates a given reaction, and the presence of influences from others that have influenced their reactions (judgements, behaviour, decisions) (Maciuszek, 2012).

Nowadays, the purchasing process is taking on a new importance in times of global competition. In business practice, an increased interest of business managers in this area can be observed (Hadaś, Ragin-Skorecka, 2017). Today's consumer is to a large extent active and involved in the market, so more attention should be paid to activities by organizations

(Grzegory, 2013). Furthermore, customers, despite being more aware, educated and oriented to the offers on the market, do not always make rational purchase decisions (Koprowska, 2017). They often live in the belief that they are free when making decisions and that their opinions, beliefs and knowledge are independent (Dolinski, 2010). However, they are subject to many mechanisms that they do not even know exist. In the context of social influence, the most popular mechanism is the use of Robert B. Cialdini's six rules. These are the ones most commonly used by organizations to influence consumers and their decisions in the context of purchasing a specific product (Doliński, 2008).

An important technique for influencing organizations is the use of neuromarketing. It involves analysing the brain's response to a given advertising message, using neurophysiological measurements to study the subconscious of message recipients (Janiszewska, 2009). It is also the optimisation of marketing stimuli using measurement tools that are applied to the analysis of human psycho-emotional behaviour (Chmielewska, 2013). A potential consumer can be reached by means of multiple stimuli, as they are registered by perceptual processes and, in the brain, at the neural level, are processed and transformed into images, memories and internal pictures (Wrona, 2014). The stimulus affecting the consumer can be sound, smell, touch, taste. This is because the possibility of touching, smelling or tasting a good increases the likelihood of buying it (Bass, 2014). According to Fugate (2007), neuromarketing also helps organizations identify elements that are neurologically involved in television advertising. By evaluating images, phrases, sound effects and music, organizations develop advertising campaigns that are more appealing to consumers (Fugate, 2007).

An important element used by organizations to influence consumers is the use of subliminal advertising, which is based on the use of neurological mechanisms to influence the recipient. Advertising influences the recipient in such a way that he or she registers invisible stimuli, thereby exerting an unconscious influence, known as subliminal persuasion (Smolarek, 2013). A subliminal message is a manipulation in the subconscious sphere (Musiol, 2007), which involves the insertion of frames (images), with a suggestion or command, into a film or computer programme, which are not perceptible to humans but registered by the human subconscious. Thus, subliminal advertising can threaten a person's sense of security, because on a mass scale it can be used to achieve socially unacceptable, even harmful goals (Olszewska, 2013). Thus, despite the fact that the consumer may state that he or she is choosing the 'first better' products when shopping, the consumer is making a choice among many other alternatives, which he or she may not be aware of (Stasiuk, Maison, 2014). Moreover, this choice is also hindered by the range of different techniques used by the organization to influence the consumer in the purchasing process, which are often applied based on different characteristics of the consumer, including the gender of the buyer.

2.2. Importance of gender in the purchase decision-making process

Gender is one of the most important determinants used in marketing communications (Putrevu, 2001) and plays an important role in explaining market behavior, including consumption behavior (Lipowski, Anganowski, 2016). The gender differences that are revealed have their origins in the brain and appear in the course of normal biological development. They relate to different ways of solving cognitive and emotional tasks and encoding and recognizing stimuli (Zimbardo, Gerrig, 2021). Gender is also an important element that differentiates an individual when it comes to making product purchase decisions. Thus, men and women differ in their motives, goals, preferences, expectations and the course of the purchasing process (Lipowski, Angowski, 2016).

In turn, Kusa, Danechova, Findra, and Sabo (2014) argue that women are characterized by a more relaxed approach to the purchasing process, treating it as a social need, unlike men, for whom it is only a functional need. This means that male consumers decide to buy when they are compelled to do so, most often when a specific need is revealed. They are also more pragmatic and most often satisfy immediate and necessary needs. They use shopping only when it is actually necessary (Angowski, 2017).

Men value the product itself more than customer service, and what matters to them when making a purchase is functionality, practicality, price and workmanship. In addition, most men prefer simplicity, both of the product and the associated customer service (Izmalkova, 2013). They almost never look for a better product, as they believe there is no point in changing if it meets their needs (Niedzielska, 2015).

Women, on the other hand, want to satisfy needs in the long term. They also prefer to shop traditionally, at a relaxed, slow pace. For the most part, they want to try things on, desire to touch them and compare their prices with other products (Kraft, Weber, 2012). Women's preference for buying in a traditional setting is also indicated by the research of Wolin and Korgaonkar (2003), justifying it by getting more information about the product and the pleasure of such a form of purchase. Women also need more information to make a purchase decision, thus comparing a larger number of available options. J. Meyers-Levy (1986) points out the same aspect. Again, these studies indicate that both women and men have different patterns of searching for product information. Men focus on the most important aspect of a product, while women need to know all the information about a product before they decide to buy it (Meyers-Levy, 1986).

In addition, women are most likely to make purchases under the influence of advertising they have been exposed to. As research by A. Rosowska (2012), the favorable (and neutral) attitude of female respondents toward advertisements contributes to this. Women derive information from advertisements, on the basis of which they make a decision to purchase the advertised product or service.

Regarding the method of purchase, on the other hand, men are more positively disposed to online shopping. Women only opt for this shopping channel when they are influenced by social and emotional factors (Dittmar, Long, Meek, 2004). They are also more demanding customers and less brand loyal (Góralaska, 2012).

Instead, they become more attached to people (for example, employees of a store), while men are more loyal to brands and their participation in loyalty programs occurs only when they perceive a product as functional and necessary (Jasiulewicz, 2010). Thus, for a man, shopping is just a way to an end, the acquisition of a new item. They make purchases most often to satisfy a specific need that has arisen and the purchasing process itself takes place only when it is actually necessary (Angowski, 2017).

Thus, gender is a factor that differentiates consumers' approach to decision-making in the purchasing process. In turn, knowing their specific preferences, organizations can take them into account when designing marketing strategy and influence consumers' purchasing decisions.

3. Methods

The research was anonymous and implemented in 2022¹ using a diagnostic survey method. A survey questionnaire was used as the research tool. The research technique, in the form of an online survey, concerned the purchasing process and consumer behavior towards the marketing activities undertaken by the organization.

The independent variable that assumed the status of an explanatory variable in the study is gender. On the other hand, the dependent variables included marketing activities related to the purchasing process. In determining the relationship, Pearson's chi-square test was used with an assumed level of $\alpha = 0.05$, and the V-Cramer coefficient was used to measure the strength of the relationship between the study variables. It was assumed that for a degree of freedom $df = 1$, a weak relationship would be characterized by relationships of 0.1-0.3, a medium one of 0.3- 0.5, while a strong one from 0.5 (Szymczak, 2015). The empirical material obtained was then subjected to statistical analysis using IBM SPSS Statistics 27.0.

The research conducted was aimed at revealing the role of the organization and its influence on consumers' purchasing decision-making process on the example of Poland, as well as explaining how gender differentiates this behavior. In addition, answers were sought on the consumer behaviors undertaken in the purchasing process. 199 consumers participated in the study, of which 79.4% were women and 20.6% were men. There is a clear downward trend in the various age groups. Respondents in the 19 to 30 age group dominated, with 82.4%.

¹ Research conducted at the Faculty of Management of the University of Lodz for the purposes of the master's thesis "The importance of social influence on consumer purchasing decisions", which was awarded for the best business issue in the academic year 2021/2022 at the Faculty of Management of the University of Lodz.

Respondents from the 31 a 45 age group accounted for 14.1%, and from the 46 a 60 age group, 2.5%. Respondents from the 60+ age group were the smallest, at just 0.5%. The largest group considering age and gender were women aged 19 to 30 - 67.3% of all respondents. Most consumers (59.8%) were characterized by their working status.

4. Results

The research obtained indicates that 88.4% of respondents make their purchases stationary, including as many as 77.8% of women and only 22.2% of men. Similar results (85.4%) were obtained in the context of choosing to make purchases online. This channel was also mostly chosen by women 79.4% compared to men - 20.6%. It should also be noted that the respondents had the opportunity to choose more than one answer. Pearson's chi-square independence test, however, indicates that both variables declaring both stationary purchase ($\chi^2(1, 199) = 2.254$, $p = 0.133$) and online purchase ($\chi^2(1, 199) = 0.0002$, $p = 0.99$) are not gender-dependent. At the same time, respondents recognize that organizations influence consumers in the purchasing process. As many as 85.2% agree with this statement, 13.1% answered "difficult to say", while 2% of respondents disagreed. Perceived influence by organizations is also not dependent on gender ($\chi^2(1, 199) = 2.211$, $p = 0.697$).

Depending on the shopping channel, organizations use different consumer-targeted activities to get consumers to buy more often. Respondents mostly cited such activities as highlighting promotional offers on price tags (82.4%), turning on music while shopping (81.4%), being informed by the store about price reductions (72.9%), the store intentionally positioning products according to a scheme (71.4%), using voice messages (62.3%), intentionally spraying scents (57.8%) and also intentionally limiting offers (46.2%). In addition, respondents also mentioned other activities. These include: posting information about promotions on the front window of the store, frequent rearrangement of merchandise throughout the store to force the customer to constantly look for products and involuntarily look at other merchandise, promotions only with a customer card, pushy employees, and recommending selected products by store employees, such as at checkout counters.

It should be noted, however, that according to respondents' declarations, the listed marketing activities were more important for women than for men. First and foremost, women are influenced by such factors as the inclusion of music (84.7%) during their purchases and time restrictions on the offer of a particular product (84.6%). On the other hand, men are affected by information about discounts (21.3%). However, the marketing activities used by organizations are not statistically significant.

Table 1.

Willingness to buy a product declared by respondents after contact with marketing activity in a brick-and-mortar store, depending on gender

Marketing action	Women	Men	χ^2	Asymptotic significance (p)*
Spraying fragrance	80.4%	19.6%	0.039	0.843
Turning on the music	84.7%	15.3%	3.312	0.069
Setting products according to the scheme	81.3%	18.7%	0.714	0.398
Voise messages	80.4%	19.6%	0.039	0.843
Discount information	78.7%	21.3%	0.134	0.714
Highlighting promotional offers on price labels	81.1%	18.9%	1.456	0.228
The limitation of the offer	84.6%	15.4%	2.791	0.095

p – probability in Pearson's Chi-square test of independence.

* adopted significance level $\alpha = 0.05$.

Source: own elaboration based on the results of the CAWI survey.

On the other hand, the most important marketing activities encouraging online shopping were indicated by the respondents: ease of shopping (69.8%), lower prices than in-store (68.8%), low delivery costs or free delivery (58.3%), promotions and offers special (56%), price comparison (49.2%), short delivery time (44.7%), positive previous experience (35.7%), availability of various payment methods (33.7%), possibility of refunding most products (32.7%), opinions on ranking websites (25.6%) and opinions on newsgroups (16.6%). However, all these activities are more important for the surveyed women than men. Especially for women in the purchasing process, promotions and special offers (87%) and the possibility of price comparison (82.2%) are more important through the Internet channel. In turn, for men, low delivery costs or free delivery are important (25.9%), as well as promotions and special offers (24%), just like for women.

Table 2.

Respondents' stated willingness to purchase a product after being exposed to an online store marketing activity by gender

Variable	Women	Men	χ^2	(p)	V-Cramera
Ease of completing purchases	78.3%	21.7%	0.059	0.807	-
Reviews on ranking sites	76.5%	23.5%	0.359	0.549	-
Ability to compare price	82.2%	13.8%	0.970	0.325	-
Low delivery costs or free delivery	74.1%	25.9%	4.702	0.030	0.154
Ability to return most products	76.9%	23.1%	0.361	0.548	-
Availability of various forms of payment	77.6%	22.4%	0.197	0.657	-
Reviews on newsgroups	78.8%	21.2%	0.009	0.925	-
Promotions, special offers	87%	24%	0.159	0.690	-
Lower prices than stationary stores	77.4%	22.6%	1.102	0.294	-
Short delivery time	80.9%	19.1%	0.222	0.638	-
Positive previous experience	80.3%	19.7%	0.053	0.818	-

p – probability in Pearson's Chi-square test of independence.

* adopted significance level $\alpha = 0.05$.

Source: own elaboration based on the results of the CAWI survey.

The research showed no significant differences in the declarations regarding the analyzed marketing activities in the online store due to the gender of the surveyed buyers, apart from low or free delivery costs ($\chi^2(1, 199) = 4.702$, $p = 0.03$, with a weak $V = 0.154$). The actions

indicated above had a similar meaning in purchasing decisions via the Internet, both for the surveyed women and men.

On the other hand, when analyzing the respondents' attitude to the purchase of a product whose price was shown as attractive (e.g. the inscription "super price" or the old price crossed out and the new, lower price shown), it can be stated that when making such a decision, the surveyed women (77.9%) attached more importance to for this product component. This is confirmed by the analysis indicating significant differences between the assessments of women and men ($\chi^2(1, 199) = 9.854, p = 0.043$, with weak $V = 0.223$). Women are therefore more price sensitive, which in turn translates into their willingness to buy.

Interestingly, as many as 43.7% of respondents very rarely or rarely (26.1%) make purchases of products after contacting them with a TV advertisement. Only 24.1% of consumers indicated that they are very often guided by advertising when choosing a specific product. At the same time, referring these results to the gender of consumers, it is noted that women more often, as much as 91.7%, make purchases after prior contact with television advertising than men (8.3%). There were no significant differences in the assessment of this aspect between women and men ($\chi^2(1, 199) = 2.887, p = 0.409$).

5. Discussion and conclusion

Today's consumer is highly engaged in the market, and organizations are increasingly active in the marketing activities used in the purchasing process. In addition, despite the increasing awareness of consumers and their orientation to the activities undertaken by the organization, they do not always make rational purchasing decisions (Koprowska, 2017). Their diversity depends on many factors: individual or sociodemographic characteristics. One of the important elements that differentiate consumers in the market is their gender, which is a major determinant of consumer behavior (Wilborn, Brymer, Schmidgall, 2007).

The research and analysis carried out indicates that Polish consumers are aware of the fact that companies influence them when carrying out the purchasing process. They use a variety of marketing activities to influence the consumer in the purchase decision-making process both in the stationary store and in the online store. The answers obtained varied by gender (the differences are not statistically significant). Women declared a greater willingness to purchase a product when the organization primarily uses time-limited offerings or the inclusion of music in a traditional store. On the other hand, when shopping online, promotions and special offers are more important to them, as well as the ability to compare the price.

In turn, in the context of the results obtained regarding the most important marketing activities that encourage consumers to buy online, it should be noted that when comparing them with the results of the E-commerce in Poland 2018 survey (Economic Information Office,

2018), one sees slight changes that have occurred recently. In 2018, the factors most encouraging to complete purchases through the online channel were low delivery costs or free delivery, lower prices than stationary, short delivery time, positive previous experience and easy payment method. These factors are also indicated primarily by male respondents. In contrast, promotions and special offers and the ability to compare prices are more important to female respondents. However, the small differences obtained (no statistical significance) in the assessment of the importance of certain marketing activities used by organizations to influence the consumer in the purchasing process between men and women may also be a result of market globalization, including the homogenization of needs and the unification of purchasing behavior patterns (Angowski, 2017).

In addition, consumers are reluctant to buy products that have been shown in TV commercials. Such products are not or very rarely or rarely bought by 94% of respondents. Comparing the result indicated above with Petrykowska's research from 2009 (Petrykowska, 2010), it can be concluded that over the past 13 years, consumers have changed their behavior little and buy products advertised on TV even less (from 10% in 2009 to 6% in 2022). Interestingly, among the consumers surveyed, it is women who are more likely than men to purchase a product that has been previously featured in a TV commercial.

Women are also more sensitive to the price of a product. When the price is more attractive, they are more likely to purchase the good in question. This is because price is one of the most important factors when comparing the same products or services (Kraft, Weber, 2012). Therefore, it is this component (price), above all, that should be considered in the marketing strategies of those goods that target the female consumer.

The results also indicate that despite consumers' awareness of the influence of organizations on them in the purchasing process, they often succumb to this influence. In turn, organizations, being aware of the existence of differences between the gender of the consumer, can more strongly and with the help of dedicated actions apply a variety of marketing activities. In turn, knowing the preferences of purchasing groups, they can also better tailor their marketing offerings.

In turn, from the point of view of marketing activities, there is a need to create a more complete understanding of the customer and the determinants of his or her market decisions, hence the increasingly exposed belief that qualitative (so-called soft) factors should be taken into account in explaining and understanding buyer behavior (Kozielski, 2015). Modern marketing departments should therefore pay attention to the gender of the consumer, as it is one of the determinants in the buying process. Appropriate marketing communication tools should therefore be adapted to highlight the needs of a specific target group. In turn, awareness of the factors affecting the customer's buying process will thus allow the organization to achieve greater sales effectiveness.

However, the study conducted has some research limitations. The first relates to the research sample, in which there was an overrepresentation of women and its unrepresentative nature. A future study would therefore need to focus on obtaining an equal sample, which, also due to the need for greater representativeness for the best possible outcome of the study, should be increased. Therefore, given the unrepresentative nature of the sample, the purpose of the study in this article has been realized only up to the surveyed population. In addition, future research on the purchasing process and the impact of companies on the consumer should be made more specific. It would be appropriate to focus on making the differences between the stationary and online shopping channels more specific. It would also be interesting to learn more about the influence of organizations on the marketing activities used, depending on other sociodemographic characteristics of consumers. However, in spite of some research limitations, the present research presented here on the gender of consumers vs. implemented actions on the part of organizations on their purchasing decision-making process could be a contribution to more in-depth research and a broader discussion on the ground of science as well as practice.

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VIRTUAL VERSUS SUSTAINABLE FASHION: A SYSTEMATIC LITERATURE REVIEW

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Purpose: The aim of the study was to determine the extent of convergence between the concepts of virtual and sustainable fashion.

Virtual reality is gaining popularity due to its immersive nature, which enables “involvement of the senses”. Owing to dynamic technological development, it is expanding into numerous fields of application and provides the potential to offer innovative products. Among those is virtual fashion, i.e., clothes and accessories that have no physical equivalent, being available to “wear” only in virtual reality. Virtual clothing is part of the premium and exclusive product segment, to which, in particular, the value added by the consumer is attributed. These products are therefore communicated as an environmentally friendly alternative to physical clothing, as they do not require the consumption of materials, thus generating no waste, using less energy and water, etc.

Design/methodology/approach: The research consisted of two phases. The main phase was conducted with a method of systematic literature review according to PRISMA standards, by means of data extracted from the databases: Scopus and Ebsco (n = 13). In a supplementary phase, there was used a method of co-occurrence keywords analysis via VOSviewer to compare the description of strictly virtual fashion (n = 218) and sustainable fashion (n = 402). Documents were searched in the Scopus database.

The conclusion was reached using the induction method.

Findings: The findings from the researched documents indicate that virtual fashion is predominantly presented accordingly to the new technological possibilities it offers. Indeed, its ecological qualities and its potential for fulfilling pro-environmental goals in the fashion industry are briefly stated in broad terms, without reference to the specific measures or data, mentioned, by comparison, in papers devoted solely to sustainable fashion.

Originality/value: The findings from the researched documents indicate that virtual fashion is predominantly presented accordingly to the new technological possibilities it offers. Indeed, its ecological qualities and its potential for fulfilling pro-environmental goals in the fashion industry are briefly stated in broad terms, without reference to the specific measures or data, mentioned, by comparison, in papers devoted solely to sustainable fashion.

Keywords: virtual reality, sustainable fashion, sustainability, fashion industry.

Category of the paper: literature review.

1. Introduction

Despite virtual reality (VR) has been created since the early 1960s (Sutherland, 1965; Lum et al., 2020), it has become extremely popular in recent years. The term “virtual” refers to something that exists or functions in a digital environment.

The widespread interest in virtual reality is being driven by several factors. First and foremost is the development of hardware and software technologies (The Business of Fashion, McKinsey & Company, 2022), including more powerful processors, better displays, advanced sensors and algorithms, which have enabled the creation of more realistic and immersive experiences. VR's popularity has also been boosted by the increased availability of advanced technology at affordable prices. Consequently, virtual reality has been implemented in many fields such as gaming, education, medicine, architecture, tourism, trainings, and many others (Mazuryk, Gervautz, 1999). Another factor was the rapid growth of the virtual reality gaming market (Sherstyuk, Vincent, Treskunov, 2009). Many players were drawn to the opportunity to dive into another reality - an immersive world (Galimberti et al., 2003). Through game plots, virtual reality has invited users to experience extraordinary adventures, travel to faraway places, meet virtual characters and explore fantastic worlds (Fu, Liang, 2022).

Due to the growing trend of virtual life, there is a constantly expanding pool of virtual items or objects being created to be experienced through computer technology such as applications, software or virtual reality platforms. The other examples are virtual images, virtual simulations, virtual environments, virtual characters, virtual objects or virtual events. Virtual realities and technologies, such as Augmented Reality (AR), Virtual Reality (VR) or Extended Reality (XR), allow users to interact with virtual objects and environments, thereby creating the illusion of being present in a digital space (The Business of Fashion, McKinsey & Company, 2022).

Virtual reality is gradually becoming more prevalent as technology advances, consumer interest grows, and it is being applied in a wide range of fields. According to experts, the future of virtual reality looks promising as the technology continues to develop and evolve, providing more sophisticated and immersive experiences (Future Of Virtual Reality..., 2023). Based on the report “Global Virtual Goods Market: Growth, Future Prospects, and Competitive Analysis, 2016-2028” by Credence Research, Inc., the global virtual goods market had generated revenues of approximately US\$67.5 billion in 2021 and is expected to grow at a CAGR of more than 20.2% during the forecast period from 2022 to 2028 to reach approximately US\$203.6 billion in 2028 (Credence Research, Inc., 2022).

Currently, the main target groups of the virtual market are the aforementioned players and digital content creators. The former group is interested in purchasing virtual items, participating in virtual games, developing characters, or interacting in a virtual environment (Jordan-Kulczyk, Zajac, 2022). Digital content creators such as graphic designers, virtual world creators, animators or musicians can offer their work in virtual worlds - in unreal as well as

simulated real places, for instance accompanying interactive experiences such as tours, as well as training simulations or product presentations. Furthermore, there are also designed virtual objects: furniture, tools, vehicles, etc., that can be used and manipulated in virtual reality (Earnshaw, Vince, 2001).

Virtual reality has also become an effective marketing tool. VR enables companies to present their products or services in an innovative way. In place of traditional presentations, virtual demonstrations are being created to engage customers' senses and shape memorable experiences (Farra, 2021). The examples of virtual marketing campaigns are contests and games played in virtual reality. A number of virtual shops are also being created, where customers can browse products, select options and make purchases via a VR interface. This provides customers with a “try before you buy” opportunity and involves them more in the purchasing process.

Accordingly, the fashion industry has also begun to use the possibilities of virtual reality. Virtual fashion is turning into strategic part of global physical fashion brands. Staying ahead of technology enables the strengthening of competitive advantage (The Business of Fashion, McKinsey & Company, 2022). Modern solutions are being implemented mainly by companies in the premium and luxury segment of the market. They accentuate their offer's exclusivity and the uniqueness of the experience provided to the customer (Black, 2022). Virtual fashion is being communicated as a new business model contributing to the implementation of sustainable development policies, especially environmental protection (Ellen MacArthur Foundation, 2022). There is a belief that the concept of virtual fashion has the potential to reduce the amount of waste generated by the traditional fashion industry. Rather than producing real clothes, virtual clothes are being created and presented in a digital environment, thus eliminating the production of physical items, and generating material waste (Mesjar et al., 2023). Moreover, it is emphasised that the production of virtual clothes does not require the use of natural resources or the emission of harmful substances (Durocher, 2022). In this regard, virtual fashion is credited with having the potential to significantly reduce negative environmental impacts, such as water consumption, greenhouse gas emissions or water and air pollution (Wagner, Kabalska, 2023). However, it should be borne in mind that virtual fashion does not directly deal with the environmental and ethical concerns related to the physical production of clothing essential to daily human existence (Pucker, 2022). This leads to the question: to what extent does virtual fashion fit in with sustainable fashion goals?

The research issue approached in this study centres on assessing the potential of virtual fashion as an emerging opportunity to support the sustainability of the fashion industry through a systematic literature review.

2. Background

2.1. Sustainable fashion

Underpinning the search of an answer to the abovementioned issue is a reference to the essence and objectives of sustainable fashion. A synthetic illustration of the problems, predominantly environmental ones, posed by the fashion industry since the beginning of the industrial age is taken as a jumping-off point.

Since the fashion industry established attractive markets in the mid-nineteenth century (Berry, 2018), it has simultaneously become one of the world's greatest environmental threats. This type of market is highly specific, as it has always existed as a supply market. Manufacturers dictate what to wear and how much the customer has to pay. Leading apparel and accessory brands owe their rapid growth in recent decades to the fast, even ultra-fast, changes in fashion trends and the popularisation of the fast fashion model (Aspers, 2016). It, thereby, contributed to ecological degradation on a global scale, as evidenced by the statistics regarding (Ellen MacArthur Foundation, 2017; Greenpeace, 2022):

- volumes of production and consumption,
- CO₂ emissions throughout production, transportation and combustion of clothes,
- microplastic recycling,
- quantities of textile waste,
- the presence of dangerous substances in textile products.

Therefore, it became imperative to undertake measures towards sustainable economic development based on producing in a way neutral for climate, energy- and resource-efficient, as well as nature-friendly (Sverko Grdic, Krstinic Nizic, Rudan, 2020). The transition from a linear, to a circular economy model is designed to fulfil these objectives (Kumar et al., 2020).

Sustainable fashion, hence, refers to the practice of designing, producing and consuming clothing in an environmentally friendly, socially responsible and economically viable way (Marcella-Hood, 2023). It attempts to solve the problems of mass production by utilising eco-friendly materials, reducing waste and pollution in addition to fostering ethical working practices (Henninger, Alevizou, Oates, 2016). Other examples of sustainable fashion practices involve the reusing of recycled or organic materials, the minimisation of water and energy consumption during production, and the reduction of textile waste through upcycling and recycling, etc. (Köhler et al., 2021).

In this sense, sustainable fashion is focused on ecology, nature and naturalness, all of which are reflected across the process of production, distribution and consumption of clothing (Niinimäki et al., 2020). It opposes the fast-fashion model based on multiple, short-term annual collections. Thus, favouring slow fashion, the long-term use of clothes made from sustainable materials (Fletcher, 2010).

Sustainable fashion, i.e. production incorporating sustainability objectives, amounts to the following specific objectives listed and discussed in EU, UN, OECD legislation and expert papers (European Commission, 2022; United Nations, 2021; OECD, 2017):

- curbing overproduction and overconsumption,
- educating consumers to make conscious choices,
- reducing greenhouse gas emissions,
- reducing energy and water consumption in production processes,
- cessation the use of hazardous chemicals,
- minimising the emission of microplastics and microfibres to the environment,
- discontinue the destruction of unsold and returned textile products,
- waste management to include:
 - prevention of textile waste,
 - collecting, reusing and recycling of textile waste,
 - gradual elimination of textiles from landfill sites,
- sewage management,
- undertaking cooperation with logistics providers with a view to switching to emission-free air shipment, maritime and road logistics for both own and outsourced transport,
- using electricity from renewable energy sources,
- using as priority materials recyclable ones within a circular cycle, not causing deforestation or conversion in their origin,
- implementing ecological product design requirements for all textile and footwear items,
- providing decent workplace and salary,
- termination of greenwashing practices,
- ensuring fair and ethical commercial principles,
- stimulating competitiveness and innovation.

To disseminate sustainable production practices, there have been introduced a range of certifications and standards for sustainable fashion, such as the Global Organic Textile Standard (GOTS) (<https://global-standard.org/>) and the Fairtrade Certification Mark ([https://www.fairtrade.net/...](https://www.fairtrade.net/)), which ensure that products meet certain environmental and social criteria.

It must be mentioned that sustainable fashion becomes notably famous among consumers, who are deeply disturbed by the ecological and social impact of the purchased apparel goods (Shaik et al., 2022). Responding to this demand, numerous fashion brands are incorporating sustainable practices into their business models. Yet, this is unfortunately a more convincing motivation for brands rather than a genuine concern towards the environment (Changing Markets Foundation, 2021; Fashion Revolution, 2022). Furthermore, the fashion industry is looking for new business models that are designed to meet both eco-friendly and ethical fashion criteria as well as enabling the constant growth of the clothing market worth and the value of fashion brands (Ellen MacArthur Foundation, 2017).

2.2. Virtual fashion

This study approaches the issue of virtual fashion not digital fashion, even though these terms are often used interchangeably, yet they have slightly different applications and product references.

Digital fashion refers to the development and presentation of clothing and accessories in digital form. It involves the use of computer-generated imagery (CGI) and other digital tools to project and demonstrate virtual apparel (Baek, 2022). Digital fashion can be delivered by means of digital art, online platforms, social media and digital marketing campaigns. It blurs the boundary between physical and virtual fashion, empowering the creation of innovative designs way outside the box. On the other hand, virtual fashion, as mentioned above, focuses specifically on integrating fashion into virtual environments or virtual reality (VR) experiences. Virtual fashion is about designing virtual clothing to be worn by digital avatars or models in virtual reality setups. It allows users to visually experience and interact with garments within immersive virtual worlds. Virtual fashion can be demonstrated on virtual fashion shows, virtual reality games and other VR applications (Casciani, Chkanikova, Pal, 2022). To conclude, digital fashion encompasses the broader concept of digital design and presenting of clothing, whereas virtual fashion is primarily concerned with the integration of fashion into virtual reality experiences.

Virtual fashion offers all sorts of new opportunities for designers to demonstrate their creations in a digital environment and to experiment with innovative forms and materials free from the constraints of physical production. Indeed, it can be generated using various tools and techniques, such as 3D modelling software or augmented reality applications (Shaik, 2022).

The market is for newcomers, virtual fashion brands and designers, at the same time as for the current big players who offer limited edition collections. The Fabricant is a pioneering company in the field of virtual fashion. They develop virtual clothes that can be worn in the form of digital renders and animations. Their mission is to change the way of perception and consumption of fashion products by leveraging digital technologies (<https://www.thefabricant.com/>). Another example is brand Carlings, a Scandinavian clothing brand. Their customers are encouraged to acquire digital garments, and to feature them in their social media photos via application (Baron, 2019).

Among the well-known brands entering the virtual fashion market is Gucci, which has developed a digital virtual fashion collection available on the Gucci app. The range includes a variety of accessories: shoes, handbags and glasses, for the personalisation of the virtual image (Marr, 2022). Burberry customers can preview and purchase virtual products displayed on models in a virtual environment (Jackson, 2017). Ralph Lauren, for its part, has launched virtual fashion collections that can be experienced via a mobile app. Clients can design their own virtual outfits and then share them on social media (Debter, 2021).

Another form of virtual fashion is virtual fashion shows where designers and fashion brands can present their collections in an innovative way, having great freedom in creating scenery, visual effects and narrative. A virtual environment where models show the fashion outfits is developed using computer graphics, animations, special effects and interactive technologies. Taking as an example the Balenciaga Afterworld: The Age of Tomorrow event, which presented the autumn/winter 2021 collection in a form of a virtual experience. The show was set in a post-apocalyptic virtual world, in which the audience could explore using virtual reality goggles. The presentation combined elements of a computer game with fashion, resulting in an innovative virtual fashion show experience (Deloitte, 2021).

By hosting virtual fashion shows, brands have the potential to reach a larger audience, regardless of their geographical location. Shows can be transmitted on streaming platforms, websites, social media or special VR apps. Spectators can watch the shows from everywhere, using mobile devices, computers or virtual reality goggles (Ahn, Bae, Kim, 2023). Virtual fashion eliminates geographical borders, letting people from all over the world discover and exhibit the designs as well as to establish networks in a virtual environment. This gives an opportunity for young designers and fashion artists coming from smaller markets to find their audience and gain recognition.

Along with the widespread popularity of virtual reality, the market for virtual fashion and related digital merchandise is expanding. That has led to the emergence of new business models such as virtual garment rental platforms and virtual fashion marketplaces to serve this market. DressX is an online platform for purchasing virtual clothes from various fashion brands (<https://www.thefabricant.com>). TwinOne, on the other hand, provides technology solutions to create hyper-realistic digital twin and display realistic 3D graphics in real time. This start-up is also the developer of a software system based on the Unreal Engine enabling the creation of high-quality virtual images that users can edit and interact with in real time and at their own pace. TwinOne's joint project with down jacket manufacturer Jacob Becon - a virtual show, was noted at Milan Fashion Week in February 2021 (Wagner, Kabalska, 2023).

It is believed that virtual clothing and fashion shows offer the potential for sustainable fashion, as they eliminate the need for organising physical shows involving high attendance and generating huge energy consumption (Mesjar et al., 2023). By reducing CO₂ emissions, no fashion and raw materials consumption and waste reduction, virtual fashion is expected to contribute to a greener and more sustainable fashion production. Citing Forbes: "DressX states that digital fashion production uses 97% less carbon dioxide than physical clothing production" (Durocher, 2022). Another press release citing The Normative report informed that the carbon footprint of Helsinki Fashion Week per visitor dropped from 137 kg to 0.66 kg carbon dioxide equivalent after switching to a purely digital format in 2020 (Zhang, 2020).

The abovementioned information is a background to the study that aims to provide its context. It actually has two perspectives in this article. The first one, standardly, is focused on a factual presentation of the context of the research problem. And the second one, adopted for

this research project, is the methodological justification of the problem undertaken. The “Background” section, in particular, regarding virtual fashion was prepared substantially on so-called grey literature, i.e., non-academic sources (Garousi, Felderer, Mäntylä, 2019). These are the most popular available studies approaching the topic of virtual sustainable fashion. They have a business-oriented approach and focus primarily on forecasting the development of the virtual market. They have been sourced from publishers such as Forbes, McKinsey & Company. Even though the grey literature is nowadays recognised as a reliable source of information (due, among other things, to a clear presentation of the research methodology) (Paez, 2017), in the case of the undertaken research problem, it prompts an attempt at verification on the basis of available reviewed studies.

Therefore, the aim of this study was to determine the extent of convergence between the concepts of virtual and sustainable fashion on the basis of systematic review of available scientific studies.

3. Methods

3.1. Research questions

Main RQ: Does virtual fashion fit into the issue of sustainable fashion?

Detailed RQ:

1. What is the specification of the description of virtual sustainable fashion?
2. What are the similarities and differences between the description of virtual sustainable fashion identified in the literature review and the description of virtual fashion assessed by the co-occurrence analysis of the keywords assigned to the studies?
3. What are the similarities and differences between the description of virtual sustainable fashion identified in the literature review and the description of sustainable fashion assessed by the co-occurrence analysis of the keywords assigned to the studies?

3.2. Research design

The undertaken research project consisted of two phases:

1. The main one: a systematic literature review conducted according to PRISMA standards (Page et al., 2021b). This type of research was prompted by the necessity to review a specific thematic area in order to evaluate the state of existing knowledge (Snyder, 2029). Inference was drawn by the induction method, an approach that relies on conclusions based on observations and input data in order to deduce general rules, patterns or dependencies (Patton, 2025).

2. Supplementary phase is based on a comparative analysis. This process of comparing and analysing two or more elements is to identify differences, similarities, strengths and weaknesses in order to better understand its characteristics (Given, 2008). This part of the research was conducted through VOSviewer, a software tool for constructing and visualising bibliometric networks (Van Eck, Waltman, 2023). VOSviewer analyses the co-occurrence of terms in a database, for example keywords in scientific articles or research topics. From the imported data, a graph is created with nodes representing terms or topics, and connections between them reflecting co-occurrences and they are grouped into clusters, i.e. sets of closely related items. The co-occurrence analysis exposes the frequency of two words occurring together in the same text. Correlations between words indicate the intensity of co-occurrence.

For the purpose of this comparative study, there have been created co-occurrence networks for following search keywords: “virtual AND fashion” and “sustainable AND fashion”. Developing a graph for a selection of studies on virtual sustainable fashion was not applicable due to insufficient data resources.

The selection of the different methods for the main and supplementary research was based on a targeting criterion - the need to identify a way of describing the selected topics and being matched according to the quantity of available data.

3.3. Data collection

The scope of the search were keywords, which function makes locating documents or web pages easy for indexers and/or search engines by providing a view on text/content. Narrowing the search area to keywords results in higher relevance (Gil-Leiva, Alonso-Arroyo, 2007).

For the purposes of the main phase of the research, three interdisciplinary bibliographic databases were explored: Scopus, Web of Science and Ebsco. Searched studies for the following phrase: “virtual AND fashion AND sustainable”. The procedure of sampling according to PRISMA standards is illustrated in the provided diagram in section below “PRISMA flow diagram”.

For the purpose of the supplementary research, documents were searched in the Scopus database for the words: “virtual AND fashion” published between 2017 and 2023, i.e. within the last 5 years, adopting the relevance criterion, and “sustainable AND fashion” published between 2017 and 2023 (as above). These two searches served as the basis for a comparative analysis. The search results were also narrowed down concerning subject area and keyword. A thorough description of the data can be found in the “Identification of studies via database” section.

The obtained data was saved in the author's profile and exported in RIS and CIS format.

4. Results

4.1. Results of the literature review on virtual sustainable fashion

PRISMA flow diagram

The diagram below illustrates the two-stage process of identifying and selecting literature items for review, conducted in accordance with the PRISMA guidelines (Page et al., 2021a).

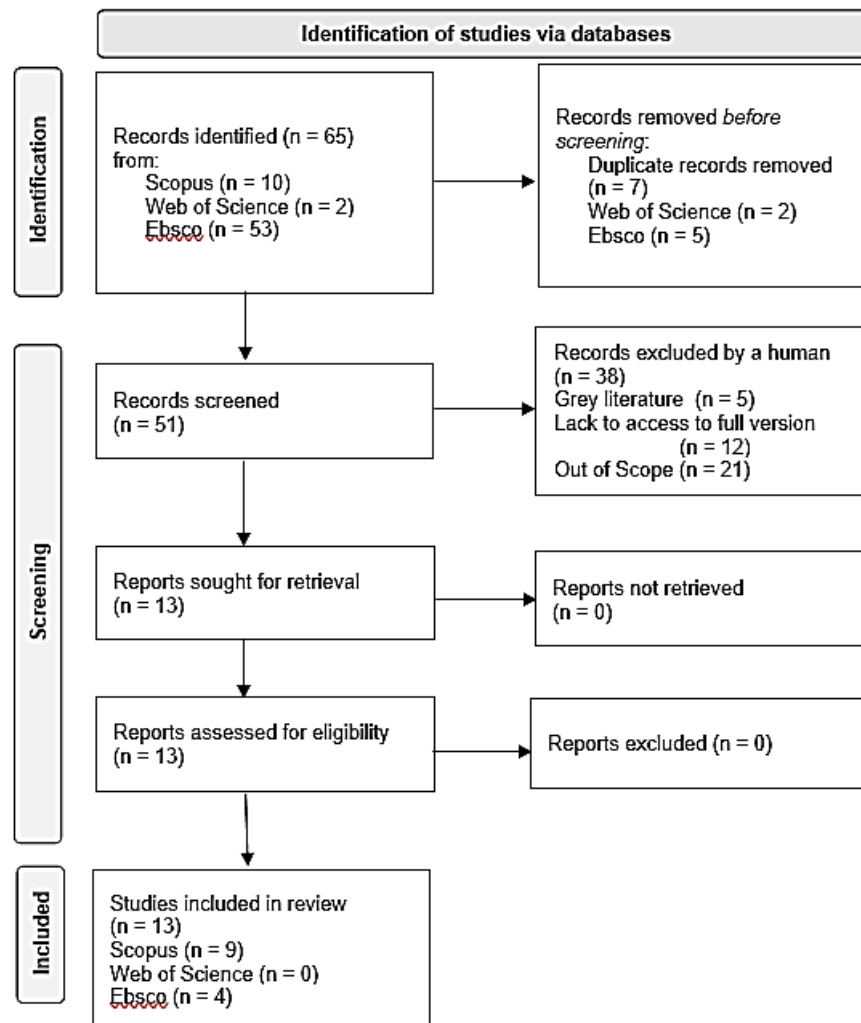


Figure 1. PRISMA 2020 flow diagram for selection of sources.

Source: own, based on: Page, McKenzie, Bossuyt et al.

Thematic overview

A content analysis of the articles selected for review has revealed the six topics presented below.

1. Virtual fashion presentation

Initially, the major focus is placed on one of the primary applications of virtual reality in the fashion industry - the presentation of both products and the space for experiencing them.

Technology, such as virtual wardrobes, perhaps implies options that may reduce overconsumption (Band, Su, 2022). It even helps users to figure out what they already have in their wardrobes as well as might recommend suitable clothing styles based on a wardrobe analysis. It is primarily consumers' socially responsible consumption behaviour and open-mindedness to innovative technology that positively influence their attitude towards virtual wardrobes, thus boosting their willingness to use virtual wardrobes. A corresponding content concerning the utility value of the virtual wardrobe is provided in an article on consumer behaviour in a virtual fashion service via a mobile app that has virtual fitting room functions. According to the authors, digital transformation within the apparel industry can improve efficiency in designing, manufacturing, distribution, sales and inventory control (Sakaguchi, Aoki, Nagamatsu, 2023).

The problem of using the virtual representation of fashion to encourage sustainable consumption was specifically addressed by narrowing the scope of the research to luxury fashion, by referring to examples of the concrete actions (Zhou, Baek, Jang, 2022):

- online product visualisation and customisation services to reduce the demand for large stocks of multiple product options;
- the use of virtual fitting rooms to reduce the carbon footprint caused by consumers travelling to stationary shops;
- offering virtual products (exclusively digital, adding virtual products to existing online gaming environments, offering digital and physical versions of products) in order to reduce consumer demand for material goods, to create or to change a digital persona linked to a concept of oneself in physical reality (e.g. a digital persona with a focus on sustainability), to eliminate problems with product disposal, to avoid unethical supply chains as raw materials are being encoded in computers, and to minimise resource consumption for transport and packaging.

2. Designing

Another core application of VR technology that has been tested and reviewed from a sustainability perspective is apparel designing tools. This subject domain included articles devoted to the problems of optimisation and innovation of the fashion design template from a 3D technology perspective and the use of relevant algorithms in 3D technology to perform multidimensional execution of fashion 3D design (Zhang, 2022) in addition to computer-aided design (CAD) and digital garment fitting using three-dimensional (3D) body scanning, virtual simulation and the application of sizing systems (Lee, 2014). A different perspective was embedded in the study about dynamic 3D fashion garments with changing styles, colours and textile patterns, especially by using a virtual 3D simulation system. Its objective was to explore the potential opportunities on online fashion platforms and the future prospects of 3D virtual clothing within the fashion and gaming industry (Choi, 2022).

3. Support for cultural heritage

The AR and VR technology are proving widely applicable in supporting cultural heritage, amongst others through projections accessible in museum venues. It is evident from the conducted revision that it could also be exploited to communicate the value of cultural fashion. These are two examples: 1. the Sinification of digital fashion. The authors proposed to transfer traditional Chinese costumes into a series of digital merchandise, serving as computer game skins for selling online (Fu, Linag, 2022). 2. A case study of the Harris Tweed Authority and Harris Tweed Hebrides brands, which through immersive technology can communicate the worth of traditional (sustainable) textiles, their history and the value of handmade products, thereby promoting slow fashion (Cross, Steed, Jiang, 2021).

4. Virtual community

Despite the title of the article containing the word 'new technology' as well as the conclusion stating that the respondents noticed and realised that modern technology can lead to green consumerism, the findings of the researchers mainly show that social media supports the fostering of eco-sensitive consumer attitudes (Joe Waheed Sayyed, Erum Sherieff, Gupta, 2021).

5. Virtual identity

An intriguing research perspective was adopted in a research project that aimed to explore how virtual fashion has been used to create new forms of identity for those who have abandoned their physical bodies and to search for an answer to the question: does wearing the virtual fashion with an avatar mean abandoning one's own body and being free to follow one's own desires, unfettered by the boundaries of different "selves"? (Koma, 2023).

6. Overviewed articles

The literature reviews featured in the search results are gripping from the perspective of the research project covered in this article. One piece of literature was noticed in all three bases. It concerns the potential of applying immersive technologies to the fashion industry in order to make it sustainable (Mesjar et al., 2023). Based on content analysis of 74 articles, the authors concluded that AR and VR technologies are part of transformational changes like reducing online returns, cutting waste through various design and production processes, eliminating the need for physical objects and allowing to educate consumers. Due to the limited number of available academic studies, they also included grey literature as relevant elements in the review.

Subsequently, the opportunities and challenges presented by the implementation of digital technologies for the fashion industry 4.0 were assessed (Akram, 2022). The authors did not specify the exact number of articles reviewed, so judging from the total citation count there are about 80, which is equivalent to the article mentioned above. A section covering the use of VR technology highlighted the user experience aspect of undergoing virtual fashion. It refers to the statement in the primary source that the immersive type has a higher UX than the non-immersive type, since fashion product purchases in immersive virtual reality enable users to effectively experience telepresence, the acuity of use intention and entertainment parameters.

With respect to the entire research area, one of the authors' recommendations is the widespread use of blockchain in the fashion supply chain and the integration of IoT, AI, and edge computing.

The third and final reviewed article presents the results of a content study of Twitter posts published between October 2020 and May 2022. A total of 528,915 records were collected (Yixin, Ding-Bang, Shizhu, 2022). According to the authors' findings, there is a large number of posts as well as a wide range of topics related to digital fashion and virtual fashion. Basically, these are informative posts about brands and the sales of their products that include virtual clothing and accessories, as well as the impact of digital fashion on the industry, the modification of marketing strategies and related to this phenomenon attitudes and judgements of the users. However, there was no reference noted regarding the potential of digital and virtual fashion towards the promotion and development of a sustainable fashion industry.

None of the above-mentioned papers provided extensive data related to the potential of virtual fashion in tackling the environmental problems of the fashion industry. So far, the authors make general statements about the potential benefits.

4.2. Results of the keyword co-occurrence analysis

In view of the insufficient number of academic studies revealed through a systematic literature review on the topic of virtual sustainable fashion, a comparative study of publications dealing with the topics of virtual fashion and sustainable fashion was carried out.

Therefore a co-occurrence analysis of keywords undertaken for publications addressing the topics of virtual fashion and sustainable fashion serves to conduct a comparative analysis alongside the results obtained in the main study - the literature review - all in order to identify similarities and differences based on the keywords assigned to the studies.

The number of scientific papers selected for the study increased significantly and has reached: 218 studies for virtual fashion and 402 for sustainable fashion. Therefore, keywords are essential for conducting a comparative analysis, enabling one to explore the content of large collections. A details of identification of studies via database presents table below.

Table 1.

Identification of studies via database

“virtual AND fashion” search within keyword	218 documents published in 2017-2023
subject area limited to	Computer Science, Engineering, Business, Management and Accounting, Social Sciences, Materials Science, Arts and Humanities, Decision Sciences, Economics, Econometrics and Finance, Psychology, Environmental Science, Physics and Astronomy, Energy
Keywords excluded	Students, E-learning, Current

Cont. table 1.

“sustainable AND fashion” search within keyword	402 documents published in 2017-2023
subject area limited to	Business, Management and Accounting, Social Sciences, Engineering, Environmental Science, Energy, Computer Science, Arts and Humanities, Materials Science, Economics, Econometrics and Finance, Decision Sciences
keywords excluded	Surveys, China, United States, Students, Education, Article, Literature Reviews, Italy, India, Empirical Analysis, Case-studies, Case Study

Source: own work.

Virtual fashion

The figure 2 demonstrates a graph created by using data from the Scopus database.

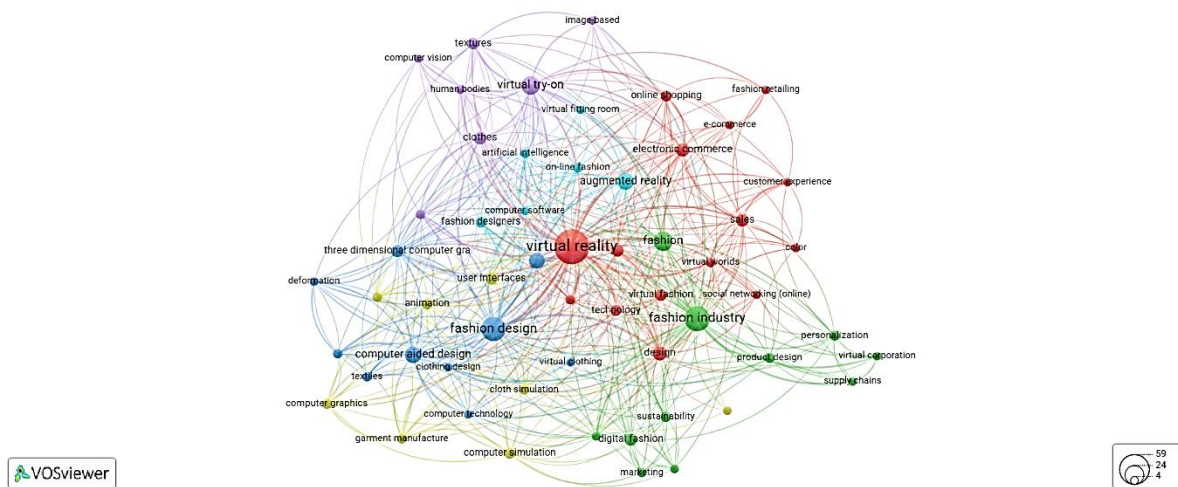


Figure 1. VOSviewer co-occurrence network visualization mapping of most frequent all keywords for studies of virtual fashion.

Source: own work.

The network consists of six clusters. The dominant keyword, as illustrated, is “virtual reality” and so is the node with the highest co-occurrence weight in Cluster 1 (see Table 2 for a detailed list of clusters and keywords). Moreover, words relating to sales predominate: “e-commerce”, “electronic commerce”, “fashion retailing”, “online shopping”, “sales”. Cluster 2 built around the word “fashion industry” with connections to general concepts such as: “marketing”, “product design”, “supply chains”, “sustainability” and “sustainable development”. The articles discussed in the sub-section “Overviewed articles” were included in this cluster.

Moving further, words from the field of computer science and computer engineering are predominant in clusters 3, 4, 5 and 6. These include: “computer aided design”, “computer technology”, “three-dimensional computer graphics”, “visualization”, “animation”, “computer graphics”, “computer simulation”, “computer vision”, “artificial intelligence”, “computer software”.

Table 2.
Clusters of high-frequency keywords related to virtual fashion

main node greatest weight total link strength in cluster	cluster	other nodes in the cluster
virtual reality	1	color, customer experience, design, e-commerce, electronic commerce, fashion retailing, human computer interaction, interactive computer graphics, online shopping, sales, social networking (online), technology, virtual fashion, virtual worlds
fashion industry	2	digital fashion, fashion, internet, marketing, personalization, product design, supply chains, sustainability, sustainable development, virtual corporation
fashion design	3	clothing design, computer aided design, computer technology, deformation, textiles, three dimensional, three dimensional computer graphics, virtual clothing, virtual fashions
user interfaces	4	virtual prototyping, visualization, animation, cloth simulation, computer graphics, computer simulation, garment manufacture
virtual try-on	5	clothes, computer vision, hosiery manufacture, human bodies, image-based, textures
augmented reality	6	artificial intelligence, computer software, fashion designers, on-line fashion, virtual fitting room

Source: own work.

The results of the analysis of the keywords co-occurrence in publications describing virtual fashion indicate that the description of virtual fashion basically refers to the application of new IT possibilities for creating new products together with their modern presentation and sale. Therefore, there is no significant difference of approach to describing virtual sustainable fashion in the context of the sustainability of the fashion industry. In fact, there is a relatively small number of articles ($n = 9$) referring to sustainability.

Sustainable fashion

The results of the analysis of the keywords co-occurrence are presented in Figure 3.

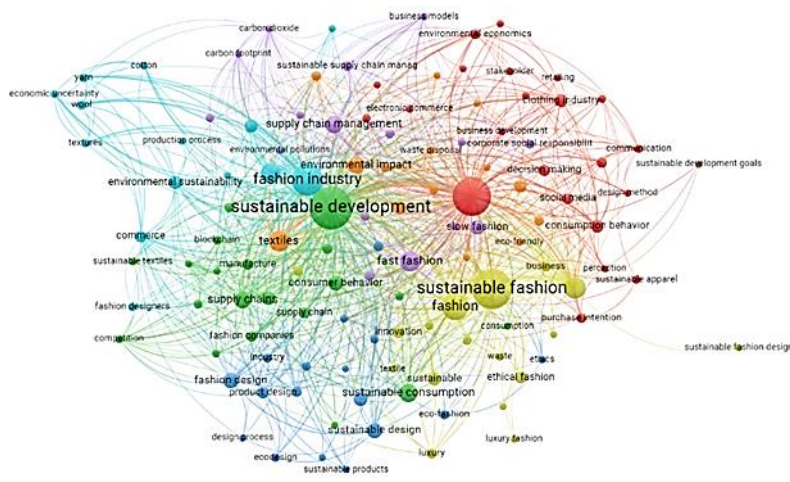


Figure 3. VOSviewer co-occurrence network visualization mapping of most frequent all keywords for studies of sustainable fashion.

Source: own work.

The graph 'sustainable AND fashion' distinguishes 7 clusters. As indicated in the figure above, the keywords with the highest relevance are “sustainability” (cluster 1) and ‘sustainable development’ (cluster 2). The main nodes in the following clusters are “fashion design”, “sustainable fashion”, “supply chain management”, “fashion industry” and “textiles” (see Table 3). Among the related words are 48 words directly relevant to the issue of sustainable fashion, including: “environmental protection”, “sustainable supply chains”, “sustainable textiles”, “sustainable consumption”, “sustainable design”, “sustainable production”, “sustainable products”, “upcycling”, “circular economy”, “circular fashion”, “ethical fashion”, “fashion consumption”, “sharing economy”, “sustainable business models”, “sustainable fashion design”, “water pollution”, “slow fashion”, “sustainable supply chain management”, “carbon dioxide”, “carbon footprint”, “corporate social responsibility”, “environmental pollutions”, “fast fashion”, “greenhouse gases”, “environmental sustainability”, “climate change”, “eco-friendly”, “environmental management”, “life cycle analysis”, “recycling”, “sustainable fashion consumption”, “textile recycling”, “textile waste”, “waste management”.

However, the entire set of 122 keywords selected in the study did not include “virtual”, “virtual reality”, “augmented reality”, “digital”, “digital fashion”, “immersive”, “immersive technology”.

Table 3.

Clusters of high-frequency keywords related to sustainable fashion

main node greatest weight total link strength in cluster	cluster	other nodes in the cluster
sustainability	1	sustainable apparel, business development, clothing industry, communication, consumption behavior, decision making, design method, electronic commerce, environmental economics, environmental protection, factor analysis, industrial development, integrated fashion, literature review, marketing, perception, purchase intention, retailing, social media, stakeholder
sustainable development	2	sustainable supply chains, sustainable textiles, transparency, block-chain, blockchain, competition, consumer behavior, consumption, fashion companies, fashion supply chain, information management, manufacture, planning, purchasing, sales, social and environmental, supply chain, supply chains, sustainable consumption
fashion design	3	industrial economics, industrial engineering, industry, product design, sustainable business, sustainable design, sustainable production, sustainable products, consumer behaviour, design, design process, eco-fashion, ecodesign, environment, ethics, upcycling
sustainable fashion	4	business, circular economy, circular fashion, ethical fashion, fashion consumption, innovation, luxury, luxury fashion, sharing economy, sustainable, sustainable business models, fashion, sustainable fashion design, textile, waste, water pollution
supply chain management	5	manufacturing, profitability, slow fashion, sustainable materials, sustainable practices, sustainable supply chain management, business models, carbon dioxide, carbon footprint, clothing, corporate social responsibility, economic and social effects, environmental pollutions, fast fashion, greenhouse gases

Cont. table 3.

fashion industry	6	commerce, consumer perception, cotton, economic uncertainty, environmental sustainability, fashion designers, garment industry, life cycle, product development, production process, textile industry, textures, wool, yarn
textiles	7	climate change, covid-19, eco-friendly, environmental impact, environmental management, life cycle analysis, population statistics, recycling, sustainable fashion consumption, textile recycling, textile waste, waste disposal, waste management, sustainable development goals

Source: own work.

To conclude, the obtained results based on a comparative keyword analysis indicate a gap in the literature contributions between sustainable fashion and virtual sustainable fashion. Inferring from keyword analysis, the former approaches the specific issues concerning the sustainability of the fashion industry, whereas the latter only alludes to them in general terms.

5. Discussion

According to the results of the research conducted, there is little academic interest in the issue of virtual sustainable fashion. One can assume that it is driven by the premise of virtual fashion's limited potential to influence the development of sustainable fashion, due to its specific nature and still narrow market. Referring to research findings published in the 2022 report 'Metaverse & Sustainability in Fashion', virtual fashion clothing has been acquired by only 8% of consumers worldwide. It was slightly higher in Asia reaching 13 percent (BCG, 2022). In contrast, according to a survey conducted in 2022 by Ipsos, only 3% of consumers across the USA have purchased virtual clothing via an AR app (Ipsos, 2022).

Virtual fashion is recognised as an opportunity to support the development of sustainable fashion through the use of virtual 3D prototyping, 3D visualisation, 3D body scanning and virtual fitting technology in order to reduce waste. What is more, it reinforces eco-friendly consumer attitudes by encouraging using the virtual wardrobe. Nevertheless, the concept of virtual fashion does not explicitly match the core principles / objectives of sustainable fashion. Virtual fashion is characterised from the perspective of new technological features providing opportunities to develop creative designs that move far beyond the patterns and standards familiar hitherto. For example, with means of immersive technologies the new ways to contribute towards fostering cultural heritage (the promotion of traditional clothing and textiles) have been found. Yet only occasionally and as a downstream factor, virtual fashion is inscribed the potential of contribution to the sustainability goals of the fashion industry. Nonetheless, it is not a priority nor a primary objective. Besides, virtual fashion targets a narrow group of consumers who possess the tools of virtual reality technology. That may also be closely related to the demonstrated interest in entering the virtual fashion market by globally known fashion brands, especially premium and luxury brands (Harba, 2019).

Moreover, Virtual Reality still has not become a permanent element of life. Even though, it is particularly favoured by young people who are open-minded for the new technologies. It is therefore worth following the further development of the virtual fashion trend, which is demand-driven. In spite of being characterised as relatively unpopular and sceptically approached nowadays, as previously indicated, there are still other research evidence suggesting that it might change over time. In accordance with the results of a 2021 survey conducted by The Business of Fashion and Altiant on a representative sample of American consumers from generations X, Y and Z, a total of 49 percent of respondents were interested in purchasing virtual fashion items from a luxury brand. Additionally, the rate was slightly lower for those who expressed an interest in purchasing digital assets from a mass fashion brand (The Business of Fashion, 2022). Another 2021 global survey amongst digital communities of fashion companies reported that consumers' interest in trying out new technologies was the main reason for engaging in virtual worlds (The Business of Fashion, 2022). Virtual fashion fulfils the objectives set by fashion creators too, which is to provide an opportunity to experiment with looks. The chief reason for young American consumers aged 14-25 being interested in virtual clothing was the diversity offering the opportunity to experiment. The respondents noted simultaneously their unwillingness to accept the offer as well as to wear those created designs in real life (Roblox, 2022).

Therefore, the validity of the statement “virtual fashion will never replace physical fashion” may be verified in a matter of years' time, as it can become a popular addition to life. After all, this diversification of the fashion industry is likely to rebalance it, since virtual fashion is expected to influence the reduction of overproduction and overconsumption (Von Horn, 2021). For this reason, an important research problem is the one regarding consumer behavior, their changes towards sustainable consumption and the impact of virtual fashion consumption on this change. (United Nations Alliance for Sustainable Fashion, 2021; Ruiz-Navarro, Hintzmann, Corrons, 2021).

Advances in the application of artificial intelligence, IoT and blockchain technologies may also contribute to the sustainability of the fashion industry (Akram, 2022). Artificial intelligence can help fashion companies better assess the sustainability of their supply chain by analysing information about suppliers and their environmental and ethical standards (Lee, 2021). IoT, which is a network of physical objects equipped with sensors, software and other technologies to connect and exchange data with other devices and systems via the internet, offers opportunities to improve sustainability efforts by using sensors to track energy consumption, waste management and water use. As a result, companies can identify areas where they can reduce their environmental impact (Jagtap, Garcia-Garcia, Rahimifard, 2021). Blockchain technology is seen as an opportunity to establish transparency in fashion production (Good on You, 2023) as called for by, among others, the European Union in its plans to introduce digital product passports (Damen, 2023).

Whereas, upcoming research tackling the topic of virtual fashion in the context of sustainability ought to involve developing a knowledge resource about the energy consumption of IT devices, tools and technologies, energy sources, emission levels, CO₂, water consumption (for cooling servers). This concern is being progressively raised by references to EU data claiming that already in 2016 data centres were consuming over 2% of the world's electricity and a volume of fuel comparable, in terms of carbon dioxide emissions, to the aviation industry (ICT Sector Helping..., 2016). This issue has already been accentuated, inter alia by the aforementioned report “Metaverse & Sustainability in Fashion” in which various scenarios of CO₂ reduction alternatives are considered, contingent on a globally implemented programme on the subject (Jordan-Kulczyk, Zając, 2022).

The limitations of the main research conducted for the purposes of this article are the acquisition of data from only three databases and concluding based on the results obtained for a small sample. However, the authors of the two other literature reviews analysed in this paper have encountered exactly the same problem, as shown in the results of the two studies. Thus, this affected the final conclusion reached on the basis of the research, unlike its predecessors, which do not confirm a direct connection between virtual and sustainable fashion.

6. Summary

Virtual fashion and sustainable fashion are two separate concepts with limited degree of overlap. Sustainable fashion refers to the practical application of designing, producing and consuming garments in an environmentally friendly, socially responsible and economically viable manner. It addresses issues such as environmental impact and consumer behaviour. Virtual fashion refers to the creation of digital clothing and accessories designed to be worn by digital avatars or used in virtual and augmented reality environments. This trend is relatively new and expanding within the fashion industry, it has potential benefits including a reduction in textile waste as well as its exceptional impact on the environment connected to the physical production of the garment. Notwithstanding, virtual fashion does not actually solve the nowadays problems regarding the ecological and ethical physical production of garments.

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CHANGES IN THE STRUCTURE OF THE CSR STRATEGY OF COMPANIES IN THE CONTEXT OF RUSSIA'S MILITARY INVASION OF UKRAINE IN 2022

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Purpose of paper: This is a presentation of basic changes in the approach to the Corporate Social Responsibility (CSR) strategy of Ukrainian and Polish companies in the context of Russia's military invasion of Ukraine, and their impact on business efficiency. This study was conducted to determine how businesses have changed CSR strategies based on the assistance provided.

Design/approach: The paper is consisted with 3 parts. The first is about a theoretical context of CSR in Ukraine and Poland – as a short view of literature and practices related to topic, in the time of begging of War. The second part includes findings on research sample – questionnaire research among Ukrainian companies and their practices with CSR during the begging the War. The last part is an attempt of conceptualization own proposal of operationalization of CSR strategy in a time of war called Emergency Reflection Algorithm.

Practical implications: The development of corporate social responsibility is one of the ways of strategic business development in achieving strategic goals, strengthening competitive positions in the market, building partnerships, establishing stable relationships between all elements of the internal and external environment of enterprises.

Social implications: With the beginning of Russia's military invasion of Ukraine, there is an active participation of business in addressing the vital needs of civilians, military support, for Ukrainian citizens. Enterprises spend insane resources in material and financial terms in turbulent times of war. In general, understanding they bring emergency impact into a social surviving. The main subject of the research was the assessment of CSR practices in the face of a huge change, which was Russia's aggression against Ukraine.

Findings: Half of the surveyed enterprises changed the strategic goals of CSR. In general, the primary goals are “Income” and “Use of material and financial resources: hire productivity of assets, better capital use, cost decrease”. The identified CSR strategy meets the criterion of measurability, and therefore all changes that are made to the current strategy or when formulating a new strategy must be adjusted to the strategic goals of CSR. Surveyed enterprises changed their strategic goals, while the rate of change in the strategic indicators of the positive contribution of CSR. This result demonstrates the need for changes in the enterprise management system.

Originality/value: There was proposed the Business Model Canvas as tool to help forming/adapting a CSR strategy.

Keywords: CSR, Ukraine enterprises, war in Ukraine, sustainability management.

Category of the paper: research paper, conceptual paper.

Introduction

The activities of any business are not limited to improving business processes and achieving business performance. The management of every company from micro-entrepreneurship to large companies must recognize the importance of business through the prism of three dimensions: economic, social, and environmental. Thus, business has strong transformative tools for the development of financial, organizational, and human capital in the internal environment of the company. And building sustainable relationships with suppliers, consumers, partners, local communities and society as a whole at the external level.

Business affects the economy, society and the environment - and this is what shapes a company's corporate social responsibility. The main task of modern business, without exception, is to reduce the negative and increase the positive impact. This can be achieved only by adhering to the principles of sustainable development on which the CSR strategy should be based, namely - the balance between meeting modern needs and protecting the interests of future generations.

The effectiveness of the CSR strategy determines the level of sustainable development of modern business at various management levels and is based on support for the generally accepted goals of sustainable development UNDP's 17. The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call for action to end poverty, protect the planet and ensure that all people have peace and prosperity by 2030 (The Sustainable Development Goals..., 2022).

CSR strategy is a tool not only for business development, but also for solving macro problems. Therefore, CSR development trends are regulated at the international and national levels. Compliance with legal standards is one of the conditions for successful implementation of CSR strategy in enterprises. This study focuses on socially responsible business in Ukraine and Poland during the Russian-Ukrainian war. Therefore, the legislative aspect of supporting the development of SCR as a strategy for sustainable business development and the environment is presented at the international, European and Ukrainian national levels.

International level. The development of CSR is supported by international organizations and associations that develop working materials on the development and implementation of various areas of business from the standpoint that "Business is an integral part of society". For example, the primary objective of UNIDO (United Nations Industrial Development

Organization) is a promotion of inclusive and sustainable industrial development in developing countries and economies in transition. UNIDO contributes to the industrial development of countries regarding compliance with the promotion of social sustainability (UNIDO Annual Report, 2020):

- Creating shared prosperity.
- Advancing economic competitiveness.
- Safeguarding the environment.
- Strengthening knowledge and institutions.
- Cross-cutting services.
- Building a better future.
- UNIDO's normative role for higher impact.

According to the UNIDO Annual Report 2021, in 2021 USD 39.3 million was spent on the development of socially responsible business in 121 countries from the European Union, USD 45.9 million from Global Environment Facility (GEF), USD 22.7 million from Multilateral Fund (MLF). A total of USD 66.9 million was received from Top Funding partners (UNIDO Annual report, 2021).

In fact, UNIDO support programs help to bring business to a higher level of development through the implementation of a CSR strategy into existing business processes. They help companies reach a new level of development and competitiveness by creating socially responsible services and products, implementing quality systems in the value chain, maintaining a high standard of social responsibility within the company, creating social and environmental innovations. In this way, the interests of stakeholders are met, companies gain competitive advantages and sustainable development for a long period of activity.

The Vision 2050: Time to Transform is the most recent international practical guide to CSR implementation created by World Business Council for Sustainable Development (WBCSD). Vision 2050: Time to Transform sets a shared vision of a world in which more than 9 billion people are able to live well, within planetary boundaries, by 2050. Its uniqueness and relevance are due to the consequences of the COVID-19 World Pandemic and the demonstration of its impact and interaction with three major global problems: the climate emergency, nature loss and mounting inequality. The vision and transformation pathways are aligned with the Sustainable Development Goals (SDGs) and the targets of the Paris Agreement. Each of the nine transformation pathways contains ten action areas for the decade ahead, designed to help companies drive transformative change in their strategies, business operations and impact on society (Vision 2050. Tome to transform, 2022). Vision 2050: Time to Transform reflects how systems are being transformed and offers a business governance framework for the coming decades.

European level. European requirements for the development of CSR are defined in the relevant laws, standards, regulations, which were revised after the global financial crisis. European conception of CSR is defined in the Commission Staff Working Document “Corporate Social Responsibility, Responsible Business Conduct, and Business & Human Rights: Overview of Progress Brussels, 20.3.2019 SWD(2019) 143 final”: *Corporate Social Responsibility (CSR) was defined in the CSR Strategy as the "the responsibility of enterprises for their impacts on society" (Overview of Progress. EUROPEAN COMMISSION, 2019). To fully meet their social responsibility, companies “should have in place a process to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders, with the aim of maximizing the creation of shared value for their owners/shareholders and civil society at large and identifying, preventing and mitigating possible adverse impacts”. The EU CSR development strategy is based on the main benefits for both individual business and the general socio-economic situation (Fig. 1).



Figure 1. Advantages of implementing the European CSR strategy at different levels of government. Source: (Renewed EU strategy 2011-14 for CSR, 2019).

European companies that develop and implement CSR strategies are based on agreed basic standards and guidelines in accordance with international standards. The companies have at their disposal the following official materials:

- OECD Guidelines for Multinational Enterprises;
- The ten principles of the United Nations Global Compact;
- The ISO 26000 Guidance Standard on Social Responsibility;
- The ILO Tri-partite Declaration of Principles Concerning Multinational Enterprises and Social Policy;
- The United Nations Guiding Principles on Business and Human Rights.

All-Ukrainian level. Ukraine's desire to become a member of the EU imposes mandatory conditions for compliance with European standards. Regarding the regulation of CSR development at the state level in Ukraine, it should be noted the following regulatory documents:

- Decree of the President of Ukraine 22722/2019 "On the Sustainable Development Goals of Ukraine until 2030" (www.president.gov.ua, 2019).
- Concepts of implementation of state policy in the field of promoting socially responsible business in Ukraine for the period up to 2030 (www.zakon.rada.gov.ua/laws/show/66-2020-p#Text, 2020).
- National Strategy for Human Rights (www.president.gov.ua/documents/1192021-37537, 2021).
- Strategies for creating a barrier-free space in Ukraine (www.zakon.rada.gov.ua/laws/show/366-2021-p#Text, 2021).

The development of CSR in Ukraine is in the active progress. More and more large Ukrainian companies are implementing a CSR strategy into the core strategy of their business. While micro, small and medium-sized enterprises provide corporate social responsibility more intuitively than consciously highlighting it as a separate business development strategy.

The analysis of international, European and domestic Ukrainian state support for CSR provides the basis for the conclusions that:

- despite the significant support of CSR at the top management level, it remains avoluntary right of every business and needs additional informational support and popularization in the business environment in order to stimulate management to its implementation. This is especially true for SMEs;
- updating standards and regulations took place in the post-crisis period (global financial crisis, global pandemic COVID-19). None of the documents offers an anti-crisis algorithm of action in crisis situations with a demonstration of the model "Emergency action now for the future prosperity" in real or simulated form. Accordingly, companies do not have clear examples of emergency changes in the structure of existing CSR strategies that have led or are projected to have a positive impact on the sustainable development of companies and society.

The CSR strategy is an important tool for the effective implementation of corporate social responsibility. Having a strategy allows businesses to monitor and regulate the progress of CSR initiatives, respectively measure their impact on key objectives. As already noted, business in the general sense can be represented in three dimensions of sustainable development, respectively, and the shade of the CSR strategy can be shifted towards a certain dimension. For a deeper understanding of the conceptual features of CSR strategies, we should look at the history of corporate social responsibility as a concept of business development. In the scientific and practical literature, there are different definitions of CSR, which also to a greater extent

determine the affiliation of corporate social responsibility to the economic, social, environmental dimension, as well as the importance of CSR in general for company development (Fig. 2).

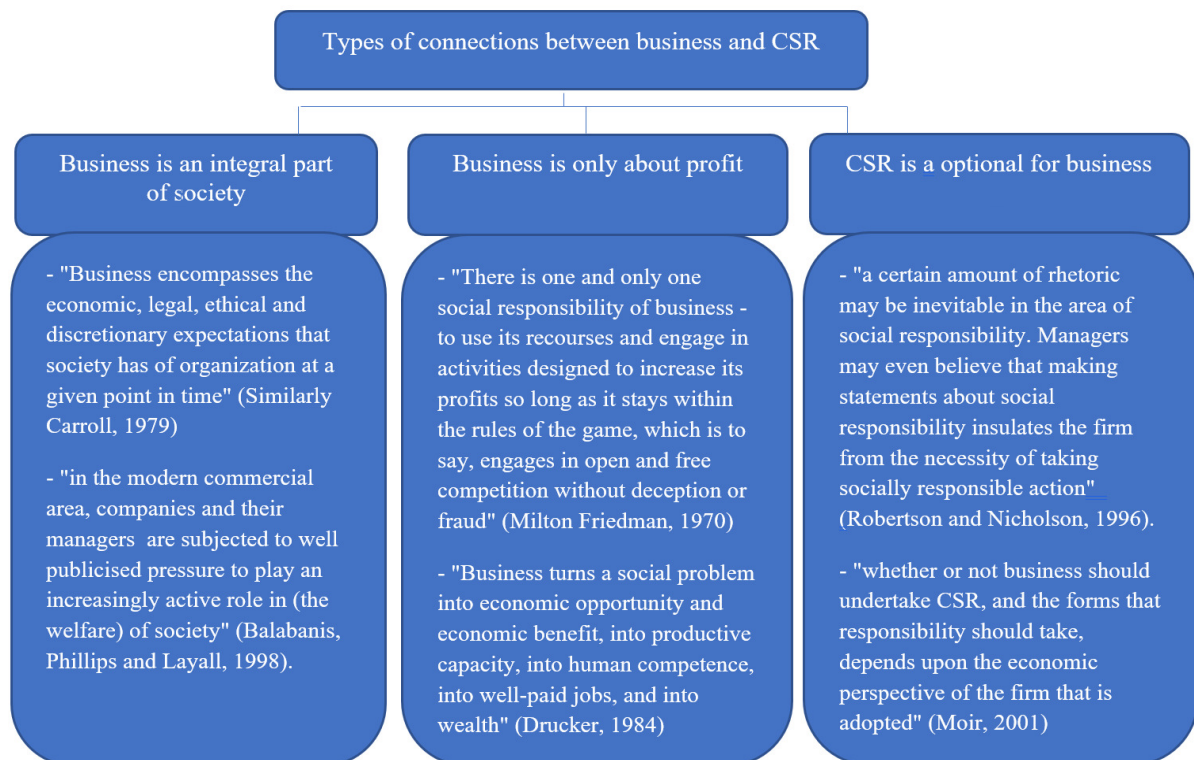


Figure 2. Types of connections between business and CSR.

Source: (Crowther, Aras, 2008).

Thus, the CSR strategy is based on an intra-corporate vision of social responsibility and an understanding of what the expected outcome is for stakeholders. While intra-corporate visions may be different and affect the concept of CSR strategy, the principles of CSR are mandatory when implementing a CSR strategy in other business processes (Fig. 3).

In this study, the CSR Strategy is proposed to be considered as a set of business processes that are implemented in the overall business development strategy. It should be borne in mind that the CSR strategy may affect the business plan of the enterprise, requiring coordination with other business goals. For example, such as increasing attractiveness to investors, increasing customer loyalty, increasing attractiveness to investors, reducing operating costs and more. Strategic business goals are the basis for the formation of CSR strategy, and the KPI of CSR strategy should be correlated with the key KPIs of strategic business processes. This approach ensures long-term efficiency and supports continuous investment in CSR initiatives. This aspect related to operationalization of CSR by the key KPIs will be discussed in a summary part of text.

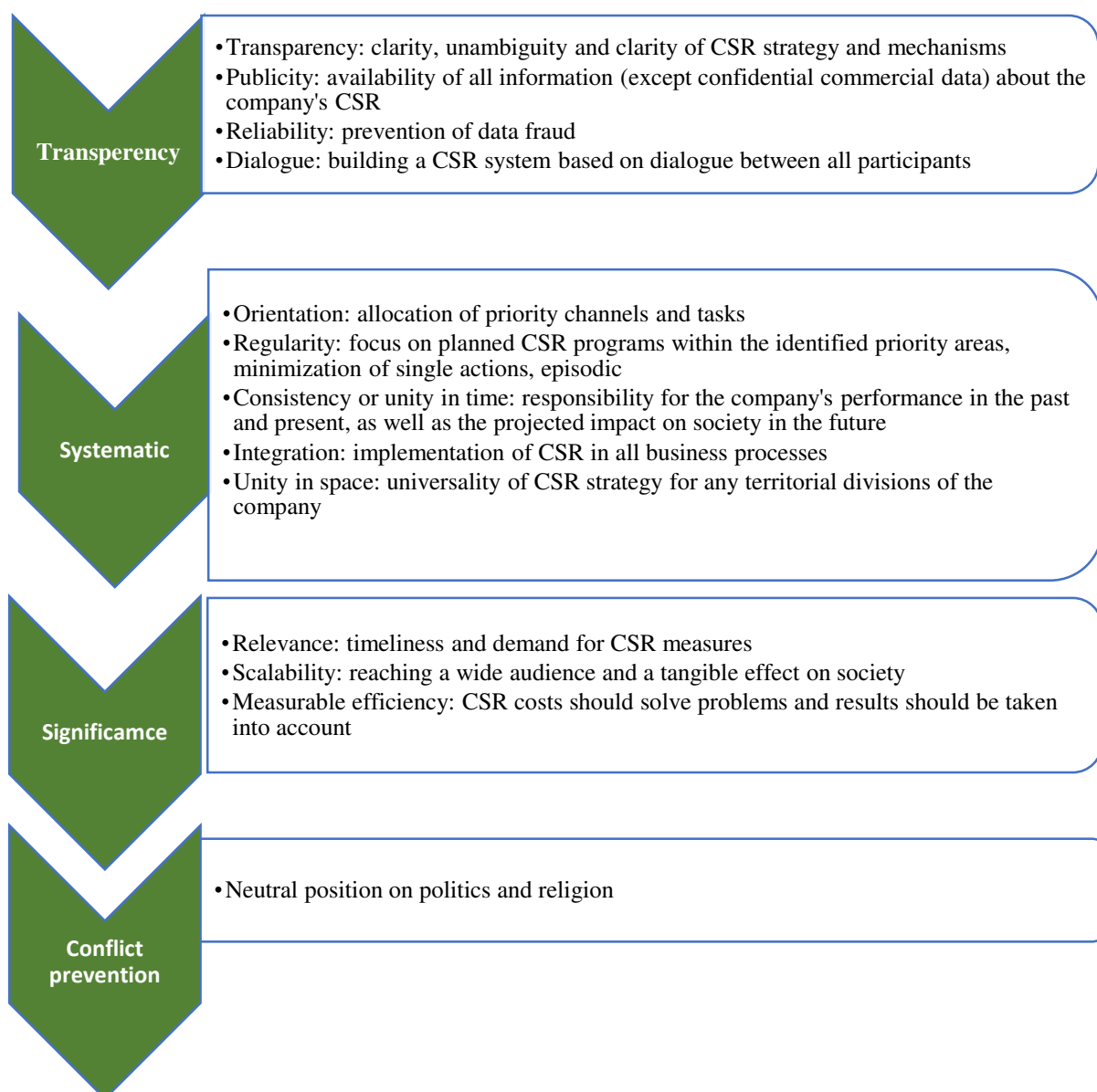


Figure 3. CSR principles that are included in the CSR strategy.

Source: (Sheehy, 2015).

In conditions of socio-economic instability, businesses must use flexible methods to implement the CSR strategy and develop an anti-crisis algorithm of formation/adaptation, which proves the second global crisis in 5 years. The military conflict in Ukraine is an example of how the world can quickly unite to support the armed forces and civilians in resisting the aggressor. During the first two months of the war, Ukrainian and Polish companies spent insane financial, material, and intangible resources in support of Ukraine. To record the contribution of business in resisting Russian aggression, the Ukrainian CSR Development Expert Organization created a Catalog of Business Contributions in the Russian-Ukrainian War. To date, the cases of 108 companies that have made their regional and or national contribution to the fight against Russia's military aggression have been collected.

The contribution is fixed by category (Fig. 4):

- financial support (transfer of funds, advance payment of taxes, business combinations for joint work);
- humanitarian aid (evacuation, food and essentials, medicines);
- military support (purchase of military equipment, machinery, food, medicine);
- media support and information resistance (fight against Russian propaganda, creation of information appeals both inside the country and abroad, etc.);
- information support of the society (open resources for education for both children and specialized vocational training/retraining for adults);
- employees support (financial support of families, relocation to safe places).

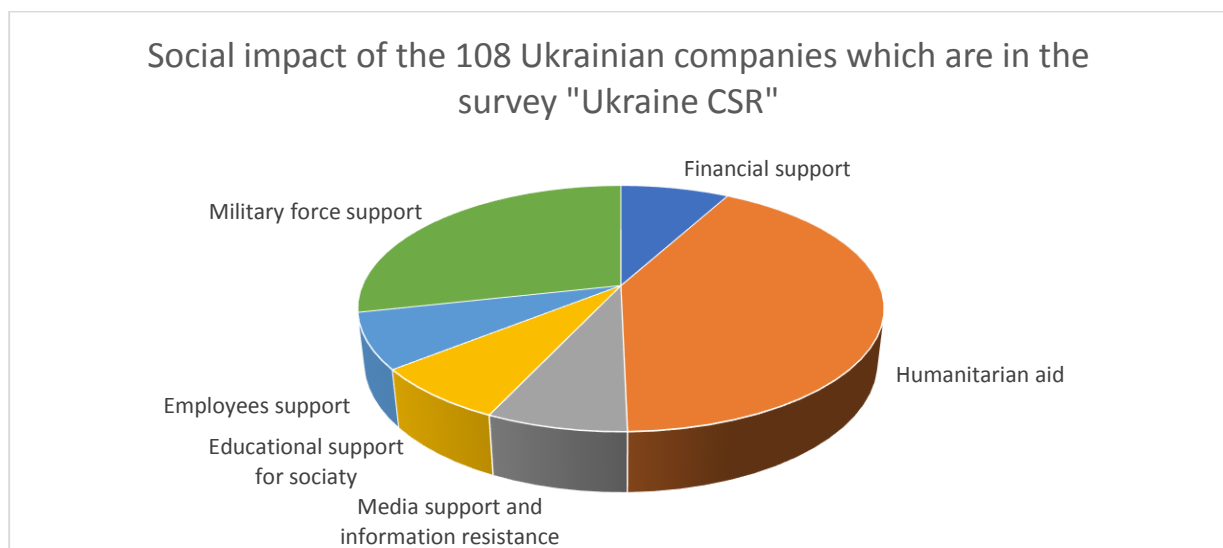


Figure 4. Social impact of the 108 Ukrainian companies which are in the survey "Ukraine CSR".

Source: (csr-ukraine.org/catalog-actions-of-companies-in-the-russian-ukrainian-war, 2022).

The chart shows that the largest resources are spent on humanitarian aid and military support. Large companies also noted their contribution by paying taxes in advance, which has a supportive effect on Ukraine's economy. Strong public and private aid came from Poland. Since 24 February, about 3.5 million Ukrainian refugees have crossed the Polish border, the border guard announced. On Wednesday 17th of May, 21,500 Ukrainians entered Poland, while 28,000 returned to Ukraine. In total, about 1.38 million Ukrainians have left Poland and returned to Ukraine. After 85 days of the war in Ukraine Poland is a country which received the biggest number of refugees. The European Commission is to disburse €248 million among the member states that accepted the most refugees from Ukraine fleeing from war.

The European Commission will grant Poland €144.6 million from the Asylum, Migration and Integration Fund for helping refugees from Ukraine, while Romania, the Czech Republic, Hungary and Slovakia will receive €39 million, €27 million, €21 million, and €15 million respectively (www.unhcr.org, Poland to receive..., 2022).

International non-governmental organizations joined the assistance, including: *People in Need, Red Cross, International Medical Corps, CARE, UNHCR, the UN Refugee Agency, OutRight Action International, Save the Children, SOS Children’s Villages, Mercy Corps, Medical Teams International, World Health Organization Foundation, Alight, International Rescue Committee, Direct Relief, GlobalGiving* and other.

Since the beginning of Russia's military invasion of Ukraine, Polish business has joined with support through humanitarian aid to Ukraine and in support of Ukrainian refugees who were forced to leave Ukraine. A state aid program Pomagamukrainie was created to effectively coordinate aid to Ukraine. According to the Polish state resource www.gov.pl individuals, companies and other institutions (from outside Poland) interested in providing material aid in Poland can help using two ways using resource www.pomagamukrainie.gov.pl (Fig. 5) (www.globalcitizen.org, 30 Meaningful..., 2022).

Two ways of material aid from Poland to Ukraine using a program www.pomagamukrainie.gov.pl	
<p>Transferring aid to the Polish institutions, if there is no recipient on the Ukrainian side.</p> <p>The aid will be directed to Polish hubs, and then coordinated by Polish institutions to Ukraine.</p>	<p>Transferring aid directly to the Ukrainian side (if they have their partner on the Ukrainian side).</p> <p>The transit of convoys with humanitarian aid through the territory of the Republic of Poland on the border with Ukraine takes place through two border crossings: Dorohusk and Korczowa.</p>

Figure 5. The specific of a state aid program Pomagamukraini.

Source: (www.globalcitizen.org, 30 Meaningful..., 2022).

Order to information portal www.statista.com, since the beginning of Russia's invasion of Ukraine in 2022, one out of every two companies in Poland has been involved in helping Ukraine, with companies from the trade sector accounting for the most significant percentage (57 percent) (Fig. 6).

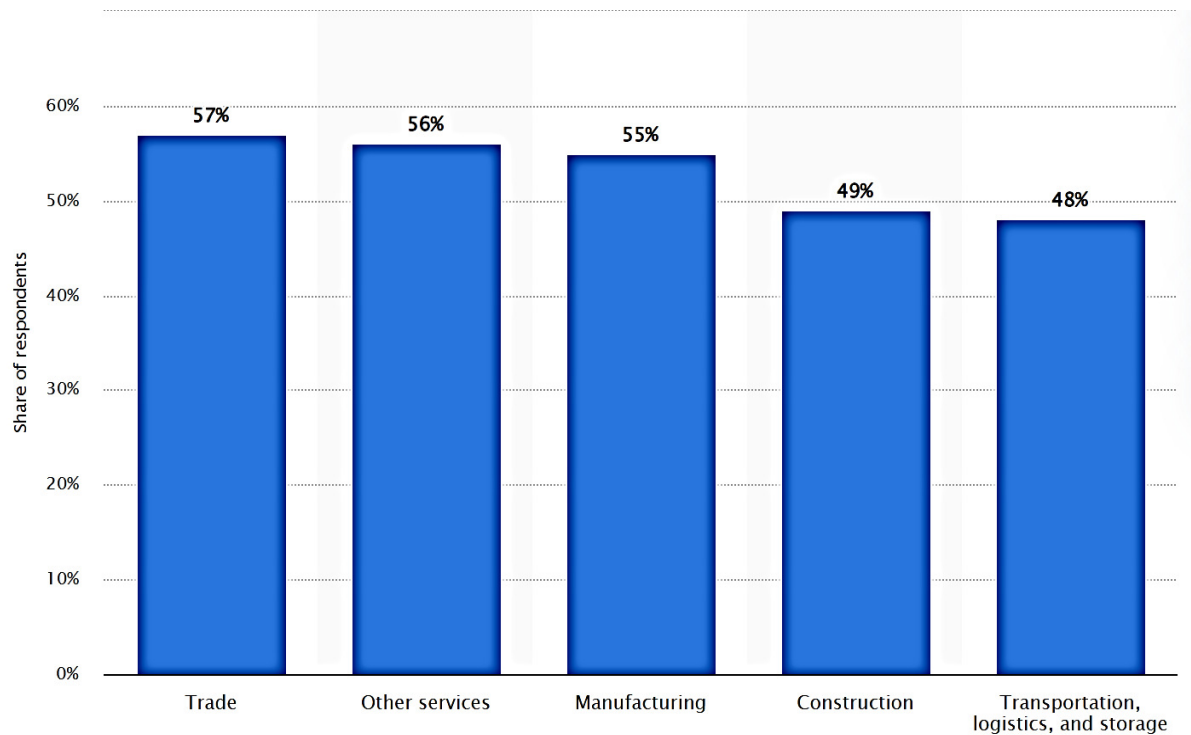


Figure 6. Share companies involved in helping Ukraine in Poland in 2022, by sector.

Source: (Share of companies involved in helping Ukraine in Poland in 2022, 2022).

Findings

Ukrainian and Polish businesses spend resources on social needs, decisions are made in a short time. But are such actions on the part of business a corporate social responsibility? Are they a newly created or adapted CSR strategy within the existing business structure? Given the criteria that determine the social contribution of business as CSR (Fig. 7), such one-time or short-term social impact does not meet the concept of CSR. In addition, most companies in the pre-war period were not related to the social problems they joined after February 24, 2022.

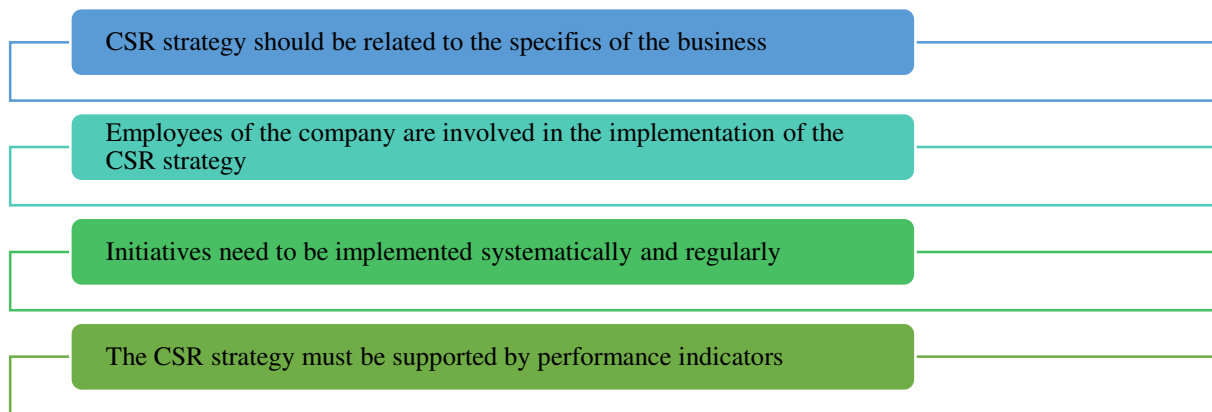


Figure 7. Criteria for SCR business strategy.

Source: own work.

As part of this study, indicators were monitored that characterize changes in the structure of CSR business strategy in Ukraine and Poland. The questionnaire was developed with the key elements of its formation. The survey was conducted in the fourth month of the war. All answers were asked to be represented in two timelines:

- "N" questions - before Russian-Ukrainian war;
- "W" questions - after the 24th of February 2022.

Company representatives were asked to specify changes in the CSR strategy in each step of the questionnaire ("W" questions), if their company accepted changes in support of Ukraine (financial support for military force, civil society, employment support for Ukrainians, inclusion, solidarity policy, etc.). For example, the company was following the Environmental dimension supporting waste reduction before Russian invasion of Ukraine. After the start of the war, the company made decision to follow the direction of the contribution to society.

The Questionnaire included 6 questions about 6 aspects of the basic field of CSR in the company (Dionisio, de Vargas, 2020; Wolska, 2013; Mirvis, Herrera, Googins, Albareda, 2016).

The identification of changes can help to understand the company's impact now for the own developmental prospects in the future. The structure of the Questionnaire is:

1 step: General information about the company:

- Name of the company;
- Location of company's activity;
- Location of company's activity;
- Field of activity;
- Size of the company: micro company, small company, medium-sized company, big enterprise, other;
- How long has the company been implementing CSR?: less than 5 years, from 5 to 10 years, more than 10 years;

- Contact info of the company representative taking part in the questionnaire: name, email;
- Consent to the use of answers in public research results: author's publication, presentation within the University scientific community.

2 step: Identification of the Sustainability Strategy of the company, which defines the CSR Strategy:

- Economic dimension: creation of economic value, generation of economic development, none;
- Social dimension, including internal and external levels: work life quality, employees wellbeing, contribution to society, welfare in general, product responsibility from the side of consumer's health and safety, none;
- Environmental dimension: environmental management, waste reduction, efficient materials use, efficient waste management and improvement in the product design in all stages of its life cycle, none.

3 step: Identification of the stakeholders (individuals or group that has an interest in any of CSR implementing decision or activity of a company/organization):

- Organization's: management, shareholders, employees, associates, none;
- External: clients, banks, distributors, suppliers, none;
- Society's: community, NGO's, government and regulating entities, environment, none.

4 step: Identification of the strategic goals of the CSR (to satisfy shareholder's expectation):

- Financial: economic value added, income, use of material and financial resources: hire productivity of actives, better capital use, cost decrease;
- Customers: client's satisfaction, customer offer development to differentiate from competitors, clients and markets portfolio (diversification, internationalization, new clients), client retention, none;
- Internal business-processes: operational excellence in the production and distribution processes (quality, efficiency, productivity); identification market needs and product/service portfolio improvement to satisfy them; post-sale service, none.

5 step: Identification of determine the CSR policy according to strategic objectives:

- Company Value Policy: organizational governance, anti-corruption, responsible political involvement, fair competition, promoting social responsibility in the value chain, respect for property rights;
- Workplace Policy: employment and employment relationships, conditions of work and social protection, social dialog, health and safety at work, human development and training in the workplace, human rights: resolving grievances, discrimination and vulnerable groups, fundamental principles and rights at work;

- Environmental Policy: prevention of pollution, sustainable resource use, climate change mitigation and adaptation, protection of environment, biodiversity and restoration of natural habitats, none;
- Marketplace Policy: fair marketing; factual and unbiased information and fair contractual practices; protecting consumers' health and safety, sustainable consumption, consumer service support, and complaint and dispute resolution; consumer data protection and privacy; access to essentials services; education and awareness; none;
- Community Policy: community involvement, education and culture, employment creation and skills development, technology development and access, wealth and income creation, health, social investment, human rights (economic, social, and cultural rights due diligence, human rights, risk situations, avoidance of complicity), human rights: civil and political rights, none.

6 step: Identification of strategic indicators of CSR's positive impact on company's development:

- Sales increase;
- Operative costs decrease;
- Work stability increase;
- Productivity and quality increase;
- Innovative level increase;
- Risk reduction related to stakeholders requirements;
- Vigilance reduction;
- Enhancement of clients' loyalty;
- Clients retention;
- Improvement in image and reputation before clients and other stakeholders;
- New clients attraction;
- Human capital: talent attraction and retention;
- Human capital: strategic skills and competences;
- Human capital: working conditions and employees welfare;
- Organizational capital: organizational culture and leadership, alignment with the strategy, team work and knowledge management;
- Organizational capital: social contribution;
- Other.

There are 30 companies from Ukraine were invited to participate in the Questionnaire including the information support of the coordinator of the Committee for Industrial Ecology and Sustainable Development of the European Business Association. In fact, 10 companies from micro-businesses to large companies took part in the survey.

Requests to participate in the Questionnaire were sent to 16 Polish companies from various fields of economic activity, including: *Nordea, Amazon, BNP Paribas Bank Polska, PEPCO Group Limited, Starbucks Poland / Starbucks Central Europe, Enterprise Solutions, Samsung Electronics Poland, Enterprise Solutions, Bosch, LPP S.A., Grupie Eurocash, Integer.pl, EWL Group, PwC Polska, Schenker sp.zo.o., Employer Branding Institute, CodeTwo Software.*

The main reasons for non-participation of Polish business representatives were:

- unwillingness to disclose details of intra-corporate strategy;
- lack of CSR as an established business strategy;
- a short period of time to establish trusting contacts with enterprises and their participation in the study.

Thus, it was possible to analyze changes in the structure of the CSR strategy based on the answers of 10 Ukrainian enterprises, which are summarized in the table below.

Table 1.

Description of 10 Ukrainian enterprises which took part in a Survey

Name of the company	Field of activity	Location of company's activity	Size of the company	Duration of the CSR implementation		
				less than 5 years	from 5 to 10 years	more than 10 years
National Energy Company	United Energy System of Ukraine	Ukraine , Member of the European Continental Energy Community ENTSO-E	Big enterprise	+		
Bayer	Pharmaceutical and agricultural	Ukraine	Big enterprise			+
Agrocenter, LLC	Agriculture	Ukraine	Big enterprise	+		
Malynovsky glass factory	Glass containers production	Ukraine	Big enterprise			+
Dniprokranservice, LLC	Metal structures production	Ukraine	Medium-sized company		+	
Ukrainian Investment and Analytical Company, LLC	Auto trade and financial leasing	Ukraine	Small	+		
Individual entrepreneurship	Online commerce	Ukraine	Small	+		
Sport Service, LLC	Sport goods distribution	Ukraine	Small		+	
Individual entrepreneurship Pus VM	Construction	Ukraine	Micro	+		
Prism Foundation NGO CF	Charity, social entrepreneurship	Ukraine	Micro	+		

Source: own study.

Among the enterprises that joined the survey - 40% are large companies, 30% - business, 20% - micro-enterprises and 10% - middle-sized enterprises. According to the criterion of the term of implementation of CSR strategy in business, the term "less than 5 years" prevails, which was noted by 60% of enterprises (Fig. 8).

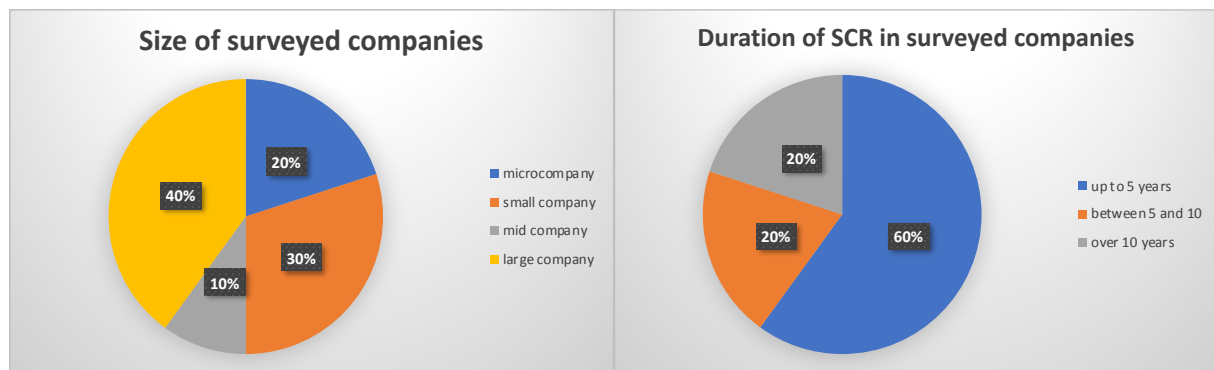


Figure 8. Characteristics of the companies that participated in the survey.

Source: own study.

Table 3.

Percentage expression of enterprises that have made changes to certain categories of CSR strategy since the beginning of the war in Ukraine

Sustainability Strategy of the company			Stakeholders		
Economic dimension	Social dimension, including internal and external levels	Environmental dimension	Organization's level	External level	Society's level
50 %	70 %	50 %	30 %	20 %	40 %
Strategic goals of the CSR					
Financial		Customers		Internal business-processes	
50 %		70 %		70 %	
CSR policy according to strategic objectives					
Company Value Policy	Workplace Policy	Environmental Policy	Marketplace Policy	Community Policy	
30 %	20 %	20 %	20 %	40 %	
Strategic indicators of CSR's positive impact on company's development					
30 %					

Source: own study.

The first key issue that affects the further formation and development of CSR strategy is the choice of Sustainability Strategy of the company, which defines the CSR Strategy. According to this parameter, obvious changes took place in the Economic dimension category. Namely, half of the respondents in this category changed their economic orientations.

In the "Social dimension, including internal and external levels" category, only three enterprises maintained the pre-war CSR benchmarks. For example, "Sport Service, LLC" decided - "After the start of the war, the company decided to go in the direction of financial support of the Armed Forces and humanitarian aid to all segments of the society, where the fighting took place and is taking place". "Dniprokranservice, LLC" also made decision in

support of community safety. A change in their social orientation was - "Support for the defense of the region through the development of metal protective anti-tank structures". "Ukrainian Investment and Analytical Company, LLC" noted a decrease in CSR funding for projects aimed at supporting the well-being of employees.

As for the "Ecological dimension", there were no changes in the development guidelines, but financial support for the projects decreased, which suspended their implementation.

Regarding the second strategic issue - Changes in stakeholders, 70% of companies have not changed their priorities. At the organizational level, CSR beneficiaries remain management. Changes in support of the company's employees occurred in 30% of enterprises. At the external level, 90% of enterprises remained the main CSR stakeholders. The main strategic task for the business was to retain existing customers.

In the category of impact on society, 60% of companies have not changed their development. While there are changes in the interaction with NGOs. The reason for this may be targeted social assistance, which minimizes cooperation with NGOs.

Half of the surveyed enterprises changed the strategic goals of CSR. In general, the primary goals are "Income" and "Use of material and financial resources: hire productivity of assets, better capital use, cost decrease".

"Customer satisfaction and retention, clients and markets portfolio: diversification, internationalization, new clients" were strategic goals of the pre-war period for 80% of enterprises. After the start of the military invasion, 70% of enterprises changed their strategic goals.

"Operational excellence in the production and distribution processes: quality, efficiency, productivity" and "Identification market needs and product/service portfolio improvement to satisfy them" were the main goals of supporting and developing business processes of more than half of enterprises before the war. In this category, half of the enterprises kept their strategic goals unchanged.

Changes in the concept, strategic goals, stakeholders inevitably lead to changes in CSR policy. According to the statistics of answers, there is an irrelevant picture. 70% of enterprises did not change their CSR policy. In the category "Company Value Policy" increased attention to Organizational governance and Fair competition. 80% of enterprises left unchanged the Workplace policy, Environmental Policy, Marketplace Policy. Significant changes took place in the Community Policy of 30% of surveyed companies that added changes in the category of Social investment.

The CSR strategy meets the criterion of measurability, and therefore all changes that are made to the current strategy or when formulating a new strategy must be adjusted to the strategic goals of CSR. According to the survey, half of the enterprises changed their strategic goals, while the rate of change in the strategic indicators of the positive contribution of CSR changed by 30%. This result demonstrates the need for changes in the enterprise management system.

Practical and research implications

As a result of the above study on changes in CSR strategy in crisis conditions as the War in Ukraine, the implementation of the algorithm "**Emergency Reflection Algorithm**" in the enterprise management system is proposed by authors. There are following assumptions and stages of this algorithm, which can be assumed as best solution in the time of crisis as war (Fig. 9):

1. The algorithm of formation/adaptation of the CSR strategy "Emergency reflection algorithm" takes place based on 12 basic stages.
2. Establishment of a working group: competent employees involved in management, personnel, financial and marketing policy of the enterprise, whose main task is to integrate corporate social responsibility into key business processes of the enterprise in order to obtain positive socio-economic results.
3. Analysis of the internal and external environment of business: diagnosis of the enterprise and the portfolio of its assets, possible areas of investment, trends in internal and external environment.
4. Identification of key stakeholders (Organization's, External, Society's) and their key needs.
5. Implementation of the current analysis and relevance of the pre-crisis CSR strategy (if there is an existing CSR strategy).
6. Defining the concept of CSR in accordance with the Sustainability Strategy of the company (Economic dimension, Social dimension, including internal and external levels, Environmental dimension).
7. Defining the CSR policy according to strategic objectives: Company Value Policy, Workplace Policy, Environmental Policy, Marketplace Policy, Community Policy.
8. Coordinating the CSR strategy with key business processes.
9. Defining the strategic goals of the CSR: Financial, Customers, Internal business-processes.
10. Defining the strategic indicators of CSR's positive impact on company's development.
11. Implementation of CSR project/projects based on Agile methodology.
12. Monitoring of implementation results.
13. Completion of the CSR project.

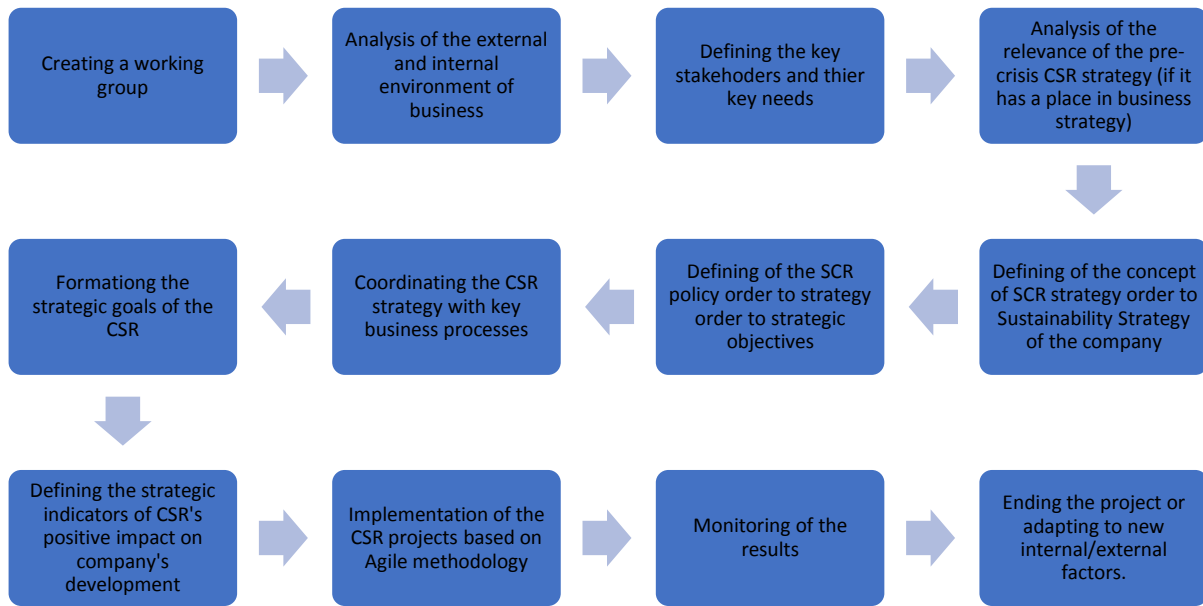


Figure 9. The structure of the Emergency Reflection Algorithm.

Source: own study based on: Ullah, Arslan, Puhakka, 2021; Vishwanathan, Van Oosterhout, Heugens, Duran, Van Essen, (2020).

Originality/value

From the point of view of sustainable business development, such implementation is an effective tool for forming/adapting a CSR strategy in conditions of instability and rapid decision-making. Based on the Business Model Canvas (Vishwanathan, Van Oosterhout, Heugens, Duran, Van Essen, 2020), which is a tool for strategic management of business processes, companies can effectively monitor the achievement of established KPIs CSR strategy by transforming the plane of pre-war time in the plane of projected KPIs of future periods. The relationship between strategy and business model of the enterprise is presented in the (Fig. 10).

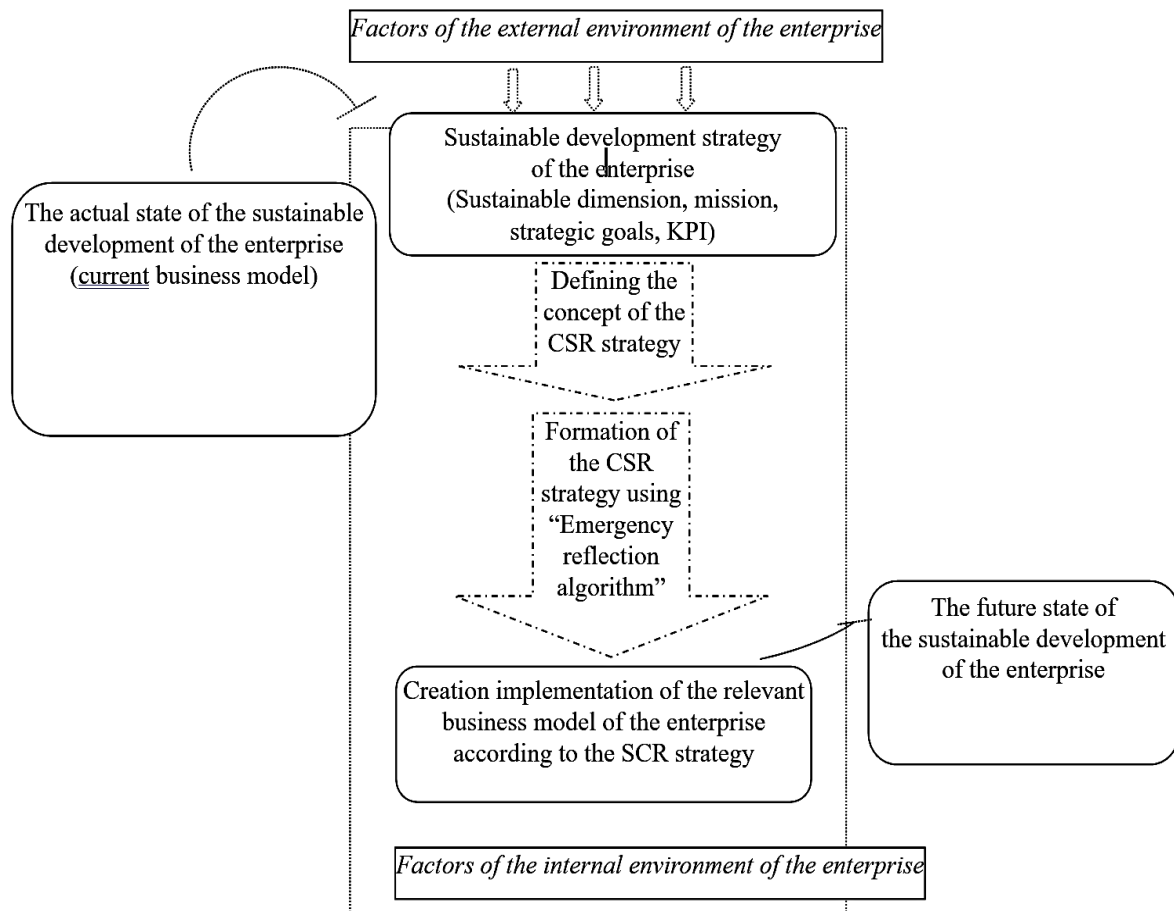


Figure 10. Connection between the business model and CSR strategy.

Source: own study by Vishwanathan, Van Oosterhout, Heugens, Duran, Van Essen, 2020.

Achievements of KPI of CSR projects are offered to be carried out with introduction of Agile methodology which helps to make progress flexibly created and adapted in order to achieve the desired results:

- focus on user needs,
- deliver iteratively,
- keep improving how your team works,
- fail fast and learn quickly,
- keep planning.

The implementation of the "Emergency Reflection Algorithm" will allow to fundamentally change the strategy in a situation of turbulent environment. At the same time to control all stages of implementation in accordance with the established parameters and the set strategic goals.

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FINANCIAL AND NON-FINANCIAL REPORTING OF ENTITIES IN THE REAL-ESTATE DEVELOPMENT SEGMENT – EXPLORATORY STUDY

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Purpose: On the grounds of stakeholder theory, agency theory, legitimacy theory, situational conditioning theory or institutional theory, the author formulated the main purpose of the article, which is to study the real estate development industry and gain new knowledge in order to identify good reporting practices.

Methodology/approach: The rationale presented justifies the choice of the real estate developer as the object of research. The subject of the study is, adequately to the purpose of the article, the use and importance of financial and non-financial reporting by the entities studied. The basis for the evaluation was a survey on those preparing and drafting the reports in the studied entities. The presentation of the results and their conclusions was preceded by a presentation of the adopted methodological assumptions. The analysis and considerations conducted in the paper, including a critical analysis of the literature and own empirical research, made it possible to positively realize the purpose of the article and allowed the author to solve the research problem.

Findings: Conclusions from the research and solutions used in the area of financial and non-financial reporting indicate the need for modification of reports tailored to the characteristics of real estate developers. This would optimize the allocation of the entity's resources in order to improve reporting and accountability, for example, of management towards stakeholders. It can be concluded that the reporting solutions currently in use are not adapted to the needs and requirements of their stakeholders.

Research limitations/implications: The main limitation of the survey is the relatively small number of respondents. However, even with a small sample, a wide range of developer practices could be observed, hence the sample size was not a problem.

Originality/value: The new formulas and solutions presented in this work lead to an expansion of previous theoretical knowledge in the field of financial and non-financial reporting of real estate development entities. On the other hand, the empirical research along with the issues proposed in the article have important theoretical and practical implications for the management of the studies entities.

Keywords: real estate developer, financial report, non-financial report.

Category of the paper: research paper.

1. Introduction

The real estate development market has become an attractive area for investors, and with the rapidly changing conditions of real estate development activity, the usefulness of the information presented in reports is also changing. Developers vary in size and pace of development, fundamentally operating in a local environment. Thus, they participate in the creation and strengthening of the socio-economic ties of their region. The peculiarities of the operation of real estate development activities make this sector worthy of a thorough analysis and substantive support. Meanwhile, the importance of real estate development activities can be attested to by the statement that “everything you see, everything you hear and everything you read is relevant to real estate development processes” (Pecea, 2009, p. 6). The real estate development process should be considered as a unification of construction technology, financing, marketing skills, administrative control and many other activities aimed at ensuring the proper operation of the entire development project for many years. Therefore, it can be said that it is a complicated process because in addition to the activities within the property, it also covers adaptation processes related to its specific macro- and micro-level environment (Kucharska-Stasiak, 2016). Through the housing dimension, real estate development activity attempts to satisfy one of the basic human aspirations to have one’s own place of residence, enabling the realization of the essential needs of life (Gliniecki, 2012). The growth and competitiveness of developers is affected by a number of challenges. In view of the progressive development of management practice and theory, the forms of management of development activities are also evolving. And the developer is the central figure of the articulated activity. For efficient management of their projects, a developer needs regular reporting (Henzel, 2004).

The literature analysis conducted by the author indicates a gap in the field of financial and non-financial reporting in development companies, thus becoming an innovative problem. The premises presented justify the choice of the real estate developer as the object of research. On the grounds of stakeholder theory, agency theory, legitimacy theory, situational conditioning theory or institutional theory, the author formulated the main objective of the article, which is to study the real estate development industry and gain new knowledge serving the identification of good reporting practices. In addition to the main objective, a specific-theoretical objective and a cognitive objective were also formulated. The specific objective is theoretical in nature and concerns the presentation of the role and importance of development activities in the economy and local communities. Meanwhile, the cognitive objective of the article is to characterize the Polish real estate developer, in particular from the perspective of the precise definition of the term “developer”, as well as to indicate the main legal and economic aspects of their activities, functioning for the local economy and community.

Realizing the objective of the work formulated in this way, a review of the existing regulations and the results of previous research in the international and domestic markets was conducted. These showed, among other things, that the explored issue is of a novel nature, which currently creates good conditions for research in this area. This study contributes to the existing literature in three different ways. Firstly, it offers empirical support for the stakeholder theory, agency theory, legitimacy theory, situational contingency theory or institutional theory. Secondly, it is one of the first studies to describe the financial and non-financial reporting of the discussed entities in this intriguing Polish business context under conditions of economic crisis, inflation, uncertain market conditions, rising costs of running a business, unclear and unstable legislation, and war in Ukraine. Thirdly, the results of this study constitute an introduction to an interesting debate about the role of financial and non-financial reporting in the evolving real estate development industry operating in a changing external as well as internal environment, which certainly merits future research. The article is intended to fill an existing gap in the domestic and foreign markets, as well as constitute a contribution to further research.

The main problem of the paper was expressed in the form of a research question of whether entities in the development segment identify and report financial and non-financial information. The main problem was further elaborated with a complementary problem also expressed in the form of a question: “What financial and managerial accounting tools are used by entities in the real estate development segment in order to generate information in financial and non-financial reports?”

The research methods used in the exploratory study included the narrative critical analysis of the economics and finance literature and analysis of statistical data. Narrative critical analysis of the economics and finance literature was applied mainly in relation to the “Introduction” and “Development activity – theoretical framework” sections. Meanwhile, the statistical method of data analysis relates to the analysis of data from the database of results of the conducted survey. The research technique used in the study was observation, which enabled the collection of research material concerning developers. The aforementioned research technique allowed the author to study issues, as well as to identify, organize and describe the specifics of real estate development activities in Poland.

The applied research methods and techniques allowed the author to achieve the main and specific objective set out, and to solve the main and specific research problem. The article consists of two main parts. The first part is devoted to a theoretical exploration of the specifics of real estate development activities. In this section, the author reviews the literature on the issue being studied and also indicates the place of the studied activity within the economic-financial-social system. In the second part, the author presents the results of a survey on financial and non-financial reporting of the surveyed entities in Poland. The entire discussion ends with a synthetic summary.

2. Real estate development activities – literature review

Developers constitute one of the main groups of real estate market participants. The real estate development market is responsible for the increase in the supply of real estate (i.e., land property suitable for development, or developed property). There are many definitions of a developer, but there is no universally accepted one, as the literature of the subject points to various explanations of this concept. Developers are able to notice a function that a certain space should serve and are able to raise funds for the investment they intend to make, thus conducting the so-called development activity. Another characteristic of a real estate developer is a situation where they become owners or co-owners of a project after it is completed, or sell it, thus recovering capital and investing it in new ventures. A feature distinguishing a developer from an investor is that it is not obligatory to commit own capital and that the developer manages the investment venture and the associated risks. An important point to emphasize is the defining feature of the developer, i.e., that they do not act on behalf of a customer, as the supply of real estate is to initiate demand. This participant in the real estate market cannot be compared to a general contractor, who manages the entire project, but on behalf of a specific client (Kucharska-Stasiak, 2016).

As D. Trojanowski notes, the Polish literature lacks a proper definition of a real estate developer, “which, on the one hand, would reflect the specifics of real estate development activities and, on the other hand, would be universal, regardless of the direction of research being conducted” (Trojanowski, 2004, p. 212).

When looking for a definition of a real estate developer, one should refer not only to Polish regulations and literature but also to the Polish language dictionary. According to the Polish Language Dictionary, a “developer” is “a person or company that invests in the construction of houses for sale” (Polish Language Dictionary, 2023). An analysis of the legal regulations and literature on the subject allows us to conclude that the concept of a “developer” is presented in a variety of ways, and the individual authors provide in their definitions what they believe to be the key features of this concept. The etymology of the word “developer” is shown in Table 1.

Table 1.*Table Review of selected definitions of “developer”*

	Source of definition	Content of the definition
Polish legal act	Act of 2021, art. 5, point 1	An entrepreneur who, in the course of their business, carries out a development project.
	National Accounting Standard No. 8 “Development activities”, point 3.4.	Developer, within the meaning of the Act on the Protection of Buyer’s Rights, and any other entrepreneur within the meaning of the Civil Code, who, as part of its development activity, under a development agreement, undertakes to establish or transfer to the purchaser (natural or legal person) or purchasers the separate ownership of a residential dwelling or premises intended for another use, or the ownership of a building or part thereof, together with the associated land or the right of perpetual use of the land and with the associated infrastructure facilities, built or reconstructed as part of a development project. A developer may conduct real estate development activities as a core business or as one of its business activities.
Polish literature by chronology	Werner, 1993	A person (company) that undertakes investment projects at its own risk and allocates the resulting facilities already at the start of the investment process for sale in order to make a profit.
	Dobrowolski, Sędek, 1996	A person who intends to make the best possible use of a property by providing it, through investment, with the greatest value.
	Kucharska-Stasiak, 2000	A person who is able to see the function that a given space should perform knows how to obtain funds for the implementation of investments, directs the implementation, that is, carries out the so-called development activity. Once the investment is completed, they become its owner or co-owner or sell it, recovering the capital and channeling it into a new venture.
	Belniak, Wierzchowski, 2001	Coordinator of the entire investment process, which leads to the creation of a new form of land development.
	Bryx, 2001	They are one of the investors, and what distinguishes them from others is that they build mainly for sale, but also for rent.
	Dąbrowski, Kirejczyk, 2001	A person or company conducting a development investment.
	Henzel, 2004	The organizer of the project conducted on the real estate market, regardless of whether it concerns residential or commercial real estate.
	Trojanowski, 2004	An entity that, in order to achieve income in the future, organizes and coordinates the process of investing in real estate, from the initiative of the planned project, through its implementation and the transfer of the final product for operation or further development.
	Gawron, 2006	A person who organizes an investment project, that is, deals with finding land for investment, regulating its legal status, preparing project documentation, implementation, searching for future buyers, but also obtaining sources of investment financing.
	Gostkowska-Drzewicka, 2007	They are an entrepreneur (natural or legal person) who carries out the business of investing in real estate at their own risk, earning a certain income from it.
	Szeremietiew, 2007	An investor-entrepreneur whose goal is to create a new property with a higher value. Accordingly, they organize the venture and direct it for the effective development of the original property. These activities can range from the construction of new facilities to the modernization and expansion of existing resources.
Kalinowski, 2011	An entity that performs a development agreement, both as a primary form of business activity and as a secondary activity.	

Cont. table 1.

	Sadowska, 2015	This is an entrepreneur who, in the course of his business, on the basis of a development agreement, undertakes to establish or transfer to the purchaser separate ownership of a residential dwelling or premises intended for another use, or ownership of a building or part thereof, together with the associated land or the right of perpetual use of the land and the associated infrastructure facilities, built or reconstructed as part of a development project.
	Antczak-Stępnia, 2019	An entity that, being aware of the resources at its disposal and the risks associated with the implementation of an investment project on its own responsibility, creates a new vision of space and implements it in order to increase the value of a given property and achieve profits from it.
Foreign literature by chronology	Peiser, Schwanke, 1992	They are coordinators of activities, transferring the idea from “paper” to real estate. They take big risks to create new properties or renovate existing ones – and earn big rewards.
	Reilly, 1993	An entity that organizes and oversees the entire project, usually from the acquisition (in various forms) of the land, through construction and final sale, and sometimes continues the maintenance of the project.
	Seutin, 2000	A natural person or a company that, in its usual activities, undertakes to carry out, on behalf of third parties, projects for the construction, renovation, modernization or development (of residential buildings, offices, commercial premises, industrial buildings, land), including the financing process.
	Avril, Roth, 2001	An individual or legal entity that initiates, promotes, starts and conducts the implementation of a real estate project, the purpose of which is the development of space, the construction of new usable real estate or the transformation of existing real estate through the creation of new functions for real estate as a result of the development process.
	D’Arcy, Keogh, 2002	A leading economic actor in the market, an agent who, operating in an imperfect price mechanism, bears a heavy responsibility for using limited land resources in order to create new space. Thus, the essential role of the developer becomes providing a stream of professional services to the real estate market by identifying opportunities resulting from a given location and realizing them.
	Kälin, 2005	A type of general contractor responsible for the overall implementation of development projects. They usually own the land, which is ready for development. They manage the construction work and commercialization of the project.
	Davis, 2007	A person, company or other entity that has an idea for real estate development, raises the necessary capital, buys land or a building for a planned construction project and takes the necessary steps for its implementation in order to make a profit. A developer is also one who buys an existing property, renovates it or revitalizes it for use for another purpose.

Source: author’s own studies based on the sources presented in the second column of table 1.

The various functions, tasks or purposes in the cited definitions of a developer were differently articulated depending on the period, or activity on the domestic or international real estate market. A developer should be viewed as an entity carrying out a special economic activity, registered in the register of entrepreneurs, subject to control, subject to the legal regime of competition and consumer protection regulations (Powałowski, 2014). Developers can be classified according to various criteria, which are presented in the literature and summarized in Table 2.

Table 2.
Chronological classification of developers according to the authors

Criteria for types of developers according to Dąbrowski, Kirejczyk, 2001	
Developer-contractor (developer-speculator)	Building a facility in order to sell it upon completion of investment or, if possible, even during the project. They do not plan for ownership and management of the facility after construction, although they sometimes do so for financial reasons or due to necessity.
Developer-investor	They operate similarly to a developer-contractor, but from the outset, they assume long-term ownership of the facility for own use or as a profit-making venture.
Target investor (long-term investor)	An entity purchasing the facility, in order to optimally invest capital, in the case of commercial facilities, as a rule, it makes the transaction conditional on the prior conclusion of rental agreements with rent at a fixed level, may manage the facility itself or through a hired manager, provides long-term financing whose repayment comes from the rent.
Service-developer; fee-developer	An entity most often hired by a landowner to prepare and possibly carry out an investment, if it does not take possession of the property, it may also be an entity that specializes in such activities and undertakes them at its own risk, without first obtaining a principal.
Land-developer	Acquires the property, usually in the form of multiple contiguous parcels of land, consolidates them, sometimes changes their zoning designation (e.g., changing the zoning status of farmland from agricultural to residential), often performs a secondary subdivision and ensures the provision of infrastructure and then sells the individual parcels.
Feasibility analysis	Analysis of investment feasibility
Criteria for types of developers according to Trojanowski, 2004	
Housing developers	Entities specialized in organizing the investment process in the housing sector. In the housing market, developers use down payments and additionally use credit.
Commercial developers	They work on projects that result in the development of properties with a range of functions, i.e., retail and services, recreational and leisure, industrial, residential (rental townhouses). The business models of this group of developers include: Construction – rental (management) – sale; Construction – rental (or management) – property ownership; Construction – sale.
Predevelopers	In the land market, the subject of this specialization is the development of investment sites by physically and legally subdividing them into parcels, change of their function in the local zoning plan and/or infrastructural development of the land (connection of utilities etc.). The following types of investors operating in this market can be distinguished here – purchaser of lands without utilities infrastructure, – land speculators, – predevelopers, – land developers.
Criteria for types of developers according to Śmietana, 2014	
New development	Carries out outward expansion investments involving the development of non-urbanized areas.
Redevelopment	Conducts investments related to the physical removal of buildings and their replacement with new facilities.
Property development	Modifies existing developments through modernization often associated with function conversions.
Land development	Conducts investments in order to prepare land for future development.

Cont. table 2.

Criteria for types of developers according to Sadowska, 2015		
Contract Developer	Has extensive knowledge in the field of construction. Most have a construction contracting entity within their structures or are closely affiliated with one. The strategic goal is to create investment projects that can guarantee a construction contract and provide profits on work performed as a general contractor. Thus, they seek to maximize construction work and the implementation budget.	
Developer-advisor	They have knowledge in many fields, for example, finance, marketing, law and engineering. Seek to secure a contract for consulting work in an investment project and realize additional profits on these services.	
Developer-operator	They participate in investment projects in which they will secure a management contract. The goal is to achieve the best possible terms under the operator contract, i.e., management commissions. They are most often affiliated with companies that specialize in facility management, such as hotel chains.	
Financial Developer	Their domain is to control the flow of capital and their intention is to place the capital available to them in such a way as to provide the highest possible return.	
Developer-user	Prepares and conducts projects targeting a specific audience (e.g., banks, insurance companies), which is primarily the developer themselves. Seeks to tailor such a facility fully to the needs of a particular customer by entering into preferential agreements with such related users. They are also referred to as occasional developers.	
Developer-salesman	Controls the property (land, terrain) and their hidden intentions most often boil down to a desire to sell the owned land for a higher price than can be obtained directly on the market. They seek to inflate the value of the controlled land in order to gain additional profits.	
Developer proper	They seek to conclude contracts (e.g., with the building contractor, with the operator, with the financing institution, with future users) on the most favorable terms. This refers to professional developers, i.e., those for whom this activity is the main source of income.	
Criteria for types of developers according to Kucharska-Stasiak, 2016		
Type of market in which they operate	The level of risk they face	Development activities
Land-developer (predeveloper)	The developer-contractor – who bears the full risk – simultaneously acts as the general contractor.	Buying land, most often agricultural land, getting it rezoned in the local development plan, dividing the land into smaller parcels or buying up adjacent parcels to create a larger investment area, developing it with infrastructure, and then selling it to other developers or investors. By changing the use, developing the land and subdividing it, the developer contributes to an increase in the value of the property.
Housing developer	A pure developer, burdened with limited risk – organizer of the construction and financing process.	
Commercial developer		

Source: author's own studies based on (Kirejczyk, 2001; Trojanowski, 2004; Śmietana, 2014; Sadowska, 2015; Kucharska-Stasiak, 2016).

A review of the theory and the author's presentation of the evolution of this concept, considerations of the essence of real estate development activity in economic and legal terms, made it possible to note, following an analysis of the various classifications presented in the literature, that the classification of a particular developer into a given group may change, for example, depending on the specifics of the next planned investment or their intentions. It is advisable at this point to cite further criteria for distinguishing real estate development activities among other business activities:

- A developer owns the land on which the property will be built.
- It is incumbent on the developer to prepare an architectural design of the property under construction (the buyer may not introduce significant structural and architectural changes). The developer bears the risk of the development project, i.e., the developer is responsible for obtaining and providing, for example, construction materials and financing of the investment (the transfer of control, risks and benefits to the purchaser occurs only after construction is completed and takes place in the form of a notarial deed documenting the transfer of ownership in relation to the constructed property or part thereof).
- The developer builds and delivers the property (Sadowska, 2015) in the form of a transfer of control, risks and benefits to the buyer, which takes place upon completion of construction in the form of a deed documenting the transfer of ownership to all or part of the built property (Skotarczak, 2016).

We can point to the habitus of the real estate development business:

- Seasonality – a significant part of the production cycle is dependent on weather conditions (except for the works carried out inside the building), i.e., the cyclical nature of the seasons determines the scope and type of construction works (Dębski, 2006).
- The random nature of the timing of construction processes – the possibility of weather anomalies.
- Significant dispersion of executed construction works – in geographic and temporal terms, as the developer tends to target the execution of several developments in different locations.
- Immobility of the construction products – the construction object will be connected more or less permanently with the ground, so the execution of any construction works requires appropriate development of the construction site, provision of work teams, production resources, equipment facilities, etc.
- Delayed revenues from facilities – applies to situations such as the construction of commercial space for rent, wherein rents will be the source of revenue, while in the case of residential construction, these would be advance payments from customers, depending on regulations.

- Significant dimensions and heavy weight of building structures – necessitate considerable expenses for the erection of a single structure and can limit the number of structures built at the same time.
- Long lifespan of building facilities – meaning that any attempt to “save money on quality” can affect the developer’s reputation and demand for its products (Jaworski, 2004).
- The developer performs their activities on the basis of a real estate development agreement.
- They accumulate various types of risks, e.g., legal, financial, construction risks, risk of investment delays, lack of financing, changes in tax regulations, changes in costs, marketing, variability of weather conditions, deviations from the construction project.
- Widespread use of third-party funds, i.e., credits and loans and funds obtained from buyers.
- The developer has the opportunity to realize their profit only after the project is fully completed (Powałowski, 2014).

It should be noted that real estate development activities have not been directly classified by the legislator in the Polish Classification of Activities (hereinafter: PKD). It is the profile of the developer’s business activity that will indicate the appropriate classification according to the PKD. Generally, two most common subclasses of the PKD are indicated, i.e., 41.10.Z (execution of construction projects related to the erection of buildings) and 68.10.Z (buying and selling of real estate on one’s own account).

First of all, the subject of development activity is the erection of residential or residential-office buildings (containing residential entities, commercial premises, e.g., retail premises, office premises, garages and accompanying buildings) as well as the erection of single-family houses and residential row houses, with the main purpose of selling or renting to third parties – the ultimate buyers of the object of the developer’s business activity (Majczyk, 2021).

Development activity can be conducted by any entity, as special requirements arise primarily in the conclusion of so-called real estate development agreements with buyers who are natural persons (Skotarczak, Błaszke, 2016). This means that the legal form of the real estate developer is irrelevant (Czech, 2018). Accordingly, in accordance with Polish legislation, a real estate developer may conduct their development activities in the following organizational and legal forms:

1. As an enterprise whose activities are regulated by civil law:
 - Natural person conducting a business activity (sole proprietorship).
 - Private partnership.
2. As a commercial law company:
 - General Partnership.
 - Limited Liability Partnership.

- Limited Partnership.
- Limited Joint-Stock Partnership.
- Limited Liability Company.
- Simple Joint Stock Company.
- Joint Stock Company.

In selecting a particular form, it is important to learn about their differences, for example, in terms of legal liability, risk bearing, and the forms of accounting. In the Polish real estate development market, it is a common practice to operate in the form of a so-called special-purpose vehicle, established for the implementation of a specific development project (Czech, 2018).

The business activity of a real estate developer includes many activities, but it is the real estate development project that constitutes its basic component (Powałowski, 2014). It can be noted that a development project is a process (activity) with such characteristics that when it is executed for the benefit of the purchaser (natural or legal person) or purchasers, the developer establishes or transfers separate ownership of a residential dwelling or premises intended for another use and the ownership of a building or part thereof, together with the associated land or the right of perpetual use of the land and the associated infrastructure facilities (Sadowska, 2015).

To sum up, the scope of development activities can be very diverse, ranging from the purchase of land, changing its intended use, through its subdivision, development and sale to the implementation of an investment project (Kucharska-Stasiak, 2016).

In view of the presented characteristics of the real estate development activity, the article mainly focuses on developers that fit into these characteristics, and this means that these will be a residential, commercial or mixed-use real estate developer.

In the context of the subject of real estate development activity, which can be defined in broader and narrower terms, it can be inferred that it mainly involves payment for its performance by third parties, who ultimately benefit from the results of the developer's activities (Gliniecki, 2012).

The developer is a professional, the creator of a project's vision, its organizer and coordinator (Henzel, 2004). A development venture is characterized by multifaceted and interdisciplinary cooperation of many stakeholders (participants in the process) who are fundamental to its success and the achievement of the intended result. Therefore, the primary task of a developer is to coordinate the activities of all participants who fulfill specific tasks in the development process. The venture is managed by the developer, who decides on the selection of its stakeholders and participants, taking into account their competencies and responsibilities, which influences the formation of relations with the environment (Henzel, 2004).

In view of the progressive development of management practice and theory, the forms of satisfying the information needs of the stakeholders of development activities (with whom the developer should cooperate and coordinate their activities) are also evolving. Once the needs are identified, elaborated and grouped, it turns out that specific information is provided to specific groups of recipients, with specific information needs, as presented in Table 3.

Table 3.

Stakeholders of the (developer's) development activity and their tasks and information needs

Stakeholders	Tasks in the development process	Information needs
Purchaser (natural person, legal person, several purchasers)	Acquisition or lease of a development project under construction	Investors, buyers and users investing risk-bearing capital and their advisors are interested in the magnitude of the risks inherent in the investments undertaken by the developer and their rate of return. They need information to help them determine whether to acquire, hold, or dispose of a particular investment. They are interested in information that allows them to evaluate the development activity.
Entity's management	Management of a development project	They need additional managerial and financial information, even though they have access to it, in order to help them fulfill their planning, decision-making, supervisory and control responsibilities. In the event of a change of management/board of directors, they need information on: whether previous management was carried out in accordance with the applicable regulations and sound economic principles (reasonableness of expenses incurred, adherence to tender procedures, compliance of adopted resolutions with the applicable law).
Employees	E.g., in-house construction works contractors, a team of professionals supporting the developer in the management of ongoing projects and management of the real estate development company	They are interested in information about the developer's stability and profitability, information that allows them to assess the developer's ability to pay salaries, pension benefits and to create jobs.
Lenders	Guaranteeing external sources of financing for the undertaken development project provided for in its financial planning	They are interested in information that allows them to determine whether their loans and the interest on those loans will be repaid within the agreed deadlines.

Cont. table 3.

Suppliers and other creditors	<ol style="list-style-type: none"> 1. Architects/designers of various specialties who are participants in the construction process – an architect prepares an architectural design that is financially efficient and attractive to potential buyers or tenants, preparing all the project documentation, providing author's supervision; assists the developer in assessing the suitability of the site for a given investment and indicating the optimal spatial and functional solutions that can be used in a given location 2. Construction works contractors: in the structure of the a estate developer entities independent of the developer – the execution of construction work in accordance with the project documentation. 3. Team of professionals including: real estate consultants, appraisers, real estate agents, property managers, lawyers, insurance agents, advertising and public relations agencies, planners, tax advisors, accountants, information technology specialists – perform advisory functions. Consultancy, provide assistance in the preparation of analyses, support the developer in the management of ongoing projects and management of the real estate development enterprise. 4. The institution that is the utility provider – deals with the construction of utility networks and connections that condition the issuance of a construction permit. 5. Owners (private, public) of real estate – offering land for the execution of new development projects. 	They are interested in information about the developer's stability and profitability, information that allows them to assess the developer's ability to ensure they receive the amounts owed to them in a timely manner.
Governments and government agencies	For example, municipal authorities responsible for drawing up local zoning plans, studies of land use conditions and directions of spatial development and issuing decisions on development conditions, the head of county administration issuing building permits, granting public approval for development projects, or tax authorities performing tax collection and enforcement activities.	They are interested in resource allocation and are therefore interested in the developer's activities. They also need information in order to regulate development activities, determine tax policy, calculate national income and other statistics based on it.
Society: – as a whole – local	Recognizing their needs based on dialogue, as well as respect and caring for their common living comfort is a test of a developer's responsibility, and a pillar of sustainable and balanced development.	They need information about trends and recent changes in the developer's level of affluence and thrift, as well as the scope of its operations. For the local community, developers have a non-financial impact, i.e., they will improve the housing conditions of local communities, but they also have a financial impact on the budget of, for example, the local government entity.

Source: own compilation based on International Accounting Standards 1999, International Accounting Standards Committee, pp. 46-48; Conceptual Framework for Financial Reporting, IFRS Foundation, March 2018, pp. 9-12, and Antczak-Stępnia, 2019.

Taking into account the above entities and their information needs, the financial and non-financial aspects of real estate development activities can be considered in the context of benefits to the local community:

- In the non-financial aspect, one can recognize the impact on the development and modernization of the housing stock, the impact on employment growth, generated by these entities, with the widespread financing of the purchase of real estate development products, for example, with credit, the activities of developers also promote demand for the sales of banking products, in addition to the impact on housing comfort, development activities are therefore also important for improving conditions in the labor market.
- In financial terms – the financial impact will also be recorded in the budget of local government entities, proceeds from the tax on civil law transactions, proceeds from the road lane occupation fee, all administrative fees and the financing and repair of municipal infrastructure (e.g., roads, central heating), an increase in tax revenues from property tax.

Given the significance of this activity in meeting housing needs, for example, the issue of real estate development activities deserves to be noticed and supported through scientific research. One of its facets, extremely important from the point of view of the general public, outside of issues such as administrative requirements for the location of new developments, their financing or tax policy, is the protection of stakeholders involved in contractual relationships with developers through reliable, credible, useful financial and non-financial reporting.

3. Methodology

Prior to exploring the state of financial and non-financial reporting of the entities in the real estate development segment, appropriate research was conducted. Pre-implementation research is aimed at assessing the development industry and gaining new knowledge required to identify good reporting practices. Therefore, the object of the study is the examination of the real estate development industry and the acquisition of new knowledge used for the identification of good reporting practices. The study on the Polish ground is exploratory in nature, as it deals with new research areas in which there was a gap in existing knowledge.

An empirical study of the real estate development industry was conducted from December 2021 to December 2022, using the following methods:

- Analysis of secondary sources – a literature study through analysis and critique of the literature allowed us to determine the current status of the studied phenomena.
- Quantitative method – a survey among entities in the real estate development segment.

The combination of these two research methods made it possible to learn about the attitudes and opinions of stakeholders, thus fulfilling the function of inspiring the identification of further research directions. The study attempted to identify the needs of managers of entities in the real estate development sector through a pilot study constituting a prelude to further in-depth research in this area. The study of the Polish real estate development segment is exploratory in nature and thus deals with new research areas where thus far there has been a gap in empirical data.

The discussed research was carried out in accordance with the research methodology presented in Figure 1.

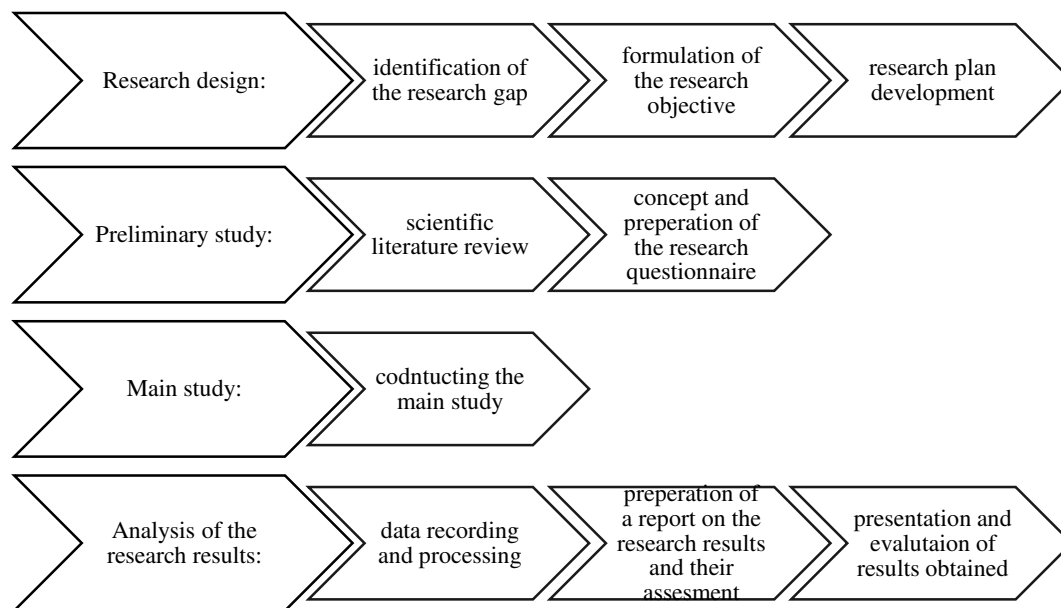


Figure 1. Research methodology.

Source: author's own studies.

The first step in the implementation of the undertaken research task was to identify the research gap and to formulate the research objective and prepare a research plan. The analysis of theoretical assumptions indicating the specifics of entities in the real estate development segment and the form of reporting determined the research directions for the conducted study. In order to achieve the objective defined in this way, surveys were conducted among a group of internal stakeholders of financial and non-financial reporting results and the entities that generate them. The primary research tool was a survey questionnaire with partially standardized questions and alternative responses developed by the research project manager (i.e., the author of the article). The survey used structured questions with the following forms of response: disjunctive (the respondent was asked to indicate one of the many possible answers proposed) and conjunctive (the respondent was asked to indicate several of the possible answers proposed). The survey also used semi-structured questions, i.e., semi-open questions, in case none of the alternatives presented was suitable for the respondent's opinion. The respondent then had the opportunity to provide their own answer. On the other hand, the unstructured

questions were answered by the respondent in their own words, thus expressing their own opinion or views on the issue being discussed.

The survey that was developed included questions grouped into two themes. The last part of the survey questionnaire contained a metric with questions about the respondent's position in the surveyed entity, the organizational and legal form, the object of the activity or the financial and non-financial data of the development company, with an indication of the voivodeship (province) in which the company's headquarters was located.

The survey was launched in Q4 2021 via the Internet (using the CAWI method), as it promotes survey effectiveness by allowing a specific research group to be reached in a quick, convenient manner. A survey in the form of a website was created using the Webankieta program (this is an online survey software). A cover letter was sent to the email addresses of development companies, stating the purpose of the research being carried out. A person who agreed to fill out the questionnaire went to a link, through which they were redirected to the questionnaire's website, where the respondent read the content of the questions from the screen and provided answers. The link assigned to these sites was sent out to a random sample, asking designated entities to complete the survey. It should be noted, however, that the sampling itself was purposive but random in nature (an individual random sampling technique was chosen). The purposive nature of sampling included the placement of contact information on a specific website, due to the possibility of contacting a particular respondent, and the selection of the type of activity conducted.

The next stage of the study involved the determination of the research techniques and identification of the exact populations and samples under study. In order to find contacts for the database, websites were used, and contact information in the form of an email address was recorded in the order of the appearing responses (the following websites were used as a reference base: <https://pzfd.pl/czlonkowie-pzfd/>; <https://businessinsider.com.pl/poradnik-finansowy/co-to-jest-wig-nieruchomosci/kj5tbrw>; <https://newconnect.pl/spolki>; <https://rynek.pierwotny.pl/deweloperzy>). A double email reminder was used in order to increase the response rate. Every effort has been made in order to make the results as precise as possible. In the end, questionnaires were sent to 2383 entities operating in different parts of Poland, from the collected contact database prepared for the survey. This study collected data from 39 Polish entities in the real estate development sector, which successively completed the survey using the questionnaire (constituting statistical data).

The final structure of the survey sample is due to the propensity of the selected respondents to participate in the survey, i.e., completed questionnaires accounted for 1.64% of the overall respondents.

In the final stage, the author observed and analyzed the structure of responses coded using a binary measure, where the fact of a marked response was coded as "1". The Excel statistical program was used for calculations. On the other hand, the aggregated results obtained will be presented mainly in the form of tables that include the percentage of indications of a given

answer. The formulated objective of the study did not require the use of other statistical measures.

Percentage shares, which reduce values to a range from 0 to 100, are often used to present data. Data is then reduced to a standard form with a base of 100, making it easier to make comparisons and draw conclusions. Percentages, however, are subject to certain limitations in their application, i.e., percentage values conceal the basis on which they are calculated. (Kothari, 2004)

A tabular description has been used, where data will be mainly presented in the form of frequency tables along with percentage distributions. Individual questions in the survey questionnaire were evaluated by different numbers of respondents, hence the only form of data presentation to ensure comparability of results was the use of percentages, and a response count histogram was additionally prepared for graphical presentation. When considering the results presented in this way, it is important to keep in mind that they refer to a certain number of observations.

In order to increase the credibility of the research conducted, each questionnaire was accompanied by a cover letter with information on the objectives of the study, assurances of anonymity and a request for participation in the study.

4. Research results

The target recipients of the survey were, in particular, the internal stakeholders of the surveyed entities, with division according to the positions held. Taking the formation of their needs and the importance of information as a foundation, the questionnaire was divided into thematic sections on financial reporting and non-financial reporting.

Among the surveyed stakeholders, the overwhelming majority were accountants of the surveyed entity (43%). Respondents were also given the opportunity to indicate a position other than those listed, but no one indicated such an answer. Other positions and frequencies for the variable “respondent’s position” are presented in Table 4.

Table 4.
Frequency for the qualitative variable “respondent’s position”

Position	Frequency	% Share
Accountant	17	43
Owner	12	31
Board member	7	18
Chief Financial Officer	3	8
Controlling specialist	0	0
Other position	0	0

Source: author’s own studies.

The geographic scope of the survey covered 16 voivodeships (provinces). The largest number of surveyed entities, i.e., 11, operated in the Łódzkie Voivodeship, accounting for 28% of all developers surveyed. The least numerous group in the sample were developers operating in the Dolnośląskie Voivodeship. Real estate development entities from the following voivodeships did not choose to participate in the survey: kujawsko-pomorskie, lubelskie, lubuskie, opolskie, podkarpackie, podlaskie, śląskie and świętokrzyskie. A summary of the distribution of samples among respondents is included in Table 5.

Table 5.

Distribution of the sample among respondents by voivodeship

Voivodeship	Frequency	% Share
Łódzkie Voivodeship	11	28%
Mazowieckie Voivodeship	7	18%
Zachodniopomorskie Voivodeship	6	15%
Pomorskie Voivodeship	4	10%
Małopolskie Voivodeship	3	8%
Wielkopolskie Voivodeship	3	8%
Warmińsko-Mazurskie Voivodeship	3	8%
Dolnośląskie Voivodeship	2	5%
Kujawsko-Pomorskie Voivodeship	0	0%
Lubelskie Voivodeship	0	0%
Lubuskie Voivodeship	0	0%
Opolskie Voivodeship	0	0%
Podkarpackie Voivodeship	0	0%
Podlaskie Voivodeship	0	0%
Śląskie Voivodeship	0	0%
Świętokrzyskie Voivodeship	0	0%

Source: author's own studies.

Among the surveyed entities, 44% were limited liability companies, while the detailed results of the other surveyed entities are presented in Table 6.

Table 6.

Registered office and organizational and legal form of the representatives of the selected surveyed entities

Organizational and legal form	Frequency	% Share
Limited Liability Company	17	44%
General Partnership	7	18%
Joint stock company	4	10%
Limited liability company, limited partnership	4	10%
Sole proprietorship	4	10%
Limited liability company general partnership	2	5%
Capital group (joint stock company + special purpose vehicles)	1	3%

Source: author's own studies.

The subject of the main activity of the surveyed entities is the comprehensive implementation of investments in the form of, for example, the purchase of land, design, construction, sale of apartments. For graphical presentation, a percentage pie chart was drawn for the qualitative variable "Main development activity" (cf. Figure 2).

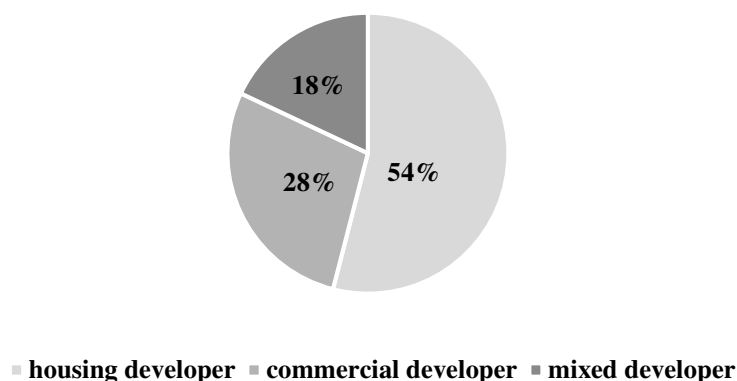


Figure 2. Percentage pie chart for the qualitative variable “Main development activity”.

Source: author’s own studies.

Minimum employment in development companies was up to 9 people, and the maximum was up to 250 people. Employment in the vast majority of entities surveyed is up to and including 9 people, which may indicate that developers are using external outsourcing services. A response count histogram was additionally prepared for graphical presentation (cf. Figure 3).

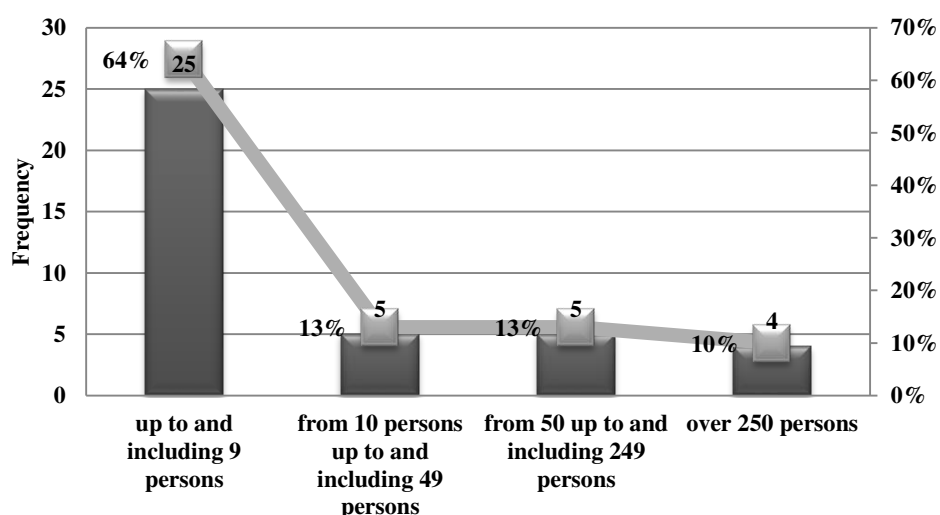


Figure 3. Histogram for the variable “Employment”.

Source: author’s own studies.

The percentage distribution of responses shows that 49% of the surveyed entities had total balance sheet assets at the end of the fiscal year in the range of PLN 1.5 million to PLN 25.5 million, hence they can be classified as so-called micro enterprises according to the Polish Accounting Law. A response count histogram was additionally prepared for graphical presentation (cf. Figure 4).

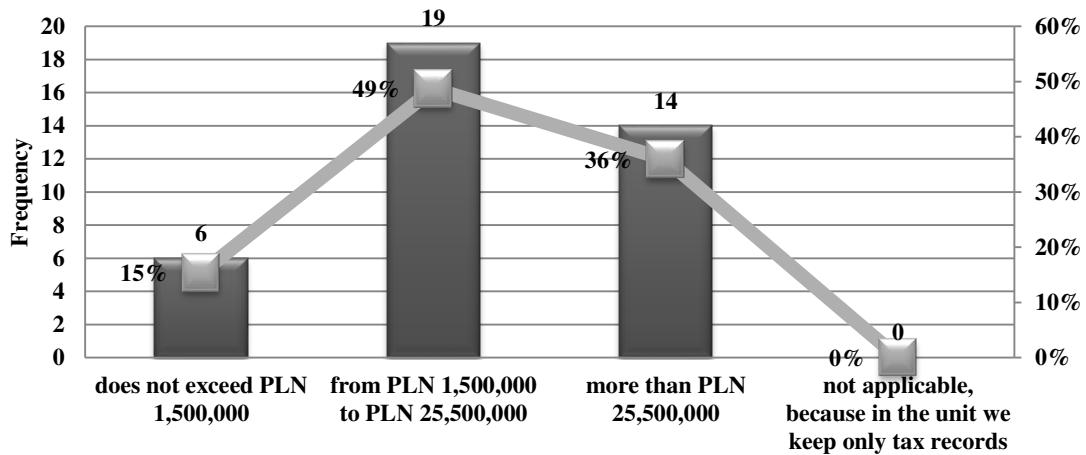


Figure 4. Histogram for the variable “Total balance sheet assets at the end of the financial year”.

Source: author’s own studies.

One of the issues considered in the questionnaire survey was the scale of net revenues from sales of goods and products at the end of the fiscal year. A response count histogram was additionally prepared for graphical presentation (cf. Figure 5). The revenue of the vast majority of the surveyed entities ranges from PLN 3 million to PLN 51 million, which confirms that micro entities – according to Polish legal regulations, i.e., the Accounting Act – prevailed among the surveyed entities.

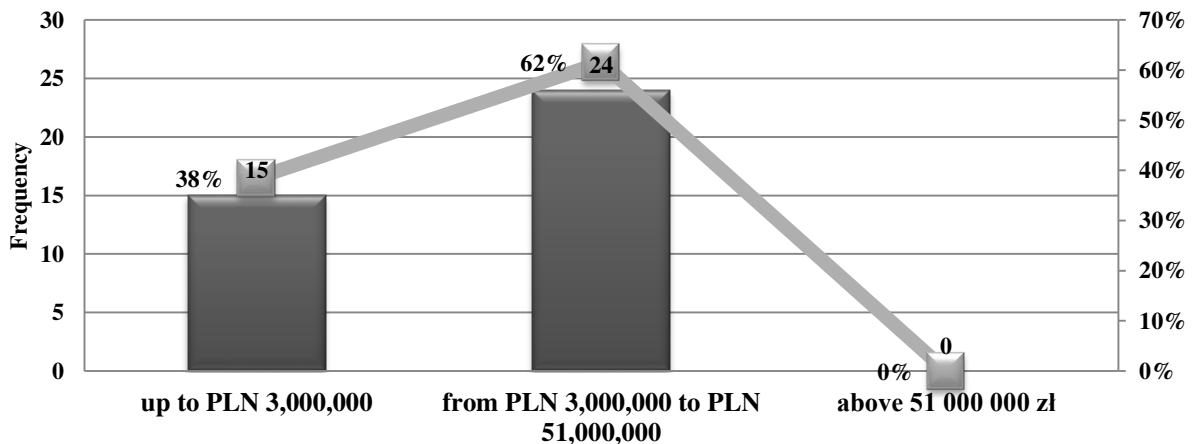


Figure 5. Histogram for the variable “Net revenues from sales of goods and products at the end of the financial year”.

Source: author’s own studies.

Responses to the first question concerning the kind of reports produced in the entity indicate that entities most commonly produced financial reports and non-financial reports separately (51%). There were also respondents stating that only financial reports are prepared in their entity. Surprisingly, 8% of the total respondents indicated that no reports were prepared. In contrast, respondents did not prepare integrated reports.

For the purpose of measuring the reporting of activities presented in the form of information on the conducted activity, the surveyed entities most often use the balance sheet, income statement and additional notes to an equal extent (16%). It should be noted that surveyed entities

are not interested in utilizing and drawing information from tools such as responsibility center accounting, time-driven costing or continuous improvement costing (cf. Figure 6).

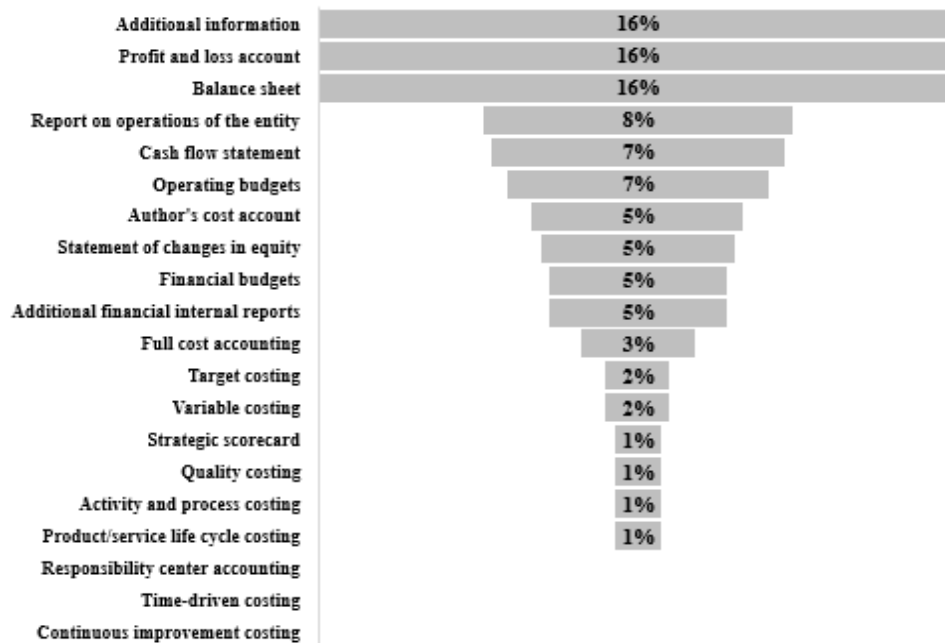


Figure 6. Measurement of reporting of activities presented in the form of information on conducted activity.

Source: author's own studies.

The next question showed the opinion of respondents indicating that financial information obtained from obligatory financial statements is not sufficient for the ongoing evaluation of real estate development activities. A statement was quoted indicating the rationale for the above thesis, as development projects have a certain life cycle, hence the profit is disclosed only after the project (or investment) is concluded.

The next two questions focused on respondents' willingness to report financial and non-financial information to stakeholders. After compilation of the results it turned out that the majority of respondents would like to produce both financial and non-financial reports for stakeholders on a quarterly basis (cf. Figure 7). In view of these survey results, one would have to wonder about the reasons for this state of affairs.

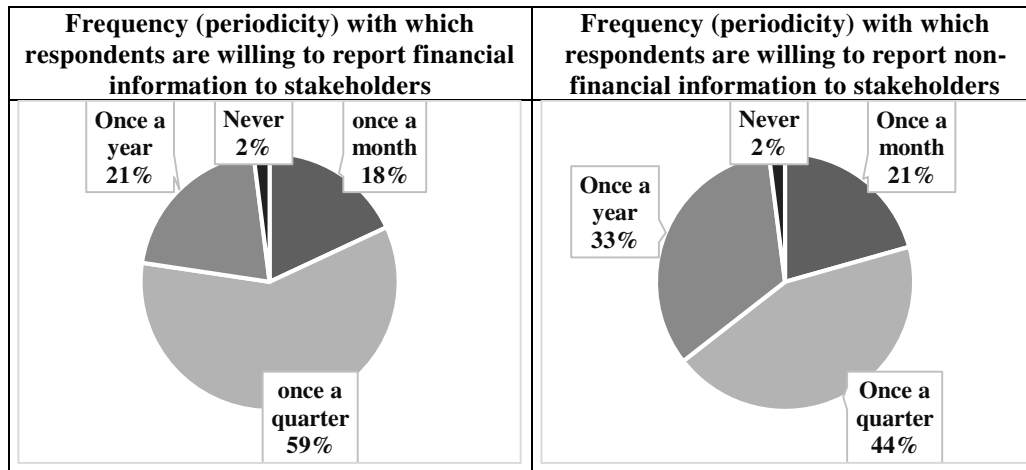


Figure 7. Comparison of frequency of reporting of financial and non-financial information.

Source: author’s own studies.

Meanwhile, 69% of respondents said they do not prepare compulsory or mandatory non-financial reports despite the introduction of statutory requirements for reporting of expanded non-financial information. Entities that prepare non-financial reports (whether in the form of a statement on non-financial information as part of the activity report or a separate report on non-financial information) used their own proprietary solutions for this purpose when preparing non-financial information (23% of respondents). The surveys also show that 5% of respondents used GRI Standards, and 3% used the SIN Standard for Non-Financial Information. It should be noted at this point that 80% of the respondents indicated the need for having non-financial information about the entity’s operations if only for the purpose of long-term planning. This result is thought-provoking, however, in the context of the lack of perceived need to report this information to external stakeholders.

Accordingly, the answers to this question are not surprising, as the vast majority of respondents do not see any benefits for the entity from reporting non-financial information from the perspective of development activities (results are presented in Table 7).

Table 7.
Benefits of reporting non-financial information from the perspective of real estate development activities – summary of results

Position	Frequency	% Share	Justification – voluntary
Yes	9	23	Ability to assess quality parameters (e.g., the number of defects and the speed of their removal during the warranty process, the number and nature of tenant changes made by customers, etc.); Ability to set non-financial goals, e.g., related to quality, competitiveness, profitability, customer interest; A more complete image of the developer; Reporting of operational data for comparison with other representatives of the development industry; Information about the market situation; Increasing the developer’s credibility; The possibility of preparing non-financial metrics; Fuller control over the developer’s operations.

Cont. table 7.

No	30	77	Unnecessary to conduct business; No reporting requirements for non-financial information where the investment is not supported by a loan; This information may be relevant only from the perspective of lenders or shareholders of public companies.
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Source: author's own studies.

The majority of respondents determined that the non-financial report should not be mandatorily reviewed by a statutory auditor.

Thus, a question has arisen as to how developers evaluate the profitability of a development project before incurring investment outlays. A survey result was therefore developed that indicates that they are especially using the "return on invested capital" measure. It can be seen that they do not use the "project IRR" measure for the aforementioned evaluation. Respondents suggested another way to assess the profitability of a development project, i.e.:

- Margin I on the investment task (after direct costs); Margin II on the investment task (after indirect costs).
- Margin after manufacturing cost.
- Attractiveness of the project, risk, ease of commercialization, estimated time of engagement.

Response frequency for the quantitative variable "Evaluation of a development project profitability" is indicated in Table 8.

Table 8.

Frequency for the quantitative variable "Evaluation of the profitability of a development project"

Answers	Frequency	% share
Net profit after tax	20	23%
Return on capital employed	19	22%
IRR of the project	4	5%
Return on invested capital	24	28%
Cash flow assessment	15	18%
Other	3	4%

Source: author's own studies.

The above research implies the conclusion that the conducted study shows that entities in the development industry mainly use financial accounting instruments. The main limitation of the survey is the relatively small number of respondents. However, even with a small sample, a wide range of developer practices could be observed, hence the sample size was not a problem. Taking into account the opinion of respondents from the real-estate development segment, the key findings of the research are as follows:

- The subject of the main activity is the complex implementation of investments in the form of, for example, purchase of land, design, construction, sale of flats.
- Financial reports are most frequently prepared.

- They most often make equal use of the balance sheet, profit and loss account and additional information.
- However, the financial information extracted from the mandatory financial statements is not sufficient for the ongoing assessment of the development activity.
- Once a quarter would be the optimum frequency for both financial and non-financial reports for stakeholders.
- There is no interest in drawing information from responsibility centre accounting, time-driven costing or continuous improvement costing.
- There are no mandatory or compulsory non-financial reports.
- There is a need to have non-financial information about the entity's activities, if only for long-term planning.
- The non-financial report should not be obligatorily verified by an expert, such as an auditor.
- The profitability of the development project before incurring the investment outlay. This is done in particular using the measure “return on invested capital”.

5. Discussion

Both in Poland and around the world, the real estate development industry is difficult, specific and extremely dynamic. The real estate developer acts in this industry as a professional, simultaneously fulfilling the role of project promoter and coordinator. It can be noted that customers are making their housing choice not only on the basis of one piece of information, which is the price – they are now interested in the financial situation of the developer, the entity’s achievements, its image, as well as the quality of service, both before and after the sale of the apartment or house.

The new formulas and solutions presented in this work lead to an expansion of previous theoretical knowledge in the field of financial and non-financial reporting of real estate development entities. On the other hand, the empirical research along with the issues proposed in the article have important theoretical and practical implications for the management of the studies entities. The benefits of the proposed solutions include:

- A remedy for the needs of their internal and external beneficiaries.
- Focus on communication of financial and non-financial information in a way that is more accessible for the stakeholder.
- Provision of a complete image of the real estate developer’s activity.

The above indications depend on the provision of the right conditions for the development of reporting in the form of the promotion of appropriate managerial attitudes aimed at the improvement of the organization's operations, through the use of innovative tools.

The conclusions generated from the stakeholder surveys suggest the need for further research work in this area and their diffusion into business practice. It is worth noting at this point that the conclusions of the analysis apply only to the study sample. These conclusions provide the basis for setting further goals to be achieved – for example, an interesting direction for further scientific work would be to address the issue of financial and non-financial reporting in the international arena.

6. Conclusions

To sum up, the author concludes that the set goal has been achieved. The considerations presented in the article contributed to the achievement of the main objective of the article, i.e., in light of the diagnosis conducted, entities in the real estate development segment overwhelmingly prepare mandatory financial reports, while they make little use of non-financial information.

The specific goal was achieved: the role and importance of real estate development activities in the economy and the local community were presented. This goal was achieved mainly through the methods of literature analysis and the observation technique.

Also important for the achievement of the main objective was the realization of the cognitive objective, i.e., the study presented the characteristics of real estate developers in Poland, in particular from the perspective of a precise definition of the term “developer”. The main legal and economic aspects of their activities and functioning for the local economy and community were indicated.

The main research problem concerning the identification and degree of reporting of financial and non-financial information has also been solved. The research problem was resolved, among other things, thanks to a critical analysis of the literature in conjunction with the results of our own research and observation of reality (the main research methods and research technique used in the study).

The results of the carried out survey as the theoretical considerations included in the article made it possible to resolve the specific research problem constructed in the form of a question: “What financial and managerial accounting tools are used by entities in the real estate development segment in order to generate information in financial and non-financial reports?”.

Conclusions from the research and solutions used in the area of financial and non-financial reporting indicate the need for modification of reports tailored to the characteristics of real estate developers. This would optimize the allocation of the entity's resources in order to

improve reporting and accountability, for example, of management towards stakeholders. It can be concluded that the reporting solutions currently in use are not adapted to the needs and requirements of their stakeholders.

In conclusion, it should be emphasized that the modernization of Polish entities from the real estate development segment is the result of encountered difficulties and provides long-term benefits for all parties concerned.

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ORGANIZATIONAL CULTURE CONDUCTIVE TO THE IMPLEMENTATION OF CORPORATE SOCIAL RESPONSIBILITY (CSR) IN THE ENTERPRISE

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Purpose: The paper aims to identify a model of organizational culture conducive to implementing corporate social responsibility (CSR) in the enterprise.

Design/methodology/approach: The article is based on the analysis and synthesis of domestic and foreign literature review.

Findings: The model of organizational culture conducive to the implementation of CSR in the enterprise is created by the following cultural values: focus on people, focus on tasks, orientation to the environment, activity, low uncertainty avoidance, collectivism, low communication context, low power distance, status based on achievements.

Research limitations/implications: Increasing the awareness of academics, students of economic studies and management practitioners on the essence and importance of cultural values that are components of the organizational culture model conducive to the implementation of CSR activities. Indications regarding the components of the organizational culture model are specific and further research should be conducted in this area.

Practical implications: The article provides new knowledge about the conditions determining the shape and structure of the organizational culture model conducive to the implementation of corporate social responsibility. The article may help enterprises to better use the potential of organizational culture as a tool supporting socially responsible activities.

Originality/value: The article extends knowledge in the field of constructing a model of organizational culture conducive to the implementation of CSR activities in the enterprise.

Keywords: organizational culture, cultural values, CSR, social responsibility, enterprise.

Category of the paper: General review.

1. Introduction

Implementing corporate social responsibility (CSR) in an enterprise is conditioned by many factors. Some have an external character, which the company either has no influence on (macroeconomic nature) or controls and shapes to a certain extent (micro-environmental nature). Internal factors constitute a separate group shaping CSR. Terec-Vlad lists staff motivation and organizational culture (2016), Stawicka internal sensitivity, organizational culture, ethics in the organization (2010), and Slack Corlett, Morris communication in the organization; organizational culture, employee involvement in CSR and relations between CSR and business strategies (2015). Because the company can only fully control internal factors, they are of particular interest to scientific researchers. Analyzing them, it is hard to deny that organizational culture is an essential factor.

In the opinion of many authors, there is a close relationship between organizational culture and CSR (Rudnicka, 2012; Doktor, 2005; Filek, 2008; Jaakson et al., 2009; Galbreath, 2010; Ganescu, Gangone, 2017; Myeongju, Hyunok, 2017; Yu, Choi, 2016; Castro-Gonzales, Bande, 2019; Ali et al., 2023). It is hard to imagine a coherent CSR policy in companies that do not take care of the cultural dimension. To understand corporate social responsibility, it is crucial to analyze the organizational culture and values on which relations in the enterprise are built because they shape the way of thinking about the enterprise and its relations with the environment (Klimkiewicz, 2010). Organizational culture is a determinant of organizational norms; it includes specific patterns, values, rules, customs, and ceremonies that members of organizations implementing CSR should follow (Stawicka, 2010). According to B. Glinkowska, understanding the essence of CSR requires the involvement of all participants in a given organization, but this can be achieved due to a specific, purposefully shaped organizational culture (Glinkowska, 2017). J. Collier and R. Esteban defined the relationship between organizational and personal values and commitment to CSR as rooting its principles and practices in the hearts and minds and the organization's culture (Collier, Esteban, 2007). Culture combines ethics and responsibility in actions, and focuses on values that allow the long-term achievement of goals (Terec-Vlad, Cucu, 2016). It supports the achievement of CSR assumptions through an orderly and well-thought-out system of activities and operating patterns (Rudnicka, 2012). For CSR to be part of the community, it must be authentic, rooted in the company's business culture (Slack et al., 2015).

In relation to the above statements, a research problem arises regarding the determination of cultural values according to which employees implementing CSR should follow. The research aims to identify a model of organizational culture conducive to the implementation of CSR in the enterprise. For this purpose, based on literature review, CSR features were defined, which are reflected in specific cultural values.

2. Literature review

2.1. Cultural values in defining the essence of CSR

In the literature, many authors analyzing the essence of CSR, relate it to cultural values. They reflect its assumptions and patterns of conduct. K. Klimek recognized honesty, respect, subjective treatment of employees, and positive responsibility as the values underlying the concept of CSR (Klimek, 2011). R. Wolniak recognized a small power distance as a characteristic value of CSR (Wolniak, 2015). On the other hand, K. Jaakson and others, studying the scientific works of other researchers, listed among the values that reflect CSR: interdependence, empathy, equality, personal responsibility, intergenerational justice, cooperation and partnership, communication, dialogue and collaboration for others (Jaakson et al., 2012). The core values of CSR also include: long-term orientation, commitment, participation, including participation in decision-making processes, respect for human rights, partnership, and integrity (Paliwoda-Matiolańska, 2014).

A. Adamik came to a much broader set of cultural values reflecting CSR by analyzing its aspects, such as relations with employees, relations with business partners, attitude towards the natural environment, attitude towards philanthropy, attitude towards ethics, attitude towards law and attitude towards company development. For each aspect of CSR, she assigned cultural values forming a specific set of them supporting its implementation. Summarizing them all, a system of cultural values conducive to the implementation of CSR can be created. These include collectivism, particularism, transcendentism, femininity, pro-partnership attitude, emotionality, polychronism (multi-activity), investments in development, conformism, openness to contacts, pro-activity, being outer-directed, holistic approach (Adamik, 2011). Table 1 presents a detailed list of them.

Table 1.
Cultural values in the aspect of CSR

Aspects of culture facilitating CSR	Aspects of a Company's social responsibility						
	Relations with employees	Relations with business partners	Attitude toward company development	Attitude toward natural environment	Attitude towards law	Attitude towards philanthropy	Attitude towards ethics
collectivism	X	X	X				
particularism	X		X	X	X		
transcendentism	X	X				X	X
femininity	X	X	X			X	
pro-partnership attitude	X	X			X		
emotionality	X	X				X	
polychronism (multi-activity)	X	X		X	X	X	
investments in development	X						

Cont. table 1.

conformism	X	X		X		X	
openness to contacts	X	X	X				
pro-activity	X		X	X	X	X	
being outer-directed	X	X		X		X	
holistic approach	X			X			X
Avoiding uncertainties		X	X		X		
The free development of natural environment				X			
conservatism					X		X
Long-term orientation			X		X		X
Synthesis			X				
Investing in development			X				

Source: own study based on: (Adamik, 2011, pp. 89-90).

The analysis of CSR definitions also provides insights into cultural values. The essence of CSR described in them is referred to in specific matters. An example is the authors who strongly emphasize the score-result aspect of CSR (McWilliams, Siegel, 2011; Saeidi et al., 2014; Gazzola, Colombo, 2014; Stefańska, 2011; Adamus-Matuszyńska, 2013). In their opinion, the application of CSR is to improve the company's competitiveness, increase its value and lead to sustainable economic and social development. Another group of researchers strongly emphasizes responsibility for the environment and relations with external stakeholders as the essence of CSR (Carroll, 2008; Zgoda, 2015; Constantinescu, Kaptein, 2015). The social and environmental aspect of CSR express the cultural value of being oriented toward the environment. Other authors emphasize a caring, fair, and responsible attitude towards their employees as internal stakeholders (Kalinowska, 2012; Zieliński, 2014). Acting as an employer interested in employees undoubtedly expresses the value of culture, which is people-oriented. Based on the definition, it is possible to list cultural values reflecting important aspects of CSR and, at the same time, consider them as conducive to the implementation of the CSR concept in enterprises.

The cited cultural values that express the essence of CSR form a reasonably wide spectrum. It would be not easy to define universal cultural values describing CSR on its basis. This is due to different understandings of the concept of cultural value and different contexts of analyzing the essence of CSR. However, numerous references to CSR to cultural values and organizational culture indicate that it should be considered as a factor conducive to the implementation of CSR.

2.2. Characteristics of socially responsible enterprises and cultural values

At this point, you can ask a question about the important values from the point of view of implementing the concept of corporate social responsibility, which should be promoted by organizational culture. Earlier, numerous examples of such values were cited. Still, it was also mentioned that on their basis, it is difficult to create a universal set of values positively influencing the implementation of CSR. Such a starting point may be an analysis of the characteristics of socially responsible enterprises. They present attitudes, solutions,

and requirements that are important from the point of view of effective implementation of CSR. In turn, each of them expresses some cultural value. Hence, the analysis of CSR features and the identification of cultural values based on them makes it possible to create a model of an organizational culture conducive to implementing CSR in the enterprise.

The distinguishing features of socially responsible enterprises include responsibility for the effects of implemented activities, reliable communication with the internal and external environment, care for environmental protection, keeping contracts and fulfilling obligations, and promoting ethical standards and behavior among stakeholders (Rozkwitalska, 2006). A. Crane and others mentioned the voluntary nature of the actions taken, the adaptation of the steps taken to the specificity of the environment and their inclusion in crucial business areas, and the transparency of the actions taken (Crane et al., 2008). Companies applying CSR are characterized by employees' creative attitude, willingness to develop and experiment, teamwork, methods of communication, friendly relations, and openness (Walkowiak, 2009). According to K. Klimek, the distinguishing features of CSR are transparency, tolerance, and dialogue in the company, freedom in decision-making, oriented on argumentation and not on power, employee involvement, and a place for implementing individual values (Klimkiewicz, 2011). Table 2 contains a presentation of CSR distinguishing features and cultural values that reflect them, based on a literature review.

Table 2.
Cultural values conducive to CSR

CSR distinguishing feature	Reasoning	Cultural value
Partnership	Strategic cooperation with clearly defined goals is a crucial component of any CSR-oriented organization. However, partnerships practiced solely for publicity undermine a company's credibility and reduce the effects of valuable cooperation. Employees should be involved, stakeholders should be consulted, and win-win solutions should be sought (Żemigala, 2007).	Orientation to the environment People orientation Task orientation Collectivism
Trust	In communicating CSR activities, it is desirable to express strong trust within the organization and build it in the external environment, as well as active dialogue to express the organization's maturity and commitment to socially responsible activities (Miszczak, 2016).	People orientation Low communication context Orientation to the environment
External dialogue and open communication	Open and honest communication builds and strengthens the organization's reputation and, above all, reduces the risk that the intentions of the company will be misunderstood (Głuszek, 2010).	Orientation to the environment Low communication context
Honesty and reliability towards external entities, stakeholders	Established ethical principles help create external relationships by building trust-based and respectful relationships with business partners, suppliers and customers, which positively affects the business atmosphere and the quality of cooperation with external contractors (Wołoszyn, Ratajczak, 2011).	Orientation to the environment Collectivism

Cont. table 2.

Focus on external stakeholders.	The company's main stakeholders in the context of CSR implementation are customers, suppliers, the local community, and the environment. The CSR concept is also implemented by organizations to consider all their stakeholders' needs (Kaźmierczak, 2017).	Orientation to the environment Activity
Engaging, activating, and educating stakeholders	Stakeholder engagement is the process an organization uses to engage relevant stakeholders to achieve agreed-upon outcomes, which may include: enabling the enterprise to learn from stakeholders, resulting in the improvement of products and processes, and informing, educating, and influencing stakeholders in such a way that their decisions and actions have a positive impact on the organization and society (AA 1000 Stakeholder Engagement Standard 2015).	Orientation to the environment Activity
Innovation	The assumption of CSR is to respect the needs of all groups of stakeholders, thanks to which it is possible to ensure uniqueness in the functioning of the enterprise, which depends on the innovation of the value noticeably offered to stakeholders, constituting a platform for achieving the assumed financial results of the enterprise (Jabłoński, 2013).	Activity Task orientation
Learning attitude	The implementation of the CSR concept in the strategic dimension should take into account the important role of immaterial assets in creating a competitive position, of which concepts related to the use of knowledge and opportunities inherent in intellectual capital are in the foreground (Jabłoński, 2013).	Low uncertainty avoidance Activity
A future-oriented approach	Socially responsible activities should have a long-term character and be included in the company's operating strategy (Wolniak, 2015).	Orientation to the environment Activity
Management commitment	An essential factor facilitating the implementation of CSR in the company is the commitment and continuous support of the top management. The awareness of the administration, the level of their knowledge, the declared and observed set of values, and contacts with employees and relations with the environment, affect the organization's conduct towards social responsibility (Kaźmierczak, 2017).	Low power distance People orientation Activity
Decentralization	The experience of many countries suggests that CSR initiatives and activities are undertaken in a network manner, and the people with the highest authority in the organization do not always have to be the most involved. It isn't easy to introduce CSR in a top-down manner (Wolniak, 2015).	Low power distance
Employee engagement	The company's activity in the CSR implementation field positively affects employees' level of organizational involvement (Brammer et al., 2007).	People orientation Collectivism
Participation in decision-making	Participation is a characteristic element of the CSR concept, which concerns the increasing role of employees in decision-making, and contributes to improving the results achieved by the organization and building a precious company (Kaźmierczak, 2017).	Low power distance Collectivism People orientation
Internal dialogue and open communication	Including employees in decision-making processes in the company requires managers to be ready to be open to dialogue with employees and two-way communication. The employee, having the right to speak out and thus participating in building the organization, contributes to the co-creation of added value for the company and society (Siarkiewicz, 2018).	Low power distance Low communication context
The critical role of employees	Employees play an essential role in the functioning of the organization, which is why they are expected to be ambassadors of the CSR program implemented in the organization (McShane, Cunningham, 2012).	People orientation Achievement based status

Cont. table 2.

Care for employees	Due to the strategic role played by employees, corporate social responsibility should primarily manifest itself in securing the interests, meeting the needs, and meeting the expectations of this group of people. The effectiveness of employees, the level of their involvement, and the degree of integration with the company largely depend on how they are treated, whether their rights are respected, on what principles the personnel policy is based, and what are its main pillars (Gadomska-Lila, 2012).	People orientation Achievement based status
Creating development opportunities for employees	A socially responsible organization needs to care for the development of its employees and create safe jobs for them, thanks to which employees gain appropriate working conditions and a sense of their dignity and value (Mazur-Wierzbicka, 2016).	Activity Low uncertainty avoidance People orientation
Cooperation	Supporting the cooperation of employees, their commitment, and teamwork is in the interest of the company because it more and more often operates in conditions of changing demand reported by customers, and the speed of reaction on the part of the company depends on the flexibility of the staff and their willingness to cooperate (Zieliński, 2014).	Collectivism People orientation
Teamwork	Teamwork plays an essential role in CSR because it requires extensive cooperation at all levels of the organization, and teams allow for the reliable setting of goals and planning activities in the field of CSR (Każmierczak, 2011).	Collectivism People orientation Low communication context
Employee creativity	CSR impacts the formation of a positive attitude to the work performed by employees, and their positive attitude to the work achieved results in greater involvement in developing new ideas and creativity (Gharleghi et al., 2018).	Activity Achievement based status
Employee flexibility	CSR requires a unique approach to people and at the same time, forces you to hire appropriate employees who can adapt to the requirements of this concept (Jasińska, 2010).	Low uncertainty avoidance Activity
Professionalism	Professionalism in CSR applies especially to the managerial staff as the group of employees who are responsible for other employees and, at the same time, is a model or reference point (Jasińska, 2010).	Activity Low uncertainty avoidance Achievement based status
Employee motivation	CSR positively impacts employees' internal motivation, so managers can use this fact to ensure greater employee involvement in the organization's CSR initiatives (Agarwal et al., 2015).	Proactivity Low uncertainty avoidance Achievement based status

Source: own study.

3. Results

Culturally-based attitudes, solutions, and requirements that are important from the point of view of CSR implementation express specific cultural values. Their combination creates a system of cultural values conducive to the implementation of CSR. The analysis of the CSR distinguishing features in Table 4 allows us to identify such cultural importance. On this basis, it can be concluded that the following cultural values create the organizational culture conducive to the implementation of CSR:

- people orientation, expressing the servile role of the organization about employees, based on mutual trust and empathy, respecting the individuality of individuals and treating them as subjects and partners. This value implements the fundamental assumption of the CSR philosophy relating to the responsible treatment of internal and external stakeholders of the company;
- tasks orientation is a cultural value opposite to focus on people, which subordinates the structure, activities, and people to the assumed priorities, including those related to CSR. The performance of tasks should be closely associated with the organization's CSR action plan, which should be manifested, among others, within the agreed scope of duties and responsibilities of employees;
- collectivism exposes the good of the group as more important than the good of individual individuals. Collectivism is manifested by a focus on group goals, collective consciousness and identity, loyalty, sharing of responsibilities, group decisions. Collectivism about the way an organization functions also refers to the corporate social responsibility carried out by the company, i.e., socially responsible activities, lawful, ethical, and all those that affect the positive relations created by the organization with its stakeholders;
- orientation to the environment, focusing the organization's attention on its environment, its careful observation and reaction to changes, interest, and a positive attitude towards external entities. The concept of corporate social responsibility implemented by the company concerns the impact of this activity on the environment and the effects of these activities;
- activity expressing criticism towards the existing schemes and standards of conduct and reflecting the need to change the current values and ways of achieving them by searching for and using new opportunities and solutions. Breaking the existing patterns of behavior and introducing a new way in the organization's functioning is a behavior characteristic of the CSR concept, particularly in the manner of achieving the social and environmental goals of the company, and not only economic ones;
- low uncertainty avoidance, meaning a low degree of anxiety in the face of novelty, uncertainty, and ambiguity, changes in the organization, information deficit, complexity of work and environment. Each change raises resistance; however, properly explaining to employees the meaning of the change in the way the organization functions in terms of CSR and the effects that this change is to bring in the future, allows you to reduce the degree of uncertainty felt by the members of the organization;
- achievement-based status that describes the cultural basis for evaluating an employee's performance and expresses the belief that an employee's position depends on their achievements and what they do, which determines their value. Socially responsible activity should primarily result from employees' awareness of creating the common

good, not from the cold calculation and opportunism. Knowledge of the principles of corporate social responsibility and, above all, their acceptance and identification with them by members of the organization allow for more effective implementation of the CSR strategy;

- low power distance expressing a low degree of acceptance of an unequal power distribution. Therefore, similar rights and mutual partnership treatment are preferred, regardless of the positions or roles held. Partnership relations created between employees within the organization and between it and other entities in its environment, based on respect for the law and market rules, align with the idea of corporate social responsibility;
- low communication context describing the cultural basis of information coding and preferring verbal and direct communication. CSR requires an active dialogue to build broad cooperation at all levels of the organization in strict, clear verbal messages to engage in socially responsible activities.

4. Conclusion

The approach to the issue of CSR is related to defining the place of a modern enterprise in socio-economic life and its tasks towards society. Many factors determine these issues. The analysis of the literature with the analysis of the results of the empirical research included, indicate the role of organizational culture as an important determinant shaping the implementation of CSR in the company's operations. They form a system of cultural values that show how employees think about the company's corporate social responsibility and the behavior appropriate for its effective implementation.

The conducted analysis allowed to achieve the research goal. Cultural values and their manifestations were identified, which would be conducive to the implementation of CSR if strengthened or promoted. However, implementing a model of an organizational culture conducive to CSR requires the management to take actions to improve the organizational culture, adequate to the concept of corporate social responsibility. Although shaping organizational culture is a complicated process due to its complexity, CSR requires taking into account the existing cultural factors in the implementation of appropriate operational solutions, and on the other hand, it means the need to shape appropriate cultural values.

Social responsibility activities carried out in such a culture will, over time, reflect the universal and contextual values in which the company operates. CSR will become implicitly rooted in the company's system at the processes, norms, and values level.

In order to verify the cultural values presented in this article, which are conducive to CSR activities, further empirical research will be conducted by the Authors. Verification of the universality of this model in different countries would be an interesting research thread.

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ANALYSIS OF THE LEVEL OF SUSTAINABILITY WITH THE APPLICATION OF KPIS

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Purpose: The purpose of the study was to analyze the essence of the concept of sustainable development and the level of fulfillment of one of the sustainable development goals of selected countries in comparison with the European Union based on a system of indicators. The level of fulfillment of Sustainable Development Goal 8 - decent work and economic growth in Poland and Slovakia was studied.

Design/methodology/approach: The research methodology used a diagnostic survey method comparative analysis and, to gather data, content analysis and desk research techniques.

Findings: As a result of the analysis carried out, it was found that surveillance using sustainable development indicators is fraught with various difficulties. An example of an inconvenience is: the need to standardize data for European Union countries and the lack of access or difficult access to adequate data in individual countries. In addition, the indicator method is characterized by certain generalizations and is fraught with subjectivity. However, the need for control and implementation of cyclical data analysis and information on the progress of implementation of the provisions of sustainable development in the member countries of the European Union is undeniable.

Research limitations/implications: An identified limitation in the implementation of the presented research methodology is the potential shortcomings in the availability of data necessary to calculate indicators monitoring the degree of achievement of sustainable development goals and the different level of detail available within the countries of the European Union community.

Practical implications: The results of the conducted research procedure provide factual knowledge that can support the process of creating future strategic plans to further the goals of sustainable development.

Originality/value: The study completes the research gap concerning comparative analyses of the level of fulfillment of selected sustainable development goals by Poland and Slovakia in relation to the level that has been registered for the European Union.

Keywords: sustainability, sustainability management, key performance indicators, sustainability indicators.

Category of the paper: Research paper.

1. Introduction

Human activity in the economic sphere affects not only the organization of social life, but also its environment, i.e. the state of the natural environment (Czerwinska, Pacana, 2023; Ulewicz, Blaskova, 2018). The absolute domination of man over the natural world, combined with the irresistible need to satisfy immediate needs, has led to the threat to his natural environment and to an ecological crisis (Olkiewicz et al., 2019). Human economic activity also affects the progressive transformation in the area of values. Man fulfilling his needs significantly affects the dynamics of economic processes (Pacana et al., 2023). However, it is worth noting that nature also has certain limits of endurance, and the consequence of exceeding them is the degradation of space affecting the well-being and condition of humans (Ulewicz, Pacana, 2017). As presented, the interaction is coming full circle and revealing the interdependence of such areas as the economy, societies and the environment.

The progressive economic and technological development of a significant number of countries has had an undeniable impact on environmental degradation. In the second half of the twentieth century, the idea of sustainable development began to form the directions of conduct and exert a significant influence on emerging global trends (Dolega, 2022). This concept implies such management of new available technologies that it does not lead to the destruction of natural resources, and at the same time ecosystems. The theory seeks to ensure a balance between the environment in which we live, technological progress and social life (Olkiewicz, Wolniak, 2020).

The purpose of the study was to analyze the essence of the concept of sustainable development and the level of fulfillment of one of the sustainable development goals of selected countries in comparison with the European Union based on a system of indicators. The level of fulfillment of Sustainable Development Goal 8 - decent work and economic growth in Poland and Slovakia was studied.

2. The issue of the quality of the indicators used

Indicators are a basic tool for monitoring the level of sustainable development, illustrating in a measurable way the essence of the concept (Staniszewska et al., 2020). The most important feature of indicators is the comparability of the result (as opposed to characteristics, which are generally presented using absolute values), allowing to determine the position of a given object (e.g., the district of a municipality) in relation to other objects (e.g., other territorial units) (Czerwinska et. al., 2022; Mazur, 2020). Comparability is hindered not by the sheer multiplicity of proposals, but by the goals that are included in sustainable development strategies that take

into account environmental economic resources, social resources (which should be maintained and protected) and resources that depend on a particular territorial unit (which should be developed). Creating a set of sustainable development indicators allows diagnosing the current state and realizing an assessment of changes over time for a specific unit (Pacana et. al., 2020; Hajduk-Stelmachowicz, 2014). However, on the other hand, such a collection provides an opportunity to compare the conditions of different units. In addition, the verticality of the developed indicators from the level of defined upstream units to downstream units and vice versa is important (Pacana, Czerwinska, 2019; Kyaw, 2022). Sustainability indicators at the global level are created by: The Committee on Environmental Policy (OECD), the Commission on Sustainable Development (UN) and the European Commission. However, for measurement at the international level to be possible and meaningful, targets set at this level should be consolidated with those of sub-national entities with consideration (Lazar et al., 2021):

- the possibility of adding priorities that respond to the specifics of a certain territorial unit,
- the state of environmental resources in the unit,
- progress and effectiveness of development activities.

In response to the significant number of sustainability monitoring solutions, as well as the numerous stakeholders affected by measuring the progress of concept implementation (business, civil society, statistical offices), the UN is presenting a reporting modality that includes global reporting indicators (about a hundred indicators) with complementary national indicators (Garcia-Sanchez et al., 2023). In this case, monitoring of progress would be done at four levels: regional, national, global and thematic. It should be noted that reports performed at the national level on progress toward the Sustainable Development Goals need not be fully comparable - individual countries have the option of choosing complementary indicators appropriate to their specific characteristics, needs and context. However, national complementary indicators should be aligned with global monitoring principles, meaning that they should be harmonized and universal (Eustachio et al., 2019).

The reporting of progress in achieving sustainable development goals at the national level is the most relevant level of reporting (Grebski et al., 2022). Reporting at the regional scale also serves an important function, as it supports knowledge sharing, mutual learning, and at the same time provides an opportunity to compare and evaluate the performance of development goals in specific countries located in the same region. Reporting on a regional scale is a link between the global and national levels. Regional sustainable development indicators include: global indicators, complementary national indicators and, if necessary, a number of indicators on the implementation of regional tasks and priorities (Barska, Jedrzejczak-Gas, 2019). Thematic reporting addresses complex and multifaceted challenges that often affect a significant number of diverse sectors. This type of reporting can involve innovative and creative ways of collecting data, unofficial data sources, and analyzing and processing data (Kozel et al., 2015). A summary of thematic areas and leading indicators for monitoring sustainability is presented in Table 1.

Table 1.

Summary of thematic areas and leading indicators for monitoring sustainable development

Subject area	Leading indicator	Number of indicators		
		Operations	Explaining	Contextual
Socio-economic development	Real GDP per capita	3	12	-
Sustainable consumption	Resource productivity	3	15	2
Social inclusion	Threat of poverty or social exclusion	5	15	1
Demographic change	Employment rate of older workers	3	4	4
Public health	Life expectancy and healthy life years	2	9	-
Climate change and energy	Greenhouse gas emissions	3	2	-
Sustainable transportation	Renewable energy consumption	4	7	1
Natural resources	Energy consumption in transportation relative to GDP	4	5	-
Global partnership	Occurrence of common bird species	3	7	3
Good governance	-	3	3	1

Source: own compilation based on Eurostat report (2015), Sustainable development in the European Union. Monitoring report of the EU Sustainable Development Strategy. <http://ec.europa.eu/eurostat/documents/3217494/6975281/KS-GT-15-001-EN-N.pdf/5a20c781-e6e4-4695-b33d-9f502a30383f>, 10.07.2023.

Among the considerable number of ideas on the construction of a set of sustainable development indicators, one is the set published in the Eurostat database. It is a set of Sustainable Development Indicators (SDI), allows monitoring the level of achievement of the objectives of the EU Sustainable Development Strategy. The European Union, in establishing sustainable development as a priority goal, unites economic development, social justice and environmental protection, with the aim of ensuring the well-being of its citizens and improving the quality of life of those living now and in the future. This is why it is so important to measure progress in the area of sustainable development, which is carried out by the European Statistical Office (Gunnarsdottir et al., 2020).

The concept of indicatorization of the European Union can be presented using a "pyramid", consisting of three main levels of monitoring. The top of the pyramid refers to 10 leading indicators (so-called Headline Indicators). Their task is to monitor the overall goals, which are related to the core challenges of the Sustainable Development Strategy. The second level of the pyramid takes into account almost 40 indicators related to operational goals (the so-called Operational indicators), while the third - the lowest level - includes almost 80 indicators related to activities (the so-called Explanatory indicators). The lowest-ranked indicators are a refinement of the leading indicators. Also included in the set of sustainable development indicators are the so-called Contextual indicators. This group of indicators does not directly serve to oversee the goals of the sustainability strategy. These indicators are not easy to interpret in a normative way, however, they build a valuable informational background on phenomena directly related to sustainable development by which they are useful for analytical purposes (Wang et al., 2021). Figure 1 shows the structure of the thematic areas and leading indicators monitoring progress toward the Sustainable Development Goals.

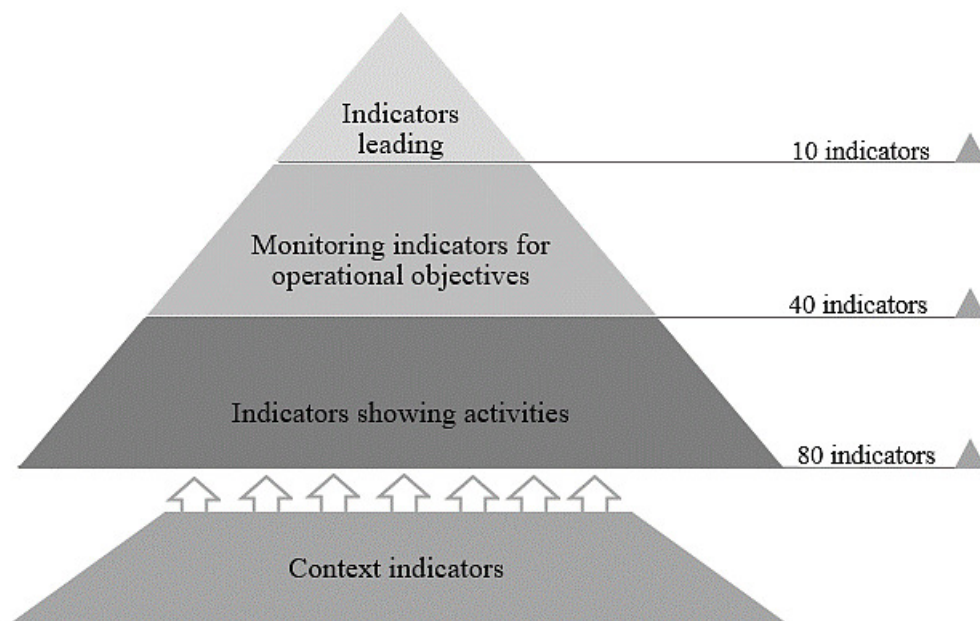


Figure 1. The structure of sustainable indicators.

Source: own study.

It is important to remember that the leading indicators of sustainable development form an overall picture of progress in the context of the fundamental challenges of the EU Sustainable Development Strategy. Wanting to get a complete and detailed view, it is necessary to undertake analysis using indicators of each area.

The purpose of sustainable development indicators is to improve the control of the degree and quality of implementation of the recommendations and goals of Agenda 2030 by creating uncomplicated information and diagnostic tools (Manero-Salvador, 2023). Indicator analysis is essential for monitoring and controlling the state, as well as managing the economic, social and environmental planes in a way that ensures a decent quality of life (de Menezes, Galvao, 2020). Which can be achieved by adhering to the principle of sustainability and the principle of intergenerational equity within all 3 orders: economic, environmental and social (some sources even state 5 orders: environmental, spatial, economic, social and institutional-political) (Novovic, 2022).

3. Research methodology

The realization of the set objective of the study was associated with the performance of systematized research steps. The scheme of analysis of the level of implementation of the objectives of sustainable development of Poland and Slovakia against the background of the European Union, presented in Figure 2, consists of the basic research steps necessary to carry out a detailed analysis of the phenomena in the area of sustainable development.

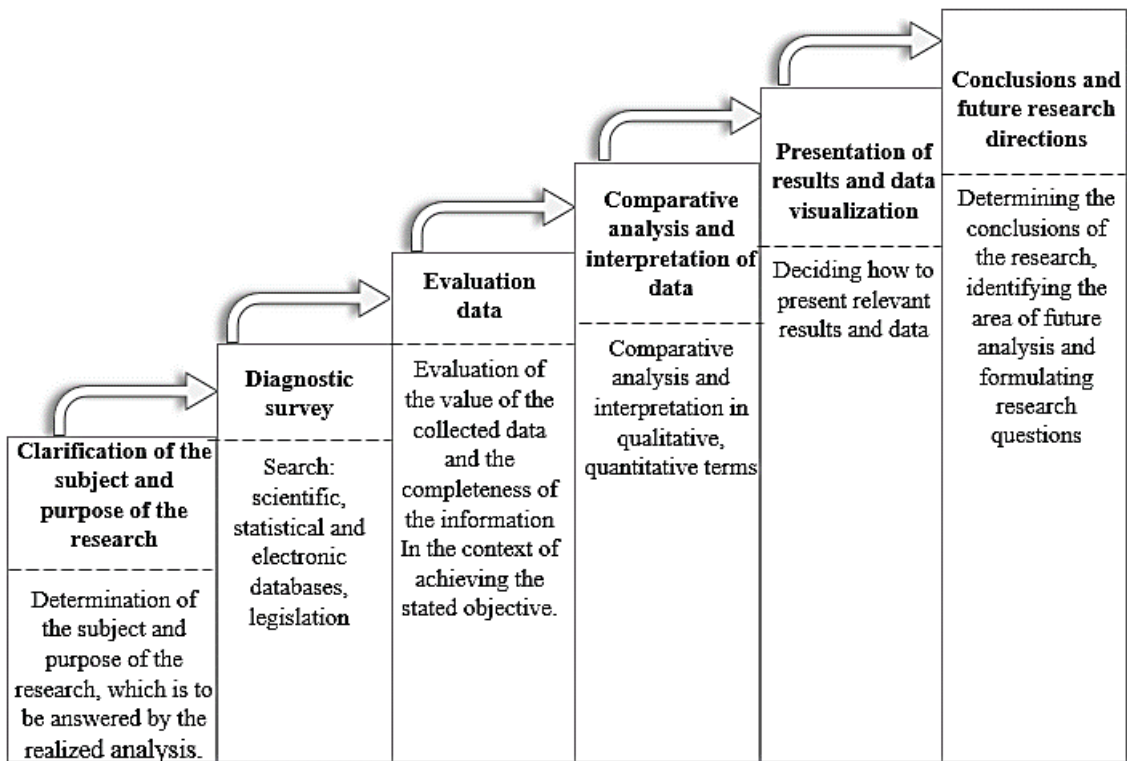


Figure 2. Schematic representation of the stages of the research procedure.

Source: own study.

The research procedure was divided into six steps, which included: specifying the subject and purpose of the research, diagnostic survey, data evaluation, comparative analysis and interpretation of data, presentation of results and data visualization, conclusions and future research directions. A cross-sectional characterization of the various stages of research implementation is as follows:

- specifying the subject and purpose of the research - this step boils down to determining the categories of objects in relation to which the research will be carried out and the cognition of reality, which involves descriptions and explanations of the phenomena and processes occurring in the studied reality;
- diagnostic survey - this step makes it possible to learn about the phenomenon specified in the purpose of the research, to determine its scope, extent, level and intensity. This activity will create a description of important processes taking place in the communities. The study used the technique of document analysis;
- data evaluation - involves understanding, performing quality assessment of the selected data in terms of achieving the research objective;
- comparative analysis and interpretation of data - analysis of the characteristics of the established subjects of the study in terms of determining similarities and differences (dissimilarities) and making sense of the collected data;

- presentation of results and data visualization - the stage of presenting the results, taking into account the principles of effective communication and the standards set for scientific research; this step also involves deciding how to organize the data and identify the relevant ones to be included in the study. Data visualization plays an important role as an element that promotes understanding and remembering of the results of the analyses carried out;
- conclusions and future research directions - defining conclusions and reflections on the completed analyses and determining the area of future scientific inquiry.

The presented model of analysis of the level of implementation of the objectives of sustainable development of Poland and Slovakia against the background of the European Union makes it possible to carry out systematized and effective diagnostic research.

4. Analysis of the implications of the concept of sustainable development of Poland and Slovakia

The 2030 Agenda is a universal development plan for the world. The implementation of the concepts contained in the 2030 Agenda requires tailoring to the prevailing realities of each country, therefore the role of countries in the implications of the concept is crucial. The complexity and permeability of the 2030 Sustainable Development Goals (SDGs) require significant commitment and appropriate cooperation. For this reason, it is important to translate the global goals to the national, regional, local level and to make them aware of their importance.

The study's analysis focuses on Goal 8 of Agenda 2030, which addresses the issue of decent work and economic growth. SDG 8 targets the achievement of full and decent employment through the promotion of economic growth, entrepreneurship, job creation, improved productivity levels and technological innovation.

In monitoring the level of achievement of Goal 8, attention has been paid to a key indicator, real GDP per capita, for this area. The indicator is calculated as the ratio of real GDP to the average population in a given year. GDP measures the value of the total final output of goods and services produced by the economy over a specified period of time. It includes goods and services that have markets (or that could have markets) and products produced by government and non-profit institutions. The values of the indicator obtained by the analyzed countries against the EU are shown in Figure 3.

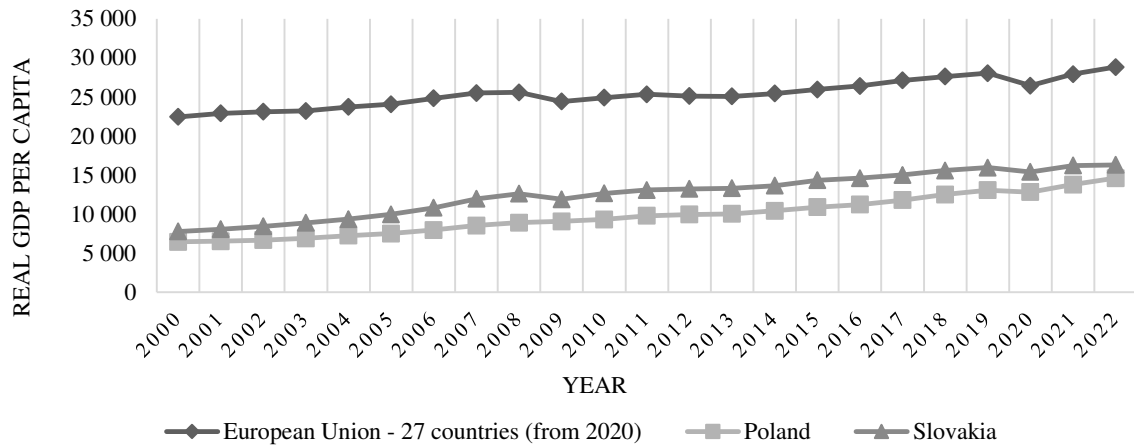


Figure 3. Dynamics of the real GDP per capita index for Poland and Slovakia against the EU.

Source: own compilation based on: <https://ec.europa.eu/eurostat>, 10.07.2023.

Real GDP per capita is calculated as the ratio of real GDP to the average population in a given year and is calculated on a rounded basis. In the period under review, the value of real GDP per capita in Slovakia increased by 109.5%. In Poland, a higher rate of growth of the indicator is observed - it amounted to 126.3%. No decline in real GDP per capita was observed in both countries over the analyzed years. In the last analyzed year - 2022 - the value of the indicator in Slovakia is 76.8% lower than the value for the EU, while in Poland the value is lower by 97.4%.

The key analysed indicator was investment share of GDP by institutional sectors. This indicator shows investment for the entire economy, government, business and household sectors. The indicator gives the share of GDP that is used for gross investment (rather than for consumption or exports, for example). It is defined as gross fixed capital formation (GFCF) as a percentage of GDP for the government, business and household sectors. Figure 4 shows the values of the indicator over the years 2000-2022 of Poland, Slovakia and the European Union.

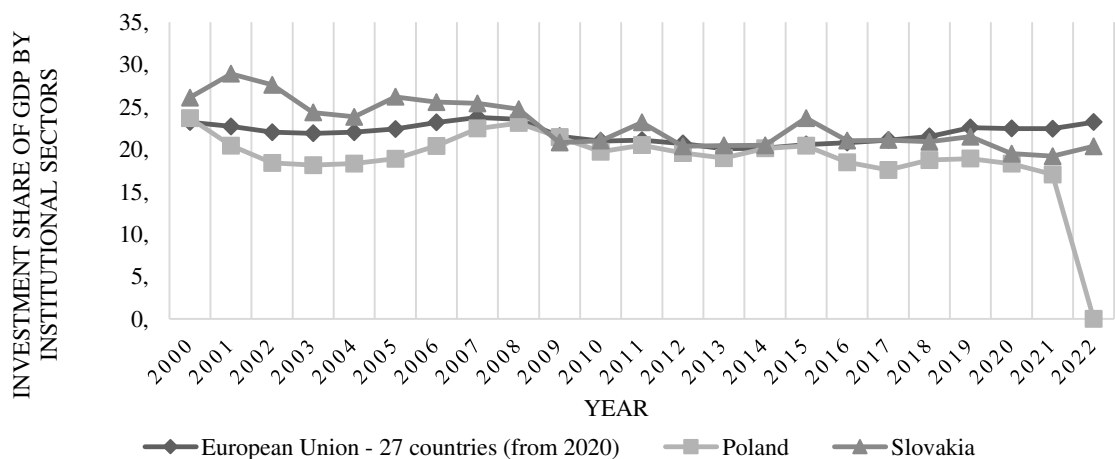


Figure 4. Dynamics of the index of investment share of GDP by institutional sectors for Poland and Slovakia in comparison with the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 10.07.2023.

In the analyzed period, both downward and upward trends were observed for Poland, Slovakia and the European Union. The most significant decreases in the value of the indicator investment share of GDP by institutional sectors in Poland took place in 2000-2004 (a decrease of 22.6%), in Slovakia in 2001-2004 (a decrease of 17.5%). In the EU there was a mild decline in the value of the indicator in question, which occurred in 2007-2013 (decline of 15.26%). As a whole, in the examined period it can be said that the level of undertaken investments for the whole economy, government, business and household sectors decreased (Slovakia - a decrease of 21.9%; Poland by 2021 - a decrease of 28.07%). No data is available on the value of the indicator for Poland in 2022.

Employment and other labor market issues are at the center of social and political debate in the EU. Paid employment is crucial to ensuring sufficient living standards and provides people with the necessary basis for achieving their personal goals and aspirations. In addition, employment contributes to economic performance, quality of life and social inclusion, making it a cornerstone of socioeconomic development and prosperity. The study also highlighted the employment rate, by citizenship. The indicator measures the percentage of the population between the ages of 20 and 64 who are employed. People who are employed are defined as those who, during the reference week, worked at least one hour for pay or profit, or did not work, but performed work in which they were temporarily absent. Figure 5 illustrates the dynamics of changes in the value of the employment rate, by citizenship.

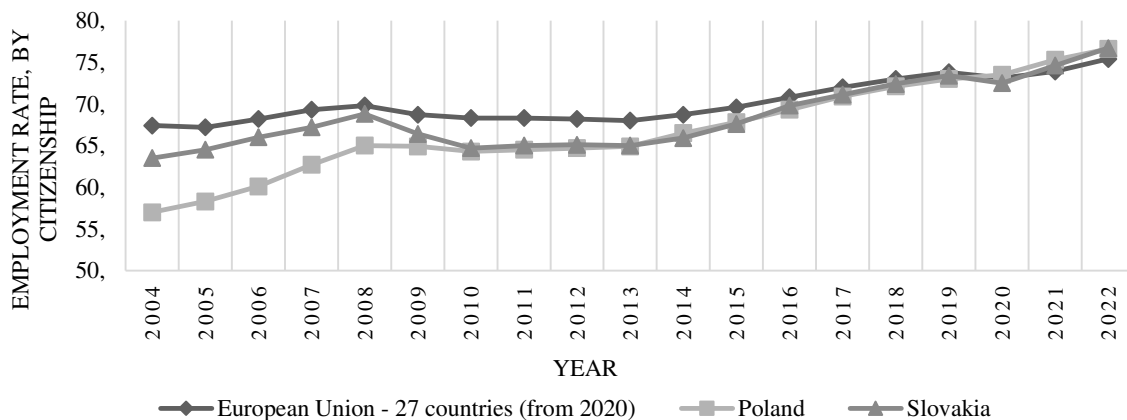


Figure 5. Dynamics of the employment rate, by citizenship for Poland and Slovakia against the EU.

Source: own compilation based on: <https://ec.europa.eu/eurostat>, 10.07.2023.

Figure 5 shows the years 2004-2022, as for 2001-2003 Eurostat indicates the unavailability of data - a break in the time series. The available data for the employment rate by citizenship indicator for the analyzed countries show a significantly increasing trend. An increase in the value of the indicator for Poland by 34.38%, for Slovakia by 20.78%, and for the EU by 11.86% was observed. Despite the fact that Poland started from a significantly lower level of the indicator than Slovakia or the EU, today both countries are at an almost identical level in terms of the level of employment measured by citizen.

Poverty and social exclusion harm individual lives and limit people's ability to realize their full potential, affecting their health and well-being and lowering their educational performance. This in turn limits people's ability to lead successful lives and further increases the risk of poverty. Without effective education, health, social systems, tax credits and employment, the risk of poverty is passed from generation to generation. This causes poverty to persist, thereby increasing inequality, which can lead to a long-term loss of economic productivity for entire social groups and hinder sustainable and inclusive economic growth. For this reason, the analysis also included the in-work at-risk-of-poverty rate. The dynamics of changes in the value of the indicated indicator is shown in Figure 6.

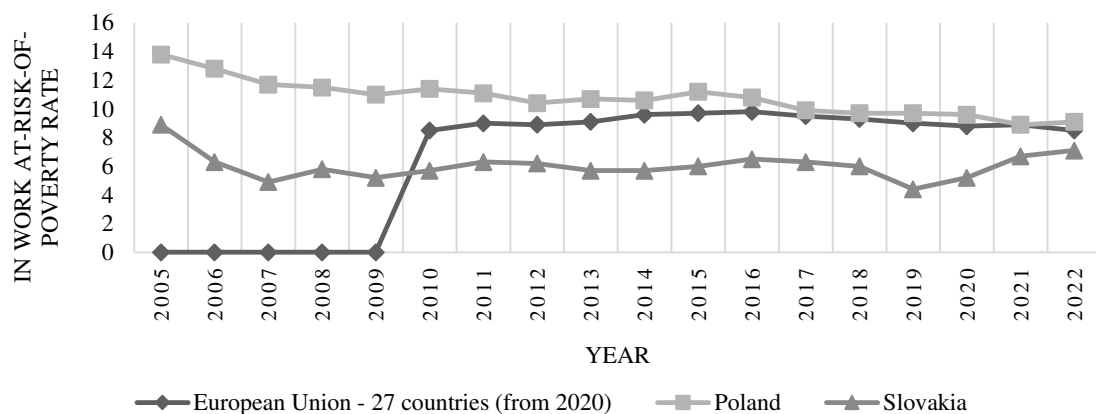


Figure 6. Dynamics of the in-work at-risk-of-poverty rate for Poland and Slovakia against the EU.

Source: own compilation based on: <https://ec.europa.eu/eurostat>, 10.07.2023.

With regard to the in-work at-risk-of-poverty rate, data from 2005-2022 are available for Slovakia and Poland, while data from 2009-2022 are available for the EU. Over the analyzed period, a desirable downward trend of 34.05% is observed for Poland. In Slovakia, there were two notable declines: between 2005 and 2007 (44.94% decline), and between 2016 and 2019 (32.30% decline). On the other hand, considering the entire research period, a decrease in value of 20.22% is observed in Slovakia. The value of the Polish and EU indicators are similar.

The analysis also included the raw material consumption (RMC) indicator. The material footprint, also referred to as raw material consumption (RMC), represents the global demand for material extraction (minerals, metal ores, biomass, fossil energy materials) caused by the consumption of goods and services in the geographic reference area. Figure 7 shows the RMC values for Slovakia and Poland and the EU.

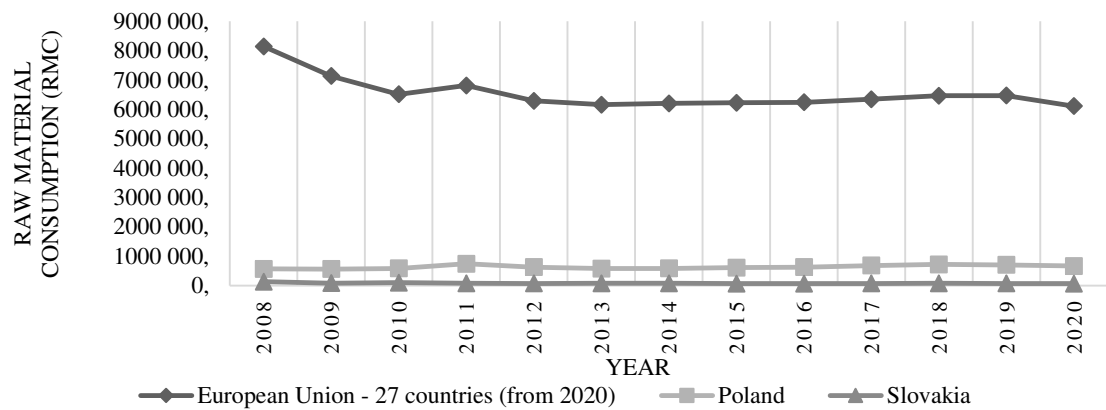


Figure 7. Dynamics of the raw material consumption (RMC) index for Poland and Slovakia against the EU.

Source: own compilation based on: <https://ec.europa.eu/eurostat>, 10.07.2023.

Data on material footprints come from material flow accounts, which model the flows of natural resources from the environment to the economy. They include domestic extraction of materials measured in gross tons of material (for example, gross ore or gross harvest), as well as imports and exports measured by the raw material equivalent of traded products (domestic extraction and foreign extraction required to manufacture products). Comparable data of Poland and Slovakia are available from the period 2008-2020. In the period under consideration, Slovakia saw a decrease of 47.21% in the index (2008 - 137303.051; 2020 - 72479.823), while Poland saw an increase of 17.16% (2008 - 569798.592; 2020 - 667610.52). With respect to the EU, a decrease of 24.97% was observed (2008 - 8,141,305.082; 2020 - 6,108,243.183). The RMC shows a significant difference between the volumes of extraction in the EU needed to produce the goods demanded by end users compared to Poland and Slovakia.

The EU supports growth, job creation and competitiveness through funding instruments such as the European Fund for Strategic Investments, the European Social Fund and its successor, the European Social Fund Plus, the European Structural and Investment Funds, Horizon 2020, the Programme for Employment and Social Innovation (EaSI), the Programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME), the Emergency Support Instrument, the Connecting Europe Facility and the Creative Europe Programme (CAP).

5. Summary and conclusions

Implementation of the concept of sustainable development is one of the main goals of the European Union. The progressiveness of EU member countries in the context of the implementation of sustainable development goals is constantly monitored using a set of

indicators. The creation of an indicator system for monitoring policies (strategies, programs) of sustainable development is one of the most difficult methodological and application problems of the research on development indicators carried out not only in Poland. Therefore, the purpose of the study was to analyze the essence of the concept of sustainable development and the level of fulfillment of one of the objectives of sustainable development of selected countries in comparison with the European Union based on the system of indicators. The level of fulfillment of objective 8 of sustainable development - decent work and economic growth in Poland and Slovakia was studied.

As a result of the analysis of the collected data, it was found that supervision with the use of sustainable development indicators is burdened with various difficulties. An example of an inconvenience is the need to standardize the relevant data for the countries of the European Union. Also troublesome is the lack of access or difficult access to adequate data in individual countries. Which may be due to the different degree of detail in the reporting of member countries. In addition, the indicator method is characterized by certain generalizations and is fraught with subjectivity. However, the need for control and realization of cyclic analysis of data and information on the issue of progress in implementing the provisions of sustainable development in the member countries of the European Union is undeniable.

Further research directions will concern the analysis of the level of fulfillment of other sustainable development goals by Poland and Slovakia. The analyses will also include development forecasts for both countries.

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THE INFLUENCE OF REMOTE WORK ON ERGONOMICS AND WORK SATISFACTION

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Purpose: The purpose of the article is to present the impact of remote work on ergonomics and job satisfaction. The purpose of the study is understood from the perspective of the impact of remote work on corporate employees.

Design/methodology/approach: Data for the study was collected from employees working at a corporation in Bydgoszcz, Poland. The study used the PLS (partial least squares) analysis method to understand the relationship between remote work and job satisfaction, and between work ergonomics and remote task performance.

Findings: The results of the study indicate that ergonomics closely influences job satisfaction. In addition, the study confirmed the hypothesis that remote work has a significant impact on task performance.

Research limitations/implications: The study is limited to employees of corporations in a specific region of Poland. Therefore, future research could focus more on the impact of remote work on corporate culture in other parts of Poland.

Practical implications: The study provides directions for human resource management to implement effective practices for improving remote work.

Social implications: This study offers support for corporate employees, providing insights into how the work environment can be improved, thereby enhancing work and employee satisfaction.

Originality/value: This is a study that attempts to provide insight into how ergonomics is important in corporate work, especially when working remotely. The findings provide important implications for improving ergonomics at work and increasing employee satisfaction.

Keywords: management, human resources, remote work, ergonomics, job satisfaction.

Category of the paper: research paper.

1. Introduction

The concept of ergonomics is related to the safety and occupational health of workers. Ergonomics plays an important role in the performance of tasks by employees in an organization, so organizations need to develop appropriate ergonomic tools and techniques for effective job performance (Law et al., 2011). Employee satisfaction is a concept that is linked to the ergonomics of work at a company. It is also an element related to health and safety climate at the workplace (Uddin et al., 2019).

Work ergonomics in organizations has changed with COVID-19 (Sangeeta, 2020). The COVID-19 situation, described as a pandemic, has affected various human resource management practices, as well as the way work is performed. Many employees were directed to carry out their work remotely, and this began to cause a problem with the lack of ergonomics of working outside the office.

The pandemic situation changed working conditions and thus the workspace in offices. The pandemic situation favored remote work, and many employees carried out work duties from their homes for many months. These changes affected ergonomics and operations in organizations (Sangeeta, 2020). In addition to ergonomics, other factors have also changed as a result of realizing work remotely. Proper execution of tasks, inadequately planned work content, and, as a result, employees' lack of satisfaction with performing tasks remotely became a problem.

A study by Uddin (2020) emphasized that organizations were not prepared for the kind of situation that occurred with COVID-19. Most organizations took measures to counter the spread of the virus. One such measure was the introduction of remote work. Organizations very quickly implemented solutions to protect employees while allowing them to perform their duties and work (Uddin et al., 2021).

One of the goals of ergonomic design is to optimize work, avoid adverse effects on employee health and contribute to the productivity and efficiency of the organization (Lager et al., 2021). When we mention occupational risks, the main one detected is, among others, ergonomic risks associated with the use of information and communication technologies, where employees spend long hours at these technologies (Sasangohar et al., 2020). In addition, one study indicated that the use of digital technologies at work also affects ergonomics and employee satisfaction, as an employee working long hours with digital technology affects the health and well-being of employees (Salmon et al., 2021).

Research on office workers indicates that when the ergonomics of the job changes significantly, thus there has been a change in engagement strategies and job satisfaction (Prajapati and Pandey, 2020). Therefore, it is worth investigating the impact of ergonomics on employee job satisfaction from the perspective of corporate employees working remotely.

This study aims to understand what impact remote work, which was not always done in ergonomic locations outside the office, had on employees. And how the absence or lack of ergonomics affected job satisfaction.

2. Influence of remote work on work satisfaction and ergonomics

Difficult times, which are characterized by events such as war, famine, floods, earthquakes and pandemics such as COVID-19, affect companies and their employees the most. Keeping employees engaged, making work rewarding and not making them fear for their own health during a pandemic is possible with proper attention to health, safety and ergonomics. This is very important if one wants to maintain productivity in the company despite the turbulent environment (Andrew, Saudah, 2012). What's more, employee engagement and a properly ergonomically adjusted workstation result in increased job satisfaction, and this can be a kind of rationale for developing the right attitudes and behaviors among employees to improve productivity.

Remote work has not been codified in the Polish Labour Code. Moreover, it is also difficult to find its definition in the literature on the subject. It should be emphasized, however, that teleworking and remote work are not identical concepts and should not be used interchangeably. Therefore, it became necessary to define this term and define the features that distinguish remote work and from teleworking. Remote work should be considered temporary or less formalized possibility of carrying out the work process in the form of the so-called home office. What distinguishes remote work is that there is no need to regulate this method of work in writing in the employment contract (at least – so far). In practice, it means that usually on the basis of an oral agreement (although in the time of a pandemic such agreements tend to occur also in a written form more and more frequently), the employee can perform the duties previously performed in organization premises directly from home (Blumberga, Pylinskaya, 2019). Therefore, it can be concluded that work in remote mode is incidental. As a rule, the employee performs work in the workplace, and only from time to time the employer allows her/him to work remotely. The most common reasons contributing to remote work are extraordinary circumstances (e.g. inability to travel to work – public transport strike; the need to stay at home – pandemic state, etc.). In such cases, the general employment relationship law should apply to the domestic worker as well. Unfortunately, this form of carrying out work from outside the office raises many doubts, as well as organizational and formal problems. Some organizational issues can be efficiently resolved using modern tools and by building appropriate relationships with the employee team (Łaniewski, 2020). On the other hand, the greatest challenge faced by employers is the need to ensure the safety of work of people performing work tasks remotely. It is an extremely difficult area of work to regulate, hence it is undoubtedly one of the most serious problems related to the use of flexible forms of work, for which no effective solution has yet been found.

An ergonomic workstation can be called such a workplace that does not cause any disease or degeneration in a person. Thus, taking into account all elements of office equipment should be selected appropriately for each employee, so that he can work in favorable and comfortable conditions for himself. Therefore, no matter what kind of work one does, one should pay special attention to the organization of the workstation. Any employee may have doubts and in such

a case can turn to the employer, who is obliged to provide him with full-fledged information on the subject in order to accommodate his needs (Dul, Weerdmeester, 2011).

The employer is obliged by law to design and adapt the workplace for all new as well as existing employees, if necessary, in their existing environment. How the workplace is organized has a huge impact on the quality of the duties performed. Employees should be focused, which can be helped by a comfortable workplace. It only takes one ill-fitting chair to negatively affect the condition of a person's spine (Goździewska-Nowicka, 2020).

When initiating an analysis and evaluation of workplace ergonomics, one should start by obtaining general information related to the operations of the enterprise in question and details relating to the conditions prevailing there, as well as the time and mode of work and equipment, and even the scope of work (Sluchak, 1992).

The risks that arise in terms of various ailments and diseases of the musculoskeletal and nervous system are also a torment in office work, which is usually considered light. Although computer use does not require a great deal of physical exertion, it does require a certain amount of muscle activity (Gregory, 2022).

Today's offices are characterized by increasingly complex and complicated structure, which is why proper organization of an office workstation is not at all the easiest tasks, as it might seem. Work environments continue to evolve with the times and try to meet the needs of not only employees anymore, but also their customers. Through the passage of years, and even the current global situation, it is easy to see how the very definition of an office is constantly changing. Currently, most of the public considers their home as an office. Looking at all these rapid changes and ergonomic principles, managing in offices becomes quite a challenge (Davis et al., 2020).

Office ergonomics is increasingly associated with computer work, as the world is moving forward and with new technologies, paper documents are going by the wayside. Hence, the number of people who deal on a daily basis with computer work continues to grow, and for the time being there is no question that this common trend is likely to change in any way in the near future (Goździewska-Nowicka, 2019).

Today's office-type workstation is seen as a synonymous with workstations with screen monitors. Today, the computer is a versatile and indispensable tool for office work, even in every field of the profession, and today's work demands high performance through productivity, creativity, but also high quality, which involves an increase in working time. Thus, it becomes a heavy burden not only physically, but also mentally for a person. Thus, it should be remembered that it is the provision of a healthy and functional work environment is the employer's responsibility. And since the world is constantly evolving, behind its progress, office environments should also move forward, if only to ensure that employees to perform their duties willingly (Gerding et al., 2021).

When analyzing the scope of concepts related to ergonomics in the office workplace it is important to note what impact the assimilation of safety and health requirements has and occupational health not only on its conditions, but also on the cost of operations.

Adjustment of space and workplace requires appropriate adjustments of the position, if only its elements equalizing individual differences, which could become very desirable. Unfortunately, the complete adjustment of these parameters to the position of a given employee is associated with certain limitations which are created by economic and technological-structural factors (Caputo et al., 2018).

It is difficult to access information on the application of ergonomics in specific enterprises, since it is simply impossible to create a workplace tailored to the individual. The condition, however, is to shape the workplace based on the so-called minimum and maximum threshold values. Using the role of these values, which are anthropometric characteristics, the enterprise is able to compose, based on the dimensions of users, a suitable workspace of work.

From the point of view of ergonomics, remote work and its forms consist mainly of work performed in a sitting position, which does not engage large muscle groups (resulting in low energy consumption), which is why it is erroneously referred to as light work in many literature and analytical studies. Remote work, however, is arduous, because the immobilization of the body in a sitting position for many hours causes a huge load on the lumbar spine (an increase in pressure in the intervertebral discs), and this promotes the formation of abnormal curvatures of the spine.

Prolonged physical inactivity while working remotely slows down physiological processes (slowed circulation, shallow breathing, fatigue, tiredness), and reduces physical, mental and psychological performance. On the other hand, the routine activities of remote work performed under the time pressure of working mental work (completing data, for example) cause monotony compounding fatigue, stress, headaches, frustration and feelings of job burnout (Geldart, 2022).

Remote work by its specification should be the result of implementing new technologies, so the workstation should be modern, based on current knowledge and experience, and the proposed solutions should be agreed with employees (especially regarding the selection of equipment, organization of working conditions and the impact of external factors on safety and health).

An employee working remotely should have a say in the method and manner of work, working hours, the pace of work, and the timing and length of breaks. Both employee and employer should remember that working from home limits social contact, therefore it is necessary to develop procedures that allow for direct or indirect contacts with the employer and co-workers, and thus induce a sense of social and professional support that reduces the stress of work duties.

The main goal of ergonomics is to ensure occupational health and safety. The employer's task is to ensure compliance with the applicable standards so as to eliminate all environmental hazards and the possibility of accidents in the workplace. However, when employees work remotely, the employer does not always have the opportunity to inspect the ergonomics of workstations outside the office. Undoubtedly, when an employee is in good shape both physically and mentally, the state of their health can translate into many benefits. An ergonomic

workstation has a positive impact on the efficiency and satisfaction of employees. As a result, employees are able to work better and more efficiently. This translates directly into improved functioning of the entire company (Ramos-Garcia et al., 2022).

Summarizing the above considerations, it should be emphasized that remote work has a very strong impact on employee satisfaction and ergonomics. When working outside the office, it is the employee himself who must ensure that his workplace has ergonomic conditions. Most often employees are unable to do this properly. Because of this, when working remotely, they begin to experience various discomforts associated with adopting the wrong position while working. Often there is neck pain, lumbar spine pain. All this causes the employee to perform worse at work, as the work is accompanied by persistent discomfort, and this in turn worsens his job satisfaction. In addition, the need to be isolated from other co-workers is a significant nuisance factor, which also translates into a deterioration of the mood of employees working remotely (Roelofsen, 2002).

3. Methods

3.1. Formulation of hypotheses

Employees' perceptions of work in relation to remote work

The pandemic has caused an unprecedented impact on the lives and work of people around the world (Dubey and Tripathi, 2020). The impact is being felt in the form of fear of infection and greater uncertainty through a contraction of economic activity and widespread shock to the labor market (Lazim et al., 2020).

Workers' perceptions toward work have changed, and these changes are as follows (Gigauri, 2020):

- a change in the content of work, as activities in organizations have changed due to the pandemic,
- a change in work ergonomics due to remote work arrangements,
- and long working hours because there has been a change in the organization work process.

In such unprecedented uncertainty, employees' attention has shifted to the content of work, so in order to understand the impact of remote work on the way work tasks are performed, the following hypothesis was formulated:

Hypothesis 1: The need to work remotely has changed the way work is done.

Impact of remote work on work challenges

The pandemic has greatly affected the way work is done. A form of remote work has been made available to employees to work and fulfill professional responsibilities (Wang et al.,

2021). In addition to the introduction of remote work, organizations have also given employees more freedom to adjust their work schedules and meet the challenges of the pandemic (Caligiuri et al., 2020).

The challenges are for employees to up-skill and down-skill without giving them time to adjust, otherwise they could be left in a compromised position and even lose their jobs (Almaiah et al., 2020).

In the same vein as the precariousness resulting from COVID-19, the risks associated with corporate jobs have increased. These risks include the serious threat of virus infection among employees who work stationary. Those working online have longer hours on digital platforms and a higher levels of dependence on technology (Mishra et al., 2020). Hence, given the above discussion, we formulate the following hypotheses for the study:

Hypothesis 2: There is a direct relationship between the need to work remotely and new challenges to work.

Perceptions of workplace ergonomics

The ultimate goal of workplace ergonomics is to keep employees safe and increase productivity. In addition to these goals, many other benefits are known to accrue to an organization when management is committed to developing and maintaining ergonomics in the workplace. According to Alyan (Alyan et al., 2021), these benefits include increased productivity, increased quality of work, decreased turnover, decreased absenteeism and increased morale.

According to Roelofsen (2002), improving key ergonomic factors in the work environment results in reduced complaints and absenteeism and increased productivity. Bentley (Bentley et al., 2021) suggest that key ergonomic factors that affect employee productivity and performance are office furniture, workspace design, noise/vibration, light intensity and ventilation/humidity. With reference to the above information, the following hypothesis was formulated:

Hypothesis 3: Proper work performance is dependent on the ergonomics of the workstation.

Challenges realized in the workplace

For the past few years, corporations have been undergoing massive changes in organization and structure. New technologies and new ways of structuring operations have left their mark on the working conditions and daily lives of employees.

Deregulation of labor markets, emerging technologies and new types of jobs have caused significant changes in working life, and working conditions are often changing. Such developments have a significant impact not only on companies' organizations, but also on the health, well-being and satisfaction of employees (Wijewantha et al., 2020).

Corporate employees, in whom an increase in psychosocial disorders has been noted in recent years, deserve special and insightful analysis. This may be related to major organizational changes, to restructuring processes or processes resulting from the global economic crisis. Based on the above discussion, the following hypothesis was formulated:

Hypothesis 4: Work challenges and ergonomics are related to working at the workplace.

Relationship between ergonomics and job satisfaction

The pandemic has caused many changes in all areas of life. Due to the need to isolate employees, many companies have decided to implement a remote work model. This different organization of work has also caused changes in the content of work, the way tasks are carried out, work ergonomics, and employee satisfaction.

Workplace ergonomics is the adaptation of the work environment, material work factors, tools and machines to human capabilities. In the workplace, the employer is responsible for creating the best working conditions for employees. When employees were forced to work remotely, it turned out that not every employee is able or has the capacity to create ergonomic workstations for themselves outside the workplace.

Failure to use ergonomic solutions results in frequent discomfort for the employee, which makes him perform his tasks less well. As a consequence of this, he does not feel as high job satisfaction as when working in the office, where his ergonomic workstation allows for better quality and productivity, and this also increases satisfaction. In view of the above discussion, the following hypothesis was decided:

Hypothesis 5: Workstation ergonomics and job satisfaction are related during remote work.

The above discussion with regards to conceptual framework and hypothesis developed are presented in Figure 1.

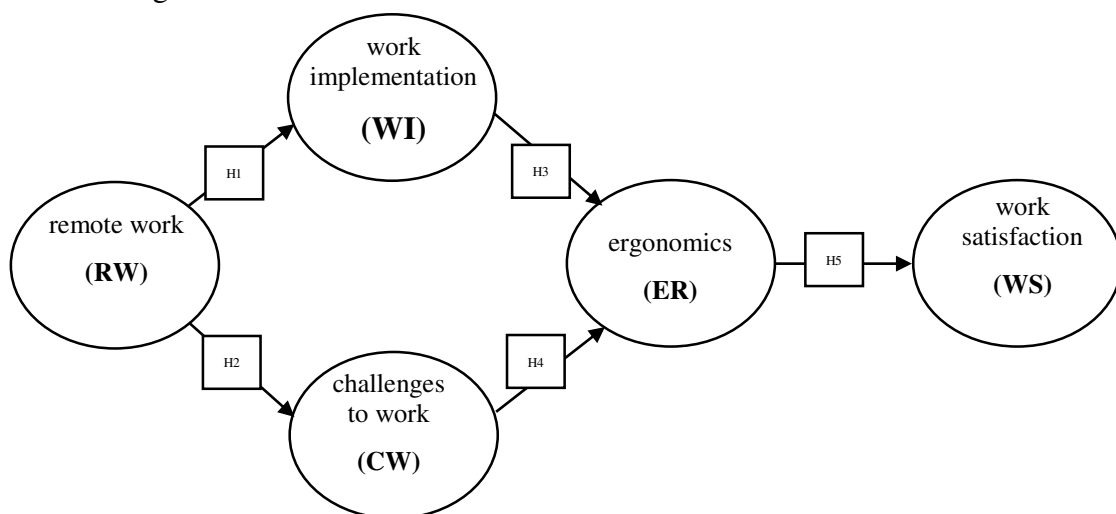


Figure 1. Conceptual framework of the study.

Source: own study.

3.2. Concept of the research plan

A survey method was used to investigate the impact of remote work on ergonomics and job satisfaction among employees of a Bydgoszcz corporation. The survey questionnaire was given to the corporation's employees electronically. Unfortunately, due to the low return of questionnaires, it was decided to implement an additional research method, namely Computer Assisted Telephone Interview (CATI).

CATI is a software tool that fully automatically assists the tele-an interviewer when conducting a telephone interview. Thanks to the presence of the electronic tool, tele-analysts execute the scenario displayed during the survey and have access to an electronic script on the computer, on which they annotate respondents' answers directly during the telephone interview. The software used during the CATI method has the ability to control the interview being conducted and use information about the respondent so as to best tailor the questions (Harris, 2021, pp. 4-6).

After implementing the survey using an electronic questionnaire and implementing another CATI research method, the survey was successfully completed with good results. The corporation employs 310 people, the research project managed to survey and obtain 208 valid questionnaires. All substantive issues found in the questionnaires in the survey were rated on a five-point Likert Scale, ranging from 1 - strongly disagree to 5 - strongly agree. All 310 questionnaires were sent to respondents and 208 valid responses were received, resulting in a response rate of 67.09%.

Respondents in the sample are mainly male $N = 73.56\%$, while the number of female respondents is $N = 26.44\%$. The corporation operates in the industrial sector, hence the higher percentage of hiring men. On the other hand, the employees of the corporation surveyed are mostly those who have completed their first degree (engineer/license) $N = 47.6\%$. A master's degree is held by $N = 42.8\%$ of those surveyed, and other degrees by $N = 9.6\%$. Work experience is also an important characteristic. The surveyed company has the highest number of employees who have worked for less than two years, $N = 47.2\%$. Those working more than two years but less than five years are $N = 28.4\%$. Employees working more than five years but less than 10 years are $N = 23.2\%$. In contrast, employees working more than ten years are the least, as they account for only $N = 1.2\%$.

Remote working significantly changes the organization of work in any company. Relying on the research carried out by Yang's research team (Yang et al., 2022), the following elements were found to define this parameter: new work organization (RW1), changing technology (RW2), increased stress (RW3), changing the rules of ergonomics (RW4) and more frequent complaints (RW5).

This measure includes the roles, responsibilities and reporting structure of the structure within the organization. Factors related to this study are linked through the research of Yogesh's team (Yogesh et al., 2020): assigned tasks (WI1), responsibility (WI2), communication (WI3), reporting results (WI4), structure (WI5).

It refers to a workplace situation that has the potential to cause injury or negative health effects to those working in the office or factory. Factors related to corporate work and workplace hazards were captured in a study by Mishra's team (Mishra et al., 2020); therefore, indicators were developed for analysis based on this study; these are: organizational culture (CW1), promotions/awards (CW2), commitment to work (CW3), career development (CW4), work safety (CW5).

A concept that is related to the study of space and practice in the workplace. The basic premise of ergonomics is to understand human needs and their space to interact with co-workers, as well as to provide physical space for work (Wilson, 2000). Based on this definition, the following elements of the study were adopted: comfort in the workplace (ER1), microclimate (ER2), break time (ER3), social factor (ER4), work posture (ER5).

It is an approach to the workplace that results in creating the right conditions for all members of the organization so that they give their best every day, are committed to the goals and values of the organization, are motivated to contribute to its success, have a heightened sense of being able to succeed, and have a sense of well-being as a result. The study considered the following factors related to employee satisfaction: sense of professional fulfillment (WS1), good relations with colleagues (WS2), work motivation (WS3), positive attitude (WS4), atmosphere (WS5).

The study applied WarpPLS 8.0, which is the most accepted PLS tool used for path-analysis models (Kock, 2019). This tool supports the methodological development of paths in comparison to the traditional PLS tool and thus supports building the gap between factor-based and composite-based structural equation modeling techniques. The study also applied Cronbach alpha to understand the reliability analysis of the constructs derived for the study.

Chen and Paulraj's (2004) findings suggest a three-step process for measuring reliability, validity and unidimensionality. To assess reliability for constructs, the average correlation between items on the scale was used. The results are shown in Table 1.

Table 1.
Cronbach's alpha, SCR and AVE

Examined variables	Indication	Cronbach's alpha index	Standardized factor loading λ_i	Composite reliability coefficient (SCR)	Average variance extracted (AVE)
Remote work					
new work organization	RW1	0.72	0.806	0.82	0.63
changing technology	RW2	0.84	0.849		
increased stress	RW3	0.76	0.835		
changing the rules of ergonomics	RW4	0.68	0.613		
more frequent complaints	RW5	0.93	0.714		

Cont. table 1.

Work implementation					
assigned tasks	WI1	0.87	0.754	0.87	0.58
responsibility	WI2	0.88	0.649		
communication	WI3	0.73	0.642		
reporting results	WI4	0.70	0.680		
structure	WI5	0.68	0.787		
Challenges to work					
Organizational culture	CW1	0.89	0.714	0.93	0.80
Promotions/awards	CW2	0.81	0.809		
Commitment to work	CW3	0.77	0.516		
Career development	CW4	0.79	0.763		
Work safety	CW5	0.85	0.614		
Ergonomics					
Comfort in the workplace	ER1	0.71	0.641	0.94	0.74
Microclimate	ER2	0.72	0.653		
Break time	ER3	0.74	0.543		
Social factor	ER4	0.87	0.911		
Work posture	ER5	0.75	0.902		
Work satisfaction					
Sense of professional fulfillment	WS1	0.87	0.831	0.75	0.55
Good relations with colleagues	WS2	0.75	0.718		
Work motivation	WS3	0.87	0.693		
Positive attitude	WS4	0.88	0.802		
Atmosphere	WS5	0.91	0.730		

Source: own study.

The Cronbach's alpha (α) value for the items and scale was well above 0.7, which is higher than the recommended value (0.6) (Cronbach, 1951). In addition, it was noted that all individual factor loadings (λ_i) were greater than 0.5, the reliability coefficients of the composite scale (SCR) were greater than 0.7, and the average variance extracted (AVE) was greater than 0.5 (see Table 1). This confirms that the constructs adopted for the study have adequate convergent validity (Chen, Paulraj, 2004).

3.3. Results

PLS does not assume a multivariate normal distribution. Therefore, traditional parameter-based parametric tests of significance are inadequate. PLS uses a bootstrapping procedure to estimate standard errors (SEs) and significance of parameter estimates (Chen, Paulraj, 2004). Table 2 gives PLS path coefficients and p-values. The estimated coefficients are interpreted as standardized beta coefficients, and the same is shown in Figure 2, which shows the final PLS model.

Table 2.
Structural estimates

Hypothesis	Impact on \longrightarrow	following elements	β	P	Results
H1	remote work	work implementation	0.67	0.001	Supported
H2	remote work	challenges to work	0.87	0.11	Not supported
H3	work implementation	ergonomics	0.63	0.23	Not supported
H4	challenges to work	ergonomics	0.59	0.07	Not supported
H5	ergonomics	work satisfaction	0.54	0.001	Supported

Source: own study.

The study tested hypotheses: H1 (remote work \rightarrow work implementation) ($\beta = 0.67$, $p = 0.01$), H2 (remote work \rightarrow challenges to work) ($\beta = 0.87$, $p = 0.11$), H3 (work implementation \rightarrow ergonomics) ($\beta = 0.63$, $p = 0.23$), H4 (challenges to work \rightarrow ergonomics) ($\beta = 0.59$, $p = 0.07$) and H5 (ergonomics \rightarrow work satisfaction) ($\beta = 0.54$, $p = 0.001$). The results indicate that H1 and H5 are supported ($\beta = 0.67$, $p = 0.01$; $\beta = 0.54$, $p = 0.01$) for the study hypothesis.

4. Discussion of results, implications for research and managers

The empirical results clearly indicate that workstation ergonomics has an impact on employee satisfaction. Directing employees to work remotely for many companies meant savings in terms of the lack of costs of maintaining workstations. However, few supervisors were aware that work done from home can be done very differently. Moreover, paying attention to the problem of ergonomics in remote work at the beginning of the pandemic period did not seem important at all. However, studies conducted on corporate employees have shown that work done remotely significantly affects the results of the tasks performed. It turns out that the lack of an ergonomic workstation in employees' homes resulted in reduced job satisfaction. The reasons turned out to be very simple. Namely, working for hours at home without a properly created workspace began to cause a feeling of discomfort on employees in the long term, this translated into less satisfactory results of their work, and this in turn caused them to feel less satisfied with their work.

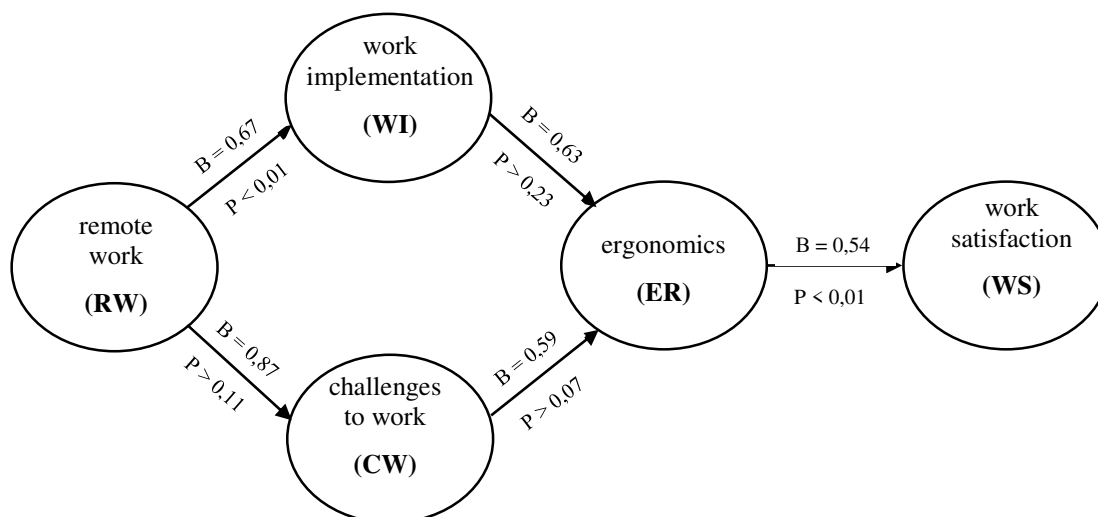


Figure 2. Final PLS model.

Source: Own study.

Respondents admitted that an ergonomic work environment allows them to perform their tasks well, so they feel professionally fulfilled, their motivation to work increases, and they have a positive attitude. With frequent breaks, they manage to build and maintain good relationships with their colleagues, and this in turn helps create a great atmosphere at work. Unfortunately, pandemic times and the need to work remotely have worsened these parameters. The lack of a comfortable position at home, where work was often done in random places, while doing family and household chores at the same time, caused employees to definitely not feel professionally fulfilled, and it was also difficult for them to maintain collegial relationships with colleagues, as they were isolated. This influenced the means to decrease their motivation to work, and thus made them feel no job satisfaction.

Working remotely was not easy for all corporate employees to implement. This is because it involved a new organization of work, increased stress levels caused by working in isolation from the rest of the workforce, and was also fraught with a lack of ergonomics. All these elements, according to the respondents, significantly affected the way they performed their tasks. It turned out that remote work for many turned out to be a challenge and taking on a lot of responsibility. There were also often problems related to communication or reporting of results. Employees of corporations unequivocally admitted that remote work has strongly influenced their professional life and has also brought a lot of chaos to the structure of the entire organization.

The role of ergonomics in remote work and its impact on job satisfaction is an issue that has not been the subject of any previous scientific consideration. The key element of the study is a significant contribution to the literature on ergonomics in remote work and its impact on employee job satisfaction. It is worth noting that the completed study is one of the few studies that integrate ergonomics and employee satisfaction and remote work from a COVID-19 pandemic perspective.

The results of this research can provide useful guidance for corporate management and employees. First, they should consider implementing a support program for employees who work remotely. They could receive a one-time grant from their employer to create an ergonomic computer workstation in their home. Since the lack of ergonomics makes remote work so difficult, it should be in the employer's interest to make changes in this area.

Managers, thanks to the completed survey among corporate employees, can also realize how important it is for an employee to perform tasks correctly, according to the supervisor's expectations, and how strongly this affects the level of job satisfaction.

The above research shows that the need to carry out work remotely has caused employees a number of difficulties. These range from a lack of support and preparation of off-site workstations, to poorer task performance, to experiencing less job satisfaction.

Ergonomics is a scientific discipline that receives too little scientific attention in Poland all the time. Its impact on real business performance is underestimated. Meanwhile, the completed study clearly shows that by designing ergonomic workstations, not only social benefits can be achieved, but also economic benefits for the organization.

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EFFECT OF DIETS OF PATIENTS USING DIETARY GUIDANCE SERVICES IN SOUTH-WESTERN POLAND ON QUALITY OF LIFE

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Purpose: The present paper aims to approximate issues related to the quality of life, which is directly affected by health status and nutrition.

Design/methodology/approach: Over the last years, there has been a noticeable trend towards healthy diets and physical activity. This is crucial for modern civilization with all its inherent lifestyle disorders and chronic diseases. These issues are correlative as demonstrated by the authors based on the empirical study and literature review of the presented problems. An empirical study referring to the problems discussed was conducted on a group of over one hundred respondents (patients of dietetic clinics).

Research limitations/implications: The results directly indicated that people who eat healthy diets, as verified by the regularity and type of products consumed, rate their quality of life relatively higher than those who do not pay attention to their nutrition.

Originality/value: The paper also refers to issues related to health and its impact on the perceived quality of life, which are correlated. An important point to emphasise is that the article points to issues that are a reflection of everyone's life, and learning about the relationships presented can contribute to greater awareness and a relatively higher quality of life.

Keywords: quality of life, healthy lifestyle, diet, health status.

Category of the paper: research paper.

1. Introduction

Many problems are encountered when defining lifestyles and quality of life. Lifestyle is a sociologically grounded concept characterized by multiple points of view (Jensen, 2007). One of the definitions states that it is the way an individual exists or would like to exist (Pulkkinen, Kokko, 2010). Another defines it as the sum of health factors such as diet, physical

activity, and stimulants (Bolt, 2002). Lifestyle is defined as the material expression of an individual's identity (Wilska, 2002) and a set of practices and attitudes that make sense in specific contexts (Chaney, 1996). In order to correctly interpret people's lifestyles, it is important to understand the differences and similarities between the different ways in which individuals encounter reality and lead their lives, how they develop and express their personality and identity, and how they form relationships with other individuals/social groups (Johansson, Miegel, 1992). It is indicated that even small differences in lifestyles can have a large impact on a person's health (Khaw et al., 2008).

Leading a healthy lifestyle, including eating a healthy diet and staying physically active has an effect on a higher perceived quality of life. A literature review reveals often divergent and mutually exclusive views, which is due to both the interdisciplinary approach of the science and the broad spectrum of interest. WHO defines the quality of life as "the individual's perception of the position of life of individuals in the context of the culture and value system in which they live and in relation to their goals, expectations, and standards" (WHO, 1996). The homogeneous nature of definitions of economic sciences, attempts to conceptualize psychological sciences, and approaches from the perspective of medicine, pedagogy, and sociology show the importance of addressing this problem. Table 1 presents the predictors of quality of life as looked at by the different fields of study (Trzebiatowski, 2011; Wnuk, Marcinkowski, 2012).

Table 1.

Predictors of quality of life by field of study

Field of study	Predictor of quality of life
Economy	Objective living conditions (financial wealth of representatives of the society)
Psychology	Quality of adolescence, positive interpersonal relations, capacity for self-actualization, self-realization, self-expression and self-transcendence, adaptive habits, and cognitive schemas
Pedagogy	Education and values
Sociology	Interpersonal relations
Medicine	Mental, physical, and social well-being

Source: Wnuk, Marcinkowski, 2011, 21-26.

Health is a concept inextricably linked to the quality of life and is one of the most important values. It is defined by WHO as "a complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2007). It is a multidimensional term, sociologically defined as a dynamic balance between the opportunities and constraints of daily life dependent on external factors on the social and environmental levels (Huber et al., 2011). Although the assessment of the quality of life has become increasingly important in health care over the past few decades (Ferrans et al., 2005) underestimation and underutilization of preventive lifestyle treatments (Angell, 2009) are still common.

Health-seeking behavior has a huge impact on the perceived quality of life. The concepts of quality of life and health are often found in the literature as interchangeable terms. Quality of life is a broader term, encompassing a greater number of determinants. The concept of quality

of life was introduced into medical science by Schipper, who defined it as "the functional effect of the disease and its treatment as perceived (experienced) by the patient" (Schipper, 1990). This term represents the patient's physical and mental state and mobility, social and economic situation, and somatic experiences (Trzebiatowski, 2011). Quality of life can be a measure of health (Wonjeong, Eun-Cheol, Sung-In, 2020) (Table 2).

Table 2.

Model of health-related quality of life

Patient's sphere of life	Criteria to be assessed
Physical	- basic physiological needs, - self-care abilities, - mobility, - physical activity, - performing social roles (in the family, at work)
Psychological	- the degree of adaptation to the disease, - experiencing negative and positive feelings, - presence of mental disorders
Social	- interpersonal contacts (type and quality), - social activity, - receiving support from the immediate environment
Somatic	- presence of disease symptoms (type, severity, and frequency), - their possible effect on changing the existing quality of life

Source: Kurpas, Czech, Mroczek, 2021, 717-181.

The effect of physical activity on human health is becoming an increasingly important topic in both research and practice of individuals due to a range of physical, psychological, and social benefits (McConnell-Nzunga et al., 2020; Shuremu, Belachew, Hassen 2023), and reduction of non-communicable diseases (Sun et al., 2021). Its absence is a predictor of chronic disease development (Galle et al., 2020). Physical activity improves human health (Bruseghini et al., 2020) regardless of age, gender, ethnicity, or weight (Nocon et al., 2007). Another determinant of human quality of life is diet (Mann, Truswell, 2002). Food intake is a prerequisite for the existence of any living organism as it requires a regular supply of energy and nutrients regardless of age, sex, or location (Whitney, Rolfes, 2019), taking into account individual health, genetic, and cultural determinants. Nutrition is the process of providing or obtaining the food necessary for health and growth. Among the elements that influence the healthy character of a diet are energy balance, the regularity of meals, and their variety (Mann, Truswell, 2002). Proper nutrition promotes health and well-being, influences the mental balance of a person, his or her perception of reality, and interpersonal relations. Food choices and behavior depend on biologically determined behavioral predispositions (taste, hunger, and satiety mechanisms), food experiences (psychological and social conditioning), personal determinants (intrapersonal and interpersonal factors), and social factors (Remick, Polivy, Pliner, 2009). This behavior depends largely on the environment in which the individual lives and the cultural norms that form and limit individual decisions. Nowadays, the conscious consumer is interested in the origin of the product and its quality (Cantarelli, 2016). Increased consumer motivation and engagement have been shown to be a key driver of healthy and sustainable eating (Wonjeong, Eun-Cheol, Sung-In, 2020). Unbalanced diets and insufficient physical activity are major

threats to health worldwide (Adhikari et al., 2022). The growing epidemic of chronic diseases, affecting both developed and developing countries, is linked to changes in diets and lifestyles (WHO, 2003; Laster, Frame, 2019). These diseases significantly reduce the quality of life of society, while burdening the budget of states through the cost of treatment of citizens (Ilan, 2021). For this reason, the governments of some countries, including Denmark, Hungary, and France, collect taxes on unhealthy (Bruce, 2012). Studies show that socioeconomic conditions and quality of life have a strong effect on the BMI of the population (Banterle, Cavaliere, 2014; WHO, 2006). It is debatable whether income level affects food choices. Based on empirical findings, Carlson A. and Frazao E. demonstrated that there is no basis for the conclusion that people with lower income cannot afford healthy eating. Age and education undoubtedly have a significant effect on the quality of diets (Carlson, Frazao, 2012). People with higher education are healthier and live longer. Studies by Koc and Kipperluis showed that their diets are of higher quality (Koc, Van Kippersluis, 2017). The aim of the present study is to approximate issues related to the quality of life, which is directly affected by health status and nutrition.

2. Material, Methods and results

The study examined 104 people. The respondents were a group of patients receiving dietary guidance from south-western Poland. The survey was conducted in the second half of April 2019. The research method was a diagnostic survey and the research tool was a survey questionnaire developed for the purpose of the study by the authors. Based on the questionnaire, the respondents assessed their quality of life and answered questions about their diet. The questionnaire consisted of questions referring to subjectively assessed quality of life, specifying individual spheres of life, including physical, mental, social and somatic. Respondents also answered questions related to eating habits. The survey was characterized by anonymity, and respondents were informed about the purpose of the survey, so they did not feel embarrassed and their answers were more honest. The study group was selected using a non-probabilistic distribution with a network nature. The aim of the study was to analyze the correlation between the quality of life and diet. The following elements were considered as proper nutrition: regular meals (quantity and frequency of meals) and paying attention to the type of raw materials and products consumed, and their origin. Quality of life has been evaluated as a general measure of life satisfaction. The results obtained in the study were used for statistical analysis. The chi-square test was used to analyze the relationship between variables. For small expected sizes, Yates' correction or Fisher exact test was used. The significance level was set at $\alpha=0.05$. The results were considered statistically significant when the calculated test probability fulfilled the inequality of $p<0.05$. Calculations were performed using Statistica 10.0 Statsoft Polska software.

A group of 104 people participated in the study, including 78 people who declared to be healthy (75% of the respondents). It is worth emphasizing that the respondents assessed their health status fully subjectively (no criterion of necessity to specify a particular disease). Men constituted a group of 40 people (38% of the study group). The age range was as follows: 66 people aged 26-45, 32 people aged under 25 (31%), and a group of 6 people aged over 45 (6%).

Quality of life was measured on a scale from 0 to 7 (with 0 meaning no satisfaction, 1 - very low satisfaction, 2 - medium-low satisfaction, 3 - low satisfaction, 4 - average satisfaction, 5 - medium-high satisfaction, 6 - high satisfaction, and 7 - very high satisfaction). The results of the empirical survey indicated that more than half of the respondents (51%) describe their quality of life as high, 27% as very high, 17% as medium-high, and only 4% declared their quality of life as average (table 3).

Table 3.

Perception of quality of life by respondents

Variable	Mean	Standard Deviation	Minimum	Maximum
Quality of Life	6	0.800485	4	7

Source: author's own study based on the empirical research.

Respondents who described themselves as unhealthy additionally assessed their quality of life in relation to physical, psychological, social, and somatic factors (according to Table 2) (Kurpas, Czech, Mroczek, 2012). The lowest scores were found for somatic factors ($M = 4.88$) whereas the highest - for physical factors ($M = 5.92$), as shown in Fig. 1.

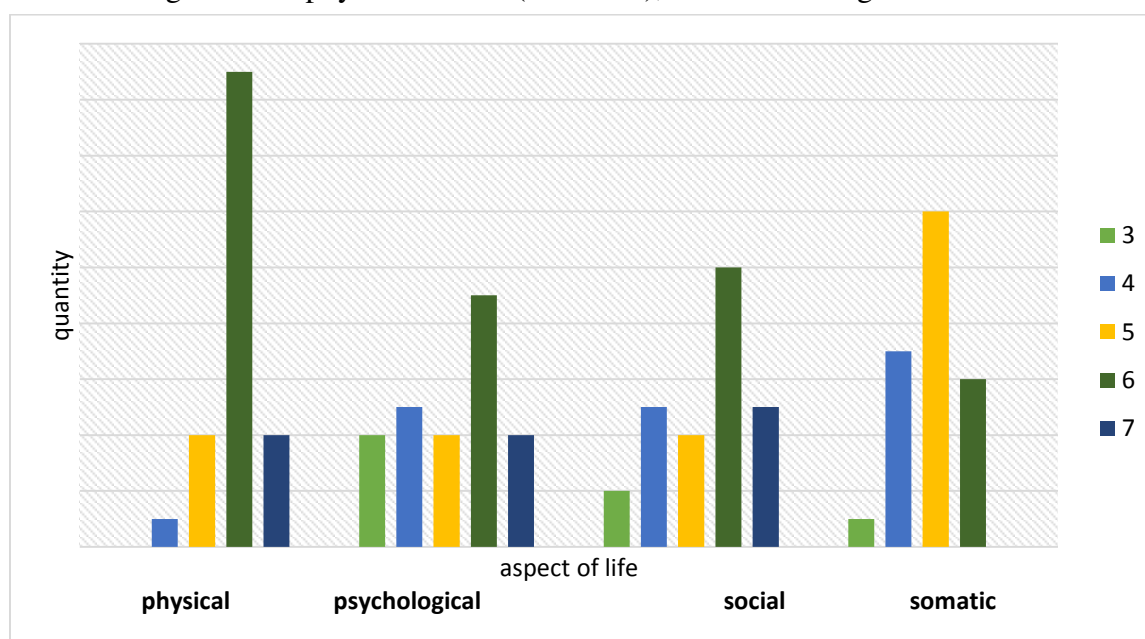


Figure 1. Health-related quality of life according to patients in aspects of physical, psychological, social, and somatic life (with 0 meaning no satisfaction, 1 - very low satisfaction, 2 - medium-low satisfaction, 3 - low satisfaction, 4 - average satisfaction, 5 - medium-high satisfaction, 6 - high satisfaction, and 7 - very high satisfaction).

Source: author's own study based on the empirical research.

The diet considered according to the study assumptions as healthy was declared by 51% of the respondents. These respondents showed that they paid a lot of attention to the meals they had and their regularity. The analysis revealed is a correlation between the quality of life and diet. The result is statistically significant ($p = 0.017$) (table 4). This observation is confirmed by the arithmetic means: for the group of respondents without a balanced diet $M = 5.81$ ($SD = 0.92$), while for those following a balanced diet $M = 6.20$ ($SD = 0.60$). Analysis using the Student's t-test indicated a statistically significant result ($p = 0.013$). It is highly probable that this is related to a greater awareness of both the principles of proper nutrition, leading healthy lifestyles, and self-perception. People with more knowledge in a variety of fields rated themselves and their happiness higher. The proportion of grades 6 or 7 in the group meeting the criteria for healthy nutrition is significantly higher compared to those not meeting the criterion (90.2% vs 66.0%). It is important to note that people who reported healthy nutrition rated their quality of life higher.

Table 4.
Quality of life and nutrition

Total	Chi-squared	df	p
Pearson's chi ²	10.19202	df = 3	p = .01700

Source: author's own study based on the empirical research.

The analysis showed that women who were on healthy diets assessed their quality of life significantly better. In contrast, in the male group, this result was statistically insignificant ($p = 0.054$) at the level of a noticeable trend. Fisher's exact test was used due to the small group sizes. It is likely that increasing the size of the study group would have a positive effect on the significance of the results, as a correlation similar to that observed in the group of women occurred. However, there is no statistical basis to consider the correlation as significant.

The correlation between an individual's health status and perceived quality of life is statistically significant. No correlations were found in the group of unhealthy people. The Fisher's test showed statistically insignificant results, which may be due to the small sample size as the differences in percentages are noticeable. The correlation found among healthy people is statistically significant based on Yates' correction ($p = 0.043$). The correlation between the quality of life and age is close to the statistical significance ($p = 0.059$). There is a tendency for the assessment of the quality of life to decline with the age of respondents (table 5).

Table 5.
Correlations between successive research elements

Quality of Life		Chi-squared	df	p
Criterion	Type of test used			
Women	Pearson's chi ²	4.338376	df = 1	p = .03726
Men	Two-tailed Fisher's exact test			p = .05360
Health status	Pearson's chi ²	25.47433	df = 1	p = .00000

Cont. table 5.

Unhealthy	Two-tailed Fisher's exact test			p = .22797
Healthy	Yates' chi ²	4.087765	df = 1	p = .04319
Age	Pearson's chi ²	5.666452	df = 2	p = .05882

Source: author's own study based on the empirical research.

3. Discussion and conclusions

Human potential is a predictor of the dependence of the quality of human life depends on awareness, health status, and knowledge and life experiences. It consists of such factors as competencies (knowledge, qualifications), internal motivations and the physical dimension understood in terms of such aspects as health or fitness (Gableta, 2003). The quality of life of the elderly, similarly to those chronically ill, is assessed relatively lower compared to younger and healthy people (WHO, 2002). Similarly to empirical studies conducted by the authors of the present article, the analysis of studies by other authors performed in the area of Poland shows that more than half of women suffering from chronic diseases assessed the quality of life as bad, while in the group of men, bad and very bad assessment was declared only by 32% of respondents (Pufal et al., 2004). Banaszkiwicz points out that while in gastrointestinal diseases that impede physiological functions (intestinal stoma), poor quality of life occurs in both sexes in a very similar percentage, very good quality of life was observed in the group of men 3 times more often (Banaszkiwicz et al., 2007). A high sense of the quality of life among unhealthy people facilitates coping with the disease (Sęk, 1993). It is indicated that quality of life deteriorates as the disease progresses (Glińska et al., 2021). It should also be noted that there is a correlation between regular physical activity and a higher quality of life (Watson et al., 2023, pp. 359-363). In addition, the 2030 Agenda for Sustainable Development draws attention against the background of sociological conditions, in which a new framework for the quality of life of residents is proposed. This document draws attention to the quality of life discussed in this article, as well as places great emphasis on pro-social behavior affecting pro-environmental behavior (McGuine et al., 2022). It should be pointed out that Puciato et al. when surveying the residents of Wrocław indicated that they rated their health-related quality of life in the social domain highest and in the physical domain lowest. They declared that the people surveyed indicated their quality of life to be average or below average. It should be pointed out that this is the same study site as that of the authors of this article (Puciato et al., 2023). It is worth noting the upward trend in the assessment of the quality of life among older adults and those chronically ill with higher education compared to those with lower education (Wysokiński et al., 2011). Social status correlates with diets. Nowadays, meals are used by consumers not only to satisfy their basic physiological needs but also those of a higher order related to displaying their social position, social contacts, or personal development (Grębowiec, 2012).

The analysis of the study by Chanduszko-Salska and Chodkiewicz indicated that, with respect to healthy dietary behavior that directly affects body weight, overweight and obese women were less satisfied with all aspects of their lives than those from the control group (with normal body weight) (Chanduszko-Salska, Chodkiewicz, 2010).

Our empirical studies confirmed that subjectively assessed quality of life correlates with diets. People who eat healthy diets (51% of respondents) indicated higher life satisfaction. This is determined by many factors. The correlation between healthy nutrition and health status does not show significance but a trend of healthy eating among healthy respondents using dietary guidance services is observed.

In addition, it should be noted, based on the results of empirical studies, that healthy nutrition can influence by increasing the subjectively assessed quality of life on the productivity of a person's activities, but also increases the productivity of employees, as well as the company as a whole, putting these relationships from an economic point of view. A team of researchers from the Health Enhancement Research Organization (HERO), Brigham Young University and the Center for Health Research at Healthways found that employees who eat a healthy diet and exercise regularly perform better at work. In their research, they showed that employees who ate healthy throughout the day were 25% more likely to perform better at work (HERO, 2016). It is therefore recommended, also from the employer's perspective, that employees take care of a healthy diet, which can increase their quality of life, willingness to perform their job duties and productivity.

It is worth considering further research in the areas of healthy eating, quality of life as well as the introduction of the factor of productivity and efficiency of work activities.

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USER AS A SOURCE OF THE INNOVATION BASED PRODUCT VALUE

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Purpose: Development of the customer perceived value expression with the product use functions optimization model aiming particularly the case of new technology based innovations.

Design/methodology/approach: Firstly, the role of customer is presented with particular attention paid to the client role in value creation process in the case of innovation based product. Then the perceived customer value and customer value definition are described. Those formulas are used in consequence as the base for expanded theoretic value concept, which is integrating the impact of used product brand and user functions mix. Finally, the introduced notion is developed in matrix form and briefly discussed.

Findings: Extended formula of innovation based new product perceived customer value is presented in the form of the matrix notation, the possible application in the company innovation based product portfolio formation process is discussed.

Research limitations/implications: Presented approach to the customer perceived value is based on the application of technical debt concept as the measure of analyzed product innovativeness, which is sensitive data and stay difficult to collect, particularly in case of new technologies.

Practical implications: Proposed extended customer perceived value formula can be used as practical tool of new technology based innovative product, allowing to assess its market value in comparison to the existing company product cost structure. Makes possible to confront the customer product appreciation to those coming from the company interior analyzes. Hence its matrix form can serve as optimization model taking under consideration the possible market potential, impact of used brand and design and product use functions mix according to their technology life cycle.

Social implications: Developed concept can reinforce the client role in commercialization process, particularly in case technology innovation. Also its use can be an interesting tool of presumption development, making it more unambiguous and proactive.

Originality/value: Presented extended formula of customer perceived value can be applied as an interesting concept of research about nature the value of new technologies based innovation product also as base for practical managerial tool of optimization the new product mix during the commercialization process.

Keywords: perceived innovativeness product value, new technology, technical debt.

Category of the paper: Conceptual research paper.

1. Introduction

The customer's participation in the value creation process leads to the conceptualization of new business models, breaking with product-centrism and more focused on the customer and his or her individual needs. This approach is also related to product innovation, resulting from a strong drive for differentiation. The innovation introduced by the company develops into customer-oriented value creation and results in a concept of customer-oriented innovation. A new organizational logic resulting from the customer-oriented value creation process requires an unambiguous formalization of the individual components of the latter. This approach assumes that the company, in order to maintain its competitive position, monitors customers for changing needs and competitors for changing products. Since innovation creates its market by conceiving a discontinuity of customer perceived value, a new strategic view of innovation is required to overcome the constraint of a defined business and market (Wu, 2005). The major challenge for a company that wishes to create radically new values and develop new markets, is to make a totally new strategic perspective based on strong relationships with customers. To create customer feedback loop, it is necessary to determine specific areas of user impact on the innovative process in a given company. Hence the key research issues that should be addressed to determine the components enabling the implementation of this process and the conceptualization of the appropriate organizational logic based on innovative product value as the user functions set. The growing importance of a customer-oriented management approach is the reason for increasing the interest in the product value concept. In addition, the development of new technologies contributes to the search for reliable tools of innovative products value measure, hence the order of presented contents. Firstly, the essence of new technologies based value creation is described, particularly underlying the customer role. Secondly, selected customer value models are described with attention paid to their possible quantification. Finally, the own concept of such value model is presented, taking into account the impact of design in relation to the individual product use functions with their technical debt as an innovation measure parameter.

2. Customer-oriented approach to the new technology and its impact on product value development

M.E. Porter's value chain applied to the innovation process has become the basis of value creation models for new technologies. For the correct application of this process, it is important to properly identify its basic and auxiliary activities. Basic activities are

directly related to the innovation model and are as follows: identification of needs, research, development (innovation), commercialization, dissemination and adaptation. Indirectly affecting the course of innovation, auxiliary activities, like competence management, research and development of technological infrastructure and knowledge management, are also needed (Porter, 1993). This division is practically a reflection of the classical approach and does not emphasize the importance of knowledge resources, including them into auxiliary activities. This is contrary to the intuitive understanding of innovation as a derivative of knowledge resources. Assuming that the concept of a knowledge-based chain reflects the essence of innovation better, it will become important to map this process to determine the way in which the value of an innovation process should be understood by its individual participants. By analyzing different types of this process, it is also possible to determine the roles of its participants in creating values at each stage of the process.

The concepts of these values are general in nature and not specific to one company only. In the proposed model of the innovation value chain, different types of value can be created by different participants. However, the accepted taxonomy of the participants needs to be clarified: the concept of the innovative knowledge producer refers to the legal or physical entity responsible for the value generated in the activities of knowledge recognition, testing, implementation and application. It is important that the innovative knowledge should provide an opportunity for the company's operations in a proven way, creating the value of potential development. According to C. Van Horne, J.M. Frayret and D. Poulin, the user of innovative knowledge can be defined as an internal or external customer (Van Horne, Frayret, Poulin, 2006). The customer's activities include the use of new knowledge to develop a product or its new application. This also applies to prototypes. The essence of the customer's role in the value creation process is therefore closely related to the ability to identify the possibilities of implementing innovation, and thus to give it potential value. It is also important to create the right infrastructure to enable the customer to obtain value from the innovation. Customers can serve as valuable partners for company product, service or process innovations by contributing innovative ideas or engaging in collaborative development projects. They can also speed up innovation development processes, engage in a larger and more long-term oriented communication process and gain access to a wider perspective on possible modes of commercializing new technology. Adopting a user-centric approach by company management requires customer involvement. Hence, the importance of customer innovativeness, defined as the capability to create and implement innovations, throughout the operating and technical systems of the company. It is a basic determinant of the customer's demand for innovation, information, and access (Ritter, Walter, 2012).

Customer innovativeness plays a primary role in the value creation reorganization assisting companies to anticipate value proposition preparation and constituting at same time a significant source of market knowledge. Integrating customer innovativeness requires building a communication system which has to be a guarantor of communication continuity

insuring a comprehensive incorporation of customer opinions even when they are opposite to the vision of company management. Customers with a high level of innovativeness have more experience in concretization of future user functions thus predetermining the market value of innovation based new products or services (Pieper, 2019). Customer participation in the technology innovation development process helps also to maintain an adequate life cycle for this process helping to reduce the risk of overinvesting in undesirable new technology product applications (Klennera, Hüsigg, Dowling, 2013).

Therewith the economic value of technology remains an unspecified concept until its commercialization, often consisting in the creation of an appropriate business model. H. Chesbrough argues that a mediocre technology supported by a good business model may be more valuable than a good technology supported by a mediocre business model (Chesbrough, 2010). In the adopted pro-consumer perspective, it is therefore important to determine the path of monetization of the new technology, and here the perspective of the potential user cannot be overlooked. However, along with the desire to include customer interaction as the basis of the product concept or business model for a new technology, it is important to take into account the statement of E. Esposito that the customer will value the product's technical and economic parameters in a variety of ways - some will be more important to him or her, others less important (Esposito, 2004). Market success, on the other hand, will depend on the performance of various activities resulting in compliance with the existing customer preferences. This approach includes the point of view of the customer and not of the designer, which fits into the market-oriented management. Such an attitude makes it possible to avoid the isolation of the market for new technology, which is usually a significant problem for companies. Different technological parameters of the product are usually not related to each other. From such a perspective, the characteristics of the product will become a compilation of technological and economic parameters. The innovation of the product will depend on what parameter is dominant in its existing characteristics. In turn, G. Tyng-Ruu Lin and J. Lin point out that in the light of growing customer requirements, achieving the durability of the value will depend on offering it simultaneously to all stakeholders of the company (Tyng-Ruu Lin, Lin, 2006). The classic concept of value is related to the usability of the products and also depends on understanding the specifics of customer needs and the speed of their satisfaction. Real value growth, long-term growth and profitability growth occur when companies are constantly developing their products and services by offering unique benefits to a selected group of customers. Maintaining a leading position therefore requires ensuring a continuous process of value creation. This approach refers to a thorough analysis of the needs of all innovation stakeholders, their preferences, feelings and emotions.

Despite their ability to create productive innovation, some companies are failing in the market. This loss of market advantage, despite offering highly innovative products, is becoming an important area of discussion and scientific and practical research. Some companies have lost their marketing skills to commercialize their innovations. It can be assumed that these companies are unable to adapt their business models to the

changing environment. This means that in the future, competition will not only concern products and technologies, but also the business model. Unfortunately, many companies build their business model based on limited information about the environment in which they operate (e.g. the fall of Kodak, overlooking the potential of the digital photography market). According to O. Gassmann, K. Frankenberger and M. Csik, companies introduce solutions that are not adequate not so much to the current market situation, but to existing trends and potentially possible changes in the functioning of society (Gassmann, Frankenberger, Csik, 2020). Usually, in such a situation, failures are accompanied by a reaction leading to the intensification of research on the development of new technologies and new products that increase the functional aspects of the current ones. R.G. Mc Grathy noticed, that some companies can be assessed by determining the degree of uncertainty in the development of innovation initiatives in relation to core activities (Mc Grathy, 2013). Some of such innovation initiatives will be linked to the expansion of the core business in order not to lose existing customers in the future. In the case of such companies, the degree of market and technological uncertainty is low. The development of core business in such conditions will be based on activities leading to increased efficiency in order to maximize the related sales revenues, thanks to which the company achieves its goals. However, if the core activity is not competitive, the introduction of innovation initiatives should serve to strengthen it. It happens often that a company develops new activities, which in the future have a chance to become core ones. In such a case, it is important to invest in new economic platforms, the development of which will be based on an innovation process. In all the cases presented above, such platforms, maintaining close contact with potential users of new products, can also become a tool for actions to minimize the risk associated with innovation. According to H. Campos, the analysis of user reactions and behavior will not only be based on statistical data, but on new ways of creating product meaning (Campos, 2021). Previous observations show a very low awareness of the user's new needs, hence the emergence of a new role for designers – identifying new needs in terms of making corresponding meanings. Such a perspective is necessary for the effective management of the innovation process, especially in the aspect of effective commercialization of new products.

The above approach to innovation breaks with the classic link with research and development. The new approach emerges as a reaction to linking innovation and technological development too closely, at the expense of a company's development and changing its operation strategy. Strongly innovative companies do not necessarily spend the most, but effectively link their innovations with the implemented strategy. They focus the management process on innovation for which they create a strong cultural support accompanied by high knowledge and understanding of the end users. Such an extension of the concept of innovation does not negate the need for intensive financing of its development, but it is not a necessary condition. Some of such companies succeed by perfectly identifying the future needs of users to increase the likelihood of market success of the developed innovation.

3. The user role in the value creation process – chosen quantification attempts

The search for ideas to create market-effective innovative products is the first and most important reason for maintaining relations with the broadly understood community around the company. Customers and users are an important part of this community. These contacts constitute therefore the economic platforms whose important area of activity is to maintain effective communication.

These platforms are often used to group admirers of a given company or brand. According to S.G. Blank, the essence of these activities is the desire to create a model, specific to a given company, of the customer development process (Blank, 2006). Its specificity includes focusing on the customer and not on the product. The model is therefore based on structuring and organizing the company's activities into customer-related ones. Those activities can be divided into four processes: finding the customer, approving the customer, shaping the customer's perception and creating a business venture as a source of value. These processes grouped in the above model are therefore a support for the product development process. Within such a perspective, a certain interpretation of a new technology allows for its application in utility functions incorporated into the new product.

Also, according to J. Redstrom, it is the new utility functions that are the consequence of such an interpretation, consisting in determining a new or different application of a new technology (Redstrom, 2006). By analysing the existing utility functions of the product, it is also possible to reinterpret them and to determine a new way of using the existing product. New technologies significantly increase the possibilities of determining utility functions and their combinations to satisfy specific needs of the customer. Then, the process of designing a new product oriented towards its user fits into the logic of presumption. This is made possible by new technologies, used in this case as an attribute of the customer communication process and as an area of searching for innovative solutions. This approach makes it possible today to design a product according to strictly defined, individual needs of the customer based on physical and psychological profile. The product is then co-designed and co-created to meet the specific needs of a specific customer. According to S. Doustmohammadi, R. Valamanesh and E. Sandres, the factors that enable the implementation of such a product concept are e_communities and three-dimensional printing (Doustmohammadi, Valamanesh, Sandres, 2014). The current expectations of the market and of the customer are different, often unpredictable, resulting from the specificity of the needs of a particular person, and not from averaging the results of the survey. The introduction of such in-depth individualization will refer not only to the material factors characterizing the needs, but also to those present in the individual sphere of feelings and beliefs, which will therefore be important for the appropriate process of creating the value of the new product.

The emerging concept of user value includes a value that is aimed at the user who directly interacts with the product. This means a deep need for the value that motivates the user, which is important for innovations that change user behaviour. Failure to take these values into account will translate into the termination of the use of the product or service and the loss of the opportunity to take over the value of innovation. These types of dependencies apply to entire groups of users. Especially if a company wants to achieve an impact at the level of society as a whole, which is particularly important in the case of an innovation process. J.F. Figueiredo, N.C. Correia, I.S. Ruivo and J.L. Alves noticed that such a modified approach to the innovation process significantly eliminates the previous dichotomous division into the technical area and the marketing area of the innovative product (Figueiredo, Correia, Ruivo, Alves, 2015). The essence of this division was the lack of consistency between the quantitative technical description and the growing amount of qualitative data characterizing the market aspect of innovation – especially in creating value for innovative products. Design has become an exemplary personification of the innovative aspect of products based on new technologies. It is an element stimulating the innovative process. It becomes a tool for understanding unsatisfied social needs. The innovation process carried out in this way begins with defining how design and innovation can be combined, using applied art, to create new, original and ground-breaking products.

According to M. Gasparin, thanks to this approach, a new meaning develops, which becomes the reason for choosing and using a new product (Gasparin, 2018). Meaning is then understood as the sense of a product, as a perception of how a thing can be experienced. Meaning is not a permanent concept, it changes depending on the person, gaining specific experience with the use of the product. The implementation of such a concept requires that design should become a key component of the innovation process by understanding the needs of the user so as to be able to create an understandable vision of the new meaning of the product that customers do not yet know or are waiting for. The product then becomes a tool of persuasion or an argument from a rhetorical perspective. It is part of the sign system by which product users create meaning.

C. Jutant, A. Gentes, M. Bejean and C. Mivielle underlined the essence of the formulated theory, which is therefore how people give meaning to things beyond the current interpretation of the fact of their possession and beliefs resulting from their use (Jutant, Gentes, Bejean, Mivielle, 2019). The semiotics of design is an important element of giving symbolic values to things. Thus, a justification of the meaning of existing things is created through material and social interaction, cultural knowledge and communication skills. From the user's perspective, what becomes important is the symbolism attributed to radical innovation and the corresponding meaning of the new product. In the case of radical innovation and derivatives of its products, the design does not refer to the current state of affairs, but must be directed by imagination and interpretation (of the new technology). Design is not a way of initiating the process of creating a new meaning for an innovative

product, but rather a tool crowning the creation of its value. In practice, according to C. Fuchs and F.J. Golenhofen, determining the value of a product means finding an answer to the question of what maximum amount of money a person is willing to pay for satisfying his or her needs (Fuchs, Golenhofen, 2019). Value will be shaped by two factors, and meeting the customer's needs constitutes the first one. This can be done in various ways, shaping the product functionality, costs, emotions and joy, and this way offering the expected meaning. The quality and unambiguousness of the estimated customer value depends in particular on the homogeneity of customer groups. It especially depends on their values, beliefs and needs. The second factor is the amount of expense that the customer is able to incur to purchase the product meeting his or her needs. This expenditure can be measured by the equivalent of money, time, energy or human labour. Hence the following formula (1).

$$\text{Value} = \frac{\text{Need Satisfaction}}{\text{Expense}} \quad (1)$$

It is not a formula in the mathematical sense, but is intended to describe the existing relationship for the needs of the product development process. The expense will usually mean the price paid for the product. The creation of value, on the other hand, occurs when the customer's needs are met or exceeded, which is reflected in a reasonable price level. For manufacturers, the perspective of value perceived by the customer will be the most important, determining his or her willingness to pay. Depending on the standards of a given market, the manufacturer has a certain opportunity to shape the level of production costs so that it corresponds to the price expected by the customer. The producer should take into account the expected price level on the market, adapting to it in order to capture the greatest possible value. Value offered to the customer can grow by reducing costs or by more effectively meeting needs expected by the customer, and it can be defined in a new way (2).

$$\text{Value} = \frac{\text{Function}}{\text{Cost}} \quad (2)$$

The process of creating value will then mean maximizing the relationship with the customer. It should be noted that so far the most commonly used approach to increasing value has been based on minimizing costs. This approach is not enough and significantly limits the possibilities of shaping value through the development of the product user functions, increasing its customer functionality. The experience gained by the user of the product will depend on the user functions, their combinations and the meaning created thanks to them.

According to Ch. Kraft, the very concept of user experience is defined as personal experiences and impressions resulting from the use or anticipated use of a product, system or service (Kraft, 2012). Simplifying the previous definition, it can be concluded that user experience is the user's feelings resulting – perceived - from the use of a given product. These feelings can be positive or negative, extreme or balanced, so an attempt can be made to describe the change in these feelings during the use of a particular product. The subjectivity of

feeling makes it difficult to measure it. It results from the fact that the reactions of different people are different. In the same situation, the feelings of individual users may therefore be completely different. The company's goal will be to maximize the positive feelings of the user of the product. Another possibility is to minimize negative feelings, the effect of which is disproportionately stronger than positive ones.

The concept of user experience is strongly related to another concept – user expectations. It is assumed that reputable brands create high customer expectations, which in turn implies high sales margins for such products. According to Q. Liu, Q. Du, Y. Hong, Y. Fan and W. Shuang, most companies will therefore strive to induce high expectations in their customers in order to be able to satisfy them with their product (Liu, Du, Hong, Fan, Shuang, 2020). The wrong reaction to high customer expectations can cause great difficulty for the company. It is worth adding that customer expectations vary according to cultural differences and the way the product brand is perceived. The relationship between the user's experience and expectations is a very interesting issue, the understanding of which creates an opportunity for companies to develop. It should be added that there is a relationship between the user experience and the customer experience. Customer experience covers all issues related to the purchase of the product. The relationship between the user's experience and expectations is a very interesting issue, the understanding of which creates an opportunity for companies to develop. It should be added that there is a relationship between the user experience and the customer experience. Customer experience covers all issues related to the purchase of the product.

4. Design and use functions technical debt as customer perceived value modelization parameters

Analyzing the possible management application of technology, P. Asthana remarked that the primary barrier to adopting a new technology is uncertainty about its acceptability to the market because of non-existing customer experience (Asthana, 1995). Any unfamiliar technology takes time to gain acceptance in the marketplace, and the early market penetration is slow because size of buyer market is small due to undefined customer expectations. Being first on the market makes for the company the unique situation of acting without competitor's pressure, so the capture of large market part is possible and the position of market innovator is granted. This situation allows to realize the extraordinary profits, but at same time this unique market position is very suitable for other companies. All the same, being first to market as a winning strategy is somewhat overrated. The concept fails to take into account the impact of how long it might take for the market to accept new high-technology products. For a product that had no time lag between the technology s-curve

and the marketing s-curve, first-to-market certainly could be a winning strategy but of course it very optimistic vision the inverse can also happen. The company, that is second or third to enter the market may have an advantage: it can target an already educated, receptive market and can thus spend its marketing resources on promoting its brand image. Hence, the business strategy of differentiation requires that the business have sustainable advantages that allow it to provide buyers with something uniquely valuable to them (Pearce, Robinson, 1994). A successful differentiation strategy allows the business to provide a product or service of perceived higher value to buyers at differentiation cost below the value premium to the buyers. Differentiation usually arises from one or more activities in the value chain that create a unique value important to buyers (Lopez, Noriega, Valenzuela, Serrano, 2022). The innovative company can show the importance of the innovation through its goals and these are different from one firm to another. In some firms, the innovation is in the essence of products and services; therefore, the business philosophy must demonstrate the firm's commitment with technological innovation. But company product innovation strategy must be conceptualized not only by focusing on R&D activities, but also by linking the innovativeness of prepared conception to the company potential. In fact analyzing the actual state of organization, innovation strategy design should be associated to technical excellence which has to be measured by both capacity to deliver customer value today and create an adaptable product for tomorrow, hence the conception of lowering technical debt - improving the ability to adapt - as an integral part of the development process (Highsmith, 2009). In some cases, technology based competitive advantage is not the key company success factor because, due to rapid propagation, international competitors can easily react and offer imitation products. In this situation, some producers try to enlarge the customer value proposition which originated in the new technology and develop a complete sales solution. This then appears as the one of main reasons to assign the innovative dimension not only to product but also to complementary services in way to make the offering more adopted to satisfy market needs. This kind of commercial combination can also be very interesting for companies as it can build a strong relationship with the customer over time giving the company the possibility to develop an innovation based value proposition based on user functions development which is also linked to the technical debt dynamics (Kumar, Puneet, 2019). For this reason, it is important to setup an integrated framework focused on mechanisms creating customer value which defines also the source of technical debt. Particular attention is placed by Ph. Kruchten, R.L. Nord and I. Ozkaya on the complex nature of technical debt specifically on the connection with the technology gap which is caused by commercialization of new products (Kruchten, Nord, Ozkaya, 2012). For this reason it is possible to state that monitoring of discrete occurrences of technical debt enables a definition of the totality of technical debt incurred not only by the whole company but also by every new developed product. It is possible to make this type of definition by analyzing a company's internal value chain model, which logics is based on the principle that innovation activities enabling

development of user functionality lead to an increase in value (Tang, Yin, Ullah, 2018). Optimization of this process will thus depend on monitoring the dynamics of technical debt creation as a result of which the optimization of the value offered to the customer will require development of an infrastructure maintaining user functions which enables limitation of defects and stabilization of the value of a product as perceived by the customer. By combining the concept of technological debt with company innovation activities, it becomes possible to define the interactions which take place within a company. Proof of this can be found in the model of technological debt creation, proposed by J. Magnusson and B. Bygstad, which is based on an assessment of ex-ante and ex-post investment decisions in the introduction of new technologies (Magnusson, Bygstad, 2014). The concept can be used as a decision tool enabling assessment of the consequences of introducing to a company an orientation on development of innovations with high returns. Monitoring the dynamics of technological debt within a company whilst research and development activities are taking place is a complementary tool in the process of assessing their future financial impact. In addition it can be applied as an element of strategic analysis which provides an assessment of the technological development of a company enabling the financing or timing requirements to be defined to develop specific domains of activity to achieve optimal new product value for the customer. Hence very interesting development possibilities for application of this concept to model technological diversification strategies especially with regard to a strategy of value creation for the customer.

Hence the most appropriate concept of customer-perceived value of a product, it was formulated by J.H. Dobbs in an original way (Dobbs, 1999). Proposed formula assumes that it is the ratio between the sum of product quality and use value, as a nominator, and price, as a denominator (1).

$$CPV = (J+U) / C \quad (1)$$

Then, the formula can be rewritten as:

$$CPV * C = (J + U) \quad (2)$$

where:

CPV – customer perceived value,

J – cost of maintaining quality,

U – product use value,

C – selling price.

A different perspective on customer-perceived value was proposed by C. Fuchs and F.J. Golenhofen. Their approach is mainly based on the importance of the product's utility (Fuchs, Golenhofen, 2019). Formula (3) is used to calculate customer value.

$CV \sim F/K$, which can be rewritten as:

$$CV * K \sim F \quad (3)$$

where:

CV – customer value,

F – product use functions,

K – total unit cost of production.

The above formula assumes that customer value is directly proportional to the value of the sum of product use functions, and inversely proportional to cost. Therefore, the result of CV and K multiplication is directly proportional to the value of product use functions. It means, that product use value is expressed here as the sum of its use functions, i.e. it can be assumed that $U = F$. Product use function is understood here as something more than the technical aspects, which are derivatives of the used technology. Hence it can be said that U means product use value. Analyzing formulas 1, 2 and 3, the difference between customer perceived value and customer value based on product use functions can be observed.

Determining customer perceived value, commercialization of innovations should be taken into account, which is also related to the optimal exploitation of the existing brand or its extension. The most common model of the innovation process focuses on the customer and ignores the issue of the design. In response to this problem, M. Mulder-Nijkamp argues that to commercialize technological innovation, the impact of the design $V(D)$ and brand $V(B)$ on customer perceived value should be taken into account (Mulder-Nijkamp, 2020). Then, customer perceived value would consist of three components (4):

$$CPV = V(D) + V(B) + U \quad (4)$$

where:

CPV – customer perceived value,

$V(D)$ – component of the product value resulting from the design,

$V(B)$ – component of the product value resulting from the brand,

U – product use value

The elements of the above sum can be expressed as the multiplication of product use value (U) by customer perceived value obtained from design D and brand B, both being proportional to U. The effect of the sum of utility functions (U) on customer perceived value (CPV) can therefore be expressed as follows (5):

$$V(D) + V(B) + U = CPV * C = CPV * (K + M) \quad (5)$$

The last part of equation (5) expresses customer perceived value according to J.H. Dobbs. Applying this expression to the equation of C. Fuchs and F.J. Golenhofen, the following relationship can be formulated (6):

$$CPV * C = V(D) + V(B) + U = CPV * (K + M) \sim J + U \quad (6)$$

where:

CPV – customer perceived value,

C – selling price,

K – total unit cost of production,

M – unit margin,

J – unit costs of maintaining quality,

U – product use value,

$V(D)$ – the component of the product value resulting from the design,

$V(B)$ – component of the product value resulting from the brand.

The above equations (5 and 6) define the essence of the concept of price, which is henceforth a reflection of product value and not only of cost. The value of unit margin (M), realized on the sale of the product, is then the amount reflecting customer perceived value, expressed here as CPV. Therefore, customer perceived value (CPV) may be greater than selling price (C). The greater the ratio of customer perceived value to selling price, the better are product use value (U) and company performance. At the same time, product use value (U) can be defined as the (FU) sum of all use functions (f_u). In the case of innovative products based on new technology, the costs of maintaining quality are allocated to technical debt created by the use of new technology in order to offer a specific use function of the product. It is then possible to formulate a new form of use value based on the sum of the values of all utility functions. Then the value of a particular use function would depend on the value of technical debt $dt_{(i,i)}$ and customer perceived value $vu_{(i,i)}$ of this particular function (Filipowicz, 2019). Using matrix notation, it is possible to express formula (6) as equation (7).

$$[CPV * C] = [V(D)] + [V(B)] + [FU] \quad (7)$$

To refine equation (7), it can be expressed more precisely as (8):

$$\begin{bmatrix} cpvc_{1,1} & cpvc_{2,1} & \dots & cpvc_{1,n} \\ cpvc_{2,1} & cpvc_{2,2} & \dots & cpvc_{2,n} \\ \dots & \dots & \dots & \dots \\ cpvc_{n,1} & cpvc_{n,2} & \dots & cpvc_{n,n} \end{bmatrix} = \begin{bmatrix} vd_{1,1} & vd_{2,1} & \dots & vd_{1,n} \\ vd_{2,1} & vd_{2,2} & \dots & vd_{2,n} \\ \dots & \dots & \dots & \dots \\ vd_{n,1} & vd_{n,2} & \dots & vd_{n,n} \end{bmatrix} + \\ + \begin{bmatrix} vb_{1,1} & vb_{2,1} & \dots & vb_{1,n} \\ vb_{2,1} & vb_{2,2} & \dots & vb_{2,n} \\ \dots & \dots & \dots & \dots \\ vb_{n,1} & vb_{n,2} & \dots & vb_{n,n} \end{bmatrix} + \begin{bmatrix} fu_{1,1} & fu_{2,1} & \dots & fu_{1,n} \\ fu_{2,1} & fu_{2,2} & \dots & fu_{2,n} \\ \dots & \dots & \dots & \dots \\ fu_{n,1} & fu_{n,2} & \dots & fu_{n,n} \end{bmatrix} \quad (8)$$

where:

$cpvc_{i,j}$ – customer perceived value of a given use function,

$vd_{i,j}$ – component of the value of a given use function resulting from the design,

$vb_{i,j}$ – component of the value of a given use function resulting from the brand,

$fu_{i,j}$ – component of the value of a given use function resulting from a given technology characterized by a certain technical debt. It should therefore be assumed that $fu_{i,j}$ is equal to the length of the vector representing the sum of vectors of technical debt value resulting from the application of new technology and value of a given use function $|\overrightarrow{fu_{l,l}}| = |\overrightarrow{dt_{l,l}} + \overrightarrow{vu_{l,l}}|$

After adding the presented matrices, the following equation can be formulated (9).

$$\begin{bmatrix} cpvc_{1,1} & cpvc_{2,1} & \dots & cpvc_{1,n} \\ cpvc_{2,1} & cpvc_{2,2} & \dots & cpvc_{2,n} \\ \dots & \dots & \dots & \dots \\ cpvc_{n,1} & cpvc_{n,2} & \dots & cpvc_{n,n} \end{bmatrix} = \begin{bmatrix} vd_{1,1} + vb_{1,1} + fu_{1,1} & vd_{2,1} + vb_{2,1} + fu_{2,1} & \dots & vd_{1,n} + vb_{1,n} + fu_{1,n} \\ vd_{2,1} + vb_{2,1} + fu_{2,1} & vd_{2,2} + vb_{2,2} + fu_{2,2} & \dots & vd_{2,n} + vb_{2,n} + fu_{2,n} \\ \dots & \dots & \dots & \dots \\ vd_{n,1} + vb_{n,1} + fu_{n,1} & vd_{n,2} + vb_{n,2} + fu_{n,2} & \dots & vd_{n,n} + vb_{n,n} + fu_{n,n} \end{bmatrix} \quad (9)$$

Considering the above equation, it should be noted that, in practical conditions, the equal sign (=) can be replaced by a proportionality sign (~) since [CPVC] includes the assigned customer perceived values of given use functions. Those values are therefore the result of a subjective assessment affected by product design, brand and use value, which relate to the assessed use functions. It should also be added that in specific cases individual matrix values may be zero, for example when the dependencies mentioned earlier do not exist or use function does not exist. The lack of use function of the product may be the result of the introduced product concept or the lack of necessary technology, or the lack of financial resources to obtain it. The method of creating the matrix [Fu] is simple and based on taking into account the phase of the technology life cycle, which also determines the level of technological innovation (fig. 1). The product decomposition into its use functions consequently makes it possible to practically assess the effects of technological and innovative changes, which will result in product use.

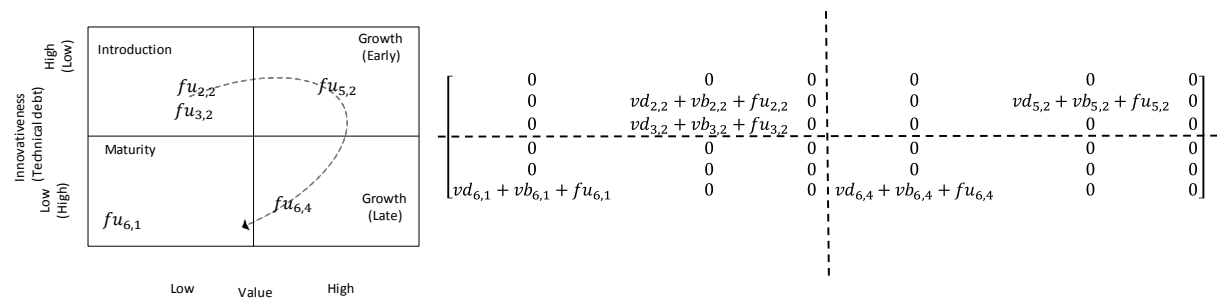


Figure 1. Principles of presenting product use as a matrix of its use functions (own elaboration).

The method of creating the matrix [Fu] is simple and based on taking into account the phase of the technology life cycle, which also determines the level of technological innovation. The product decomposition into its use functions consequently makes it possible to practically assess the effects of technological and innovative changes, which will result in product use. Analyzing equation (9), it can be stated that the relationship between matrix elements can have three forms: $cpvc_{i,i}$ is smaller than $vd_{i,i} + vb_{i,i} + fu_{i,i}$, greater or equal. When it is smaller, it means that the design, brand and technology, as components of a use function, do not translate into greater customer perceived value. Thus, when the effects of components are combined, it does not result in synergy in customer perception. When matrix element $cpvc_{i,i}$ is greater than the sum of those components, then for a given use function, the goal is achieved thanks to their synergy. This means that customer perceived value of the use function is positively affected by the efforts made by the company, and the synergy between the design, brand and technology has been achieved. This situation is the most desirable, leaving the question of whether this greater value of the use function also translates into the entire product. On the other hand, when $cpvc_{i,i}$, i.e. a matrix element expressing customer perceived value, remains equal to the sum of use function components, then there is no synergy between them. Customers behave as the company predicts, but their reaction is probably caused by the fact that their needs have been satisfied according to their vision. As said above, product decomposition into its use functions (9) enables a practical assessment of technological innovation. One of use function components is technology, with technical debt resulting from its use. Technical debt determines the level of technological innovation, also from the perspective of possible competitive imitation.

The approach presented above enables the evaluation of product perceived value through the prism of product use functions. It is therefore possible to model future customer perceived value taking into account the level of future technological innovation used to manufacture the product (Fuller, Bartl, Ernst, Muhlbacher, 2006). Conceived model can be also used as an optimization tool because by analyzing the possible distribution of the origin of customer perceived value between design, technology and usability, the structure of a new product can be rearranged according to customer perception, at the same time taking into account company capabilities. It is also possible to use this model as a budgeting tool for a new product development process, bearing in mind technical debt resulting from the use of new technology. The existing possibilities of modeling the mix of use functions allow the analysis of future changes in the product structure. Because of this, the company can try to optimize use functions according to future changes in company technological potential and according to the user's preferences. It is possible to apply the proposed approach to the general modeling of future products. It also provides an opportunity to engage the potential user in maximizing the value of current and future products.

5. Conclusions

The effectiveness of the innovative product commercialization process is crucial for a company's market competition. An important factor affecting the implementation of a new product is the way the user evaluates it, hence the need for a more thorough assessment of the customer's ideas resulting from the current use of the product for its further development. The process of searching for ideas as a source of new product applications is also gaining importance. The aforementioned concept of user experience as one of the key factors for the success of product sales can therefore be a source of innovation conceptualization. Designing a new product or service based on a new technology without defining its utility functions in line with the user's needs is inappropriate and may cause a negligible response from the market. It is up to the user to determine the effectiveness of the process of creating innovation value. It can be noted that the feelings resulting from the use of a new product may be subjective and subject to external influences. A commercial success of a new technology is conditioned by creating the right perception of the new product value. As a consequence, information about the use of the product and the experience resulting from using it should be constantly monitored and taken into account in the course of the commercialization of innovation. The proposed approach can be applied to the simulation of product new meanings in terms of maximizing customer perceived value according to future changes in company technological potential. The proposed perspective provides an opportunity to determine the specific level of technological innovation expected by the user of a given product and the possible costs to be incurred in order to obtain that innovation. It is also possible to identify the needs for the development of new use functions adapted to the phase of the technology life cycle. The presented model is an interesting concept of quantifying the customer perceived value of a new technology based product. The described possible application of the product use function technical debt provides an attractive opportunity to assess the product value, also in the future. The presented model concept is also an example of an interesting tool for use in the process of managing the innovative product development. Obviously, access to empirical data is the problematic, because of reported high sensitivity for companies. Attempts made so far were not effective, due to the companies' protection of access to used new technologies parameters, or the time-consuming data collection process. Indeed, the difficulties encountered are a challenge for the empirical verification of the proposed concept, and thus will provide material for separate research in the future.

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IMPACT OF THE COVID-19 PANDEMIC AND THE INFLATION CRISIS ON THE FINANCIAL CONDITION AND EXPENDITURE STRUCTURE OF POLES

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Purpose: The purpose of the article was to assess the impact of the COVID-19 pandemic and the inflationary crisis that followed on the financial condition and consumer and investment expenditures of Poles. This purpose was supplemented by detailed research hypotheses.

Design/methodology/approach: The study was conducted using the diagnostic survey method on a group of 1,000 randomly selected Polish residents. The research tool was an original survey questionnaire containing 50 substantive (problem) questions and 9 metric questions. Selected statistical tests were used in the analysis of the survey results.

Findings: The research results indicated that the pandemic and inflationary crises contributed to the deterioration of Poles' financial condition. A significant decline in real income was declared by about 23% of respondents in both crisis phases. About one-fifth of active respondents were affected by job loss, mainly temporarily. A quarter of respondents indicated a significant increase in the share of consumer expenditure in current income and the need to give up a number of goods and services beyond basic consumption. A persistently limited Poles' propensity to invest was found, as well as little dynamic change in outlays and investment forms.

Research limitations/implications: Limitations are the estimated nature of the information obtained in surveys. The reliability of some data can be improved by repeating the survey on the same sample at a time interval.

Practical implications: The crises have changed Poles' attitudes toward accumulating savings and spending money. Awareness of this fact should prompt potential business entities and financial institutions to remodel their offerings in accordance with market conditions. Government bodies can use the research results to manage the crisis more effectively on a national scale.

Social implications: The research revealed the Poles' limited knowledge of managing their own finances and could be a rationale for measures to disseminate such knowledge to society.

Originality/value: The value of the research is the original author's diagnostic approach based on a representative research sample, addressing current social and economic problems of Poles, not fully recognized and disseminated in publications.

Keywords: pandemic and inflation crisis, Poles' financial condition, consumer and investment expenditures.

Category of the paper: Research paper.

1. Introduction

Since the dawn of time, people and state institutions have had to deal with various local and global threats to life and social development of an epidemic nature. Examples include the plague epidemic, which in the 14th century killed about a third of Europe's population at the time, or "Spanish flu", the 1920s influenza pandemic with an estimated 50 million victims (Krajewska, 2020). The contemporary case to us was COVID-19, an infectious disease caused by the SARS-CoV-2 coronavirus, which was found in November 2019 in Wuhan, central China, and was declared a pandemic by the World Health Organization on March 11, 2020 (WHO, 2020). Although the COVID-19 pandemic's health effects were not as dramatic as those of the two previously mentioned (an estimated 6.3 million people worldwide had died from it by August 2022), it caused massive social and economic perturbations.

As the COVID-19 pandemic spread, social life changed by introducing various formal restrictions on mobility and human contact. Coronavirus testing, quarantine and, in some countries or occupational groups, COVID-19 vaccination have been made mandatory. Health systems' conversion to fighting the virus and restrictions on diagnosis and treatment of other diseases have contributed to a large number of excess deaths. In Poland, for example, the number of deaths in 2021 exceeds the annual average of the last 50 years by nearly 154,000 (519,500 vs. 366,000) (GUS, 2022).

The virus has also left its mark on the economies of many countries (Jackson et al., 2021; Bartosiewicz, Książopolski, Zybała, 2021). Many industries' operations have been suspended. Transportation of raw materials and finished products has been severely restricted, and exports to many countries have been suspended due to border closures. Breaking supply logistics chains resulted in reduced production in active industries. Jobs were threatened and the unemployment rate increased. Concerns about the impact of COVID-19 on the global economy were compounded by the conflict between OPEC and Russia resulting in large declines in oil prices in March 2020 which, in addition to reducing oil export revenues (Ozili, Arun, 2020), led to strong declines in global stock prices (Jaworski, 2021). In the first 9 days of March 2020, stocks traded on stock exchanges around the world lost USD 9 trillion in value (He, Duffy, Horovitz, 2020). Finally, there were significant declines in GDP and unfavorable developments in other macroeconomic indicators in the economies of many countries (Halmai, 2021; Zamfira, Lordache, 2022; Pavolová, Culková, Šimková, 2022) with a varying degree of intensity (Ghecham, 2022). The International Monetary Fund forecast that

in three pandemic years (2019-2021) the global public debt will increase by USD 24.6 trillion (34%), and the Polish public debt will increase even more, by PLN 451 billion (43.1%) (Frączyk, 2021).

The implementation of the aforementioned pandemic restrictions and an economic collapse danger necessitated the implementation of solutions to minimize the impending recession effects. The economy was to be helped by so-called anti-crisis (anti-covid) shields, i.e. comprehensive packages of laws and regulations to counteract the adverse effects of COVID-19 (Staniszewski, 2020; Kubiczek, Derej, 2021; Ahmed, Sarkodie, 2021). The Council of Ministers of the Republic of Poland adopted the first national package of laws implementing anti-crisis solutions on March 25, 2020. In Poland, they materialized in the form of successive anti-crisis shields (1.0-4.0) in the period until June 2020. In Poland, they materialized in the form of successive anti-crisis shields (1.0-4.0) in the period until June 2020. Among other things, they introduced flexible management of the central and local government budgets, tax relief and relief on social security contributions for entrepreneurs, subsidized employee salaries, support for entrepreneurs with loans from the Industrial Development Agency, and interest rate subsidies on bank loans for enterprises affected by COVID-19. Combined budget funds transfers, as well as funds from the Guaranteed Employee Benefits Fund and the Anti-Coronavirus Fund to the economy, financial institutions, health care and investment support under the anti-crisis shields are estimated at over PLN 312 billion. However, in addition to the presumed protective effects, they caused an imbalance between the money supply and the supply of consumer goods and services to appear in the market when several sectors of the economy were closed. This imbalance was exacerbated by the NBP's continued low interest rate policy in 2020 - 2021 and the associated increased money supply in the form of cheap bank loans. These factors, according to the authors of the publication, were the main indicators of the ongoing inflation crisis, with its negative consequences for the budgets and financial security of the Polish people (Redo, 2022). The inflationary spiral in 2022 was triggered by the war in Ukraine and the resulting perturbations in the energy markets (Desalegn, Tangl, Fekete-Farkas, 2022; Bednar, Cecdlova, Kaderabkova, Rezabek, 2022). There is a danger that we could remain with high inflation for longer (Bonam, Smadu, 2021).

The purpose of the article is to attempt, based on our own empirical research, to provide an answer to the question of the extent to which the pandemic and inflation crises (referred to in the text as the first and second crisis phases) have affected the financial condition and the structure of changes in consumer and investment expenditures of the statistical Pole. The research attempted to resolve a number of specific questions, such as temporary or permanent job loss due to COVID-19, the level of lost earnings or business profits, the need to change employment, the extent of using crisis shields, the impact of crises on respondents' savings levels, the level of credit burdens, the extent of changes in the structure of consumer

and investment expenditures, and the choice of methods of securing savings against inflation. These issues are detailed in the form of research hypotheses in the research methodology.

The literature study authorizes the conclusion that although the literature treating the impact of the COVID-19 pandemic on the Polish economy, finance or health care is abundant, the issues addressed in this article have few equivalents in it. Examples of items that can provide a comparative basis include studies on the impact of COVID-19 on: the financial situation of households (Paździor, Majek, 2021), consumer behavior (Samuk, Sidorovich, 2021), the vulnerability of public and private budgets to the crisis (Zbroińska, 2022), on working life and the labor market (Juza, Walawender, 2021; Radlińska, 2021) or the quality of young people's lives (Wicka, 2021).

2. Research methodology

The main purpose of the article is to assess the pandemic crisis impact and the subsequent inflation crisis on the financial condition and the size and structure of the consumption and investment expenditures of Poles. This purpose was detailed by the following research hypotheses:

Hypothesis h1: The financial condition of Poles deteriorated significantly during both crisis phases, both in subjective assessment and as measured by the level of change in real monthly earnings/income.

Hypothesis h2: The pandemic and inflation crises caused permanent or temporary job losses and/or difficulties in changing jobs for a significant number of respondents, and shielding/stabilization measures in this area were insufficient.

Hypothesis h3: Both crisis phases significantly influenced the increase in the share of consumer expenditures in respondents' current income, the change in its structure and the subjective assessment of one's own purchasing power as a consumer.

Hypothesis h4: Crisis situations have significantly affected the dynamics and change in the forms of investment by Poles.

Hypothesis h5: Respondents' financial situation and the structure and size of their consumption and investment expenditures showed a significant relationship with their metric characteristics.

Hypothesis h6: Respondents' current financial situation and its future projection significantly affected the structure and size of consumer and investment expenditures in both crisis phases.

Hypothesis h7: Respondents' financial situation and the structure and trends in consumer and investment expenditures in the two crisis phases differed significantly.

The research was conducted by the BIOSTAT Research Agency (contractor) in October 2022 using the diagnostic survey method on a group of 1,000 randomly selected Polish residents. The research tool was an original survey questionnaire containing 50 substantive questions and 9 metric questions (M1 to M9) characterizing the respondents. Substantive questions P1 to P25 were for the first crisis phase (pandemic) covering the period (Q1'2020 - Q3'2021) and were repeated as questions P26 to P50 for the second crisis phase (inflationary) covering the period (Q3'2021 - Q3'2022).

For each phase, the substantive questions are grouped into three thematic blocks regarding:

- the respondent's financial and work situation (P1 to P9 for the first phase and P26 to P35 for the second crisis phase),
- the structure and dynamics of consumer expenditures (P10 to P18 for the first and P36 to P44 for the second crisis phase),
- structure and changes in investment expenditures (P19 to P25 for the first and P45 to P50 for the second crisis phase).

The survey was conducted using the CAWI technique, using the Contractor's online research panel. It included a sample of 1,000 adult Poles, participants in the Opinion Research Internet panel. The sample selection considered a representative distribution of the population by age and gender according to CSO data¹, as well as the Internet usage percentage by age and gender². The sample distribution by age (M1) is shown in Table 1, and by gender (M2) in Table 2.

Table 1.

Representative distribution of the survey sample by age after adjustment (M1)

Age range	Conversion rate	Adjustment	[%]	[N]
18-24 years	1.00	2,614,962	11.0%	110
25-34 years	1.00	5,042,117	21.2%	212
35-44 years	0.96	6,030,080	25.4%	254
45-54 years	0.86	4,393,148	18.5%	185
55-64 years	0.65	3,150,491	13.2%	132
65 years and older	0.35	2,536,934	10.7%	107
TOTAL		23,767,732	100.0%	1000

Source: BIOTON data.

Table 2.

Representative distribution of the survey sample by gender after adjustment (M2)

Gender	Conversion rate	Adjustment	[%]	[N]
Woman	0.76	12,386,116	51.7%	517
Man	0.78	11,578,706	48.3%	483
TOTAL		23,964,822	100.0%	1000

Source: BIOTON data.

¹ Population as of December 31, 2021, updated on May 27, 2022.

² Based on the CBOS research release *Korzystanie z Internetu*, no. 77/2022.

Regarding the education level (M3), the largest respondent groups were those with secondary education (45.1%) and higher education (39.5%), while the smallest, less than 1%, were those with primary and post-graduate education.

The majority of respondents (31%) came from small cities (up to 100,000 residents) and medium-sized cities (27.9%), while residents of large cities and rural areas made up a similar 20% representation (M4).

Respondents from two- and three-person families (28% each) and four-person families (25%) participated in the survey in the largest numbers. The smallest percentages were single (6%) and respondents from families of five or more (13%) (M5).

According to the income criterion (M6), the largest group (24.7%) were those with monthly net family income in the range of PLN 5001 to 7000, while the smallest groups were those with high income, PLN 13001 to 20000 (2.3%) and very high income, more than 20000 (1.2%). The share of those with very low incomes, up to PLN 3000, was 12.9%.

Declaring their housing situation (M7), almost three-quarters of respondents indicated their own apartment or house. Renting and living with family accounted for comparable indications of several percent.

Respondents' professional status structure (M8) is shown in Table 3, and the working respondents' business structure (M9) is shown in Table 4.

Table 3.

Respondents' professional status (M8)

Economic area	[%]	[N]
Employment in the public sector	19.2%	192
Employment in the private sector	45.7%	457
Own business	4.7%	47
Retirement/pension	16.4%	164
During learning/study	5.4%	54
Without a job	8.6%	86

Source: BIOTON data.

Table 4.

Respondents' employment by business (M9)

Business	[%]	[N]
Industry	16.5%	115
Public administration	7.5%	52
Other, what kind of?	18.0%	125
Trade	18.4%	128
Construction	9.8%	68
Education	6.2%	43
Transportation	8.2%	57
Hotel industry, gastronomy, tourism	3.6%	25
Finances	5.3%	37
Consulting and legal services	3.2%	22
Healthcare	3.4%	24

Source: BIOTON data.

To verify research hypotheses h1 to h4, tables of the indicated numbers of specific answer variants from the cafeteria of survey substantive questions were used, as well as by confronting with each other the answers to analogous substantive questions on the first (P1 to P25) and second crisis phases (P26 to P50). A discussion of the research results and verification of the aforementioned hypotheses are presented in the paper's Section 3.

In order to verify hypotheses h5, h6 and h7, a correlation calculus was used between specific variable groups, both metric and substantive, characterizing the respondents' financial situation and consumption and investment expenditures in the first and second crisis phases. The analyses were conducted using Statistica software. A chi-square test was used to examine the relationship between variables. The strength of the relationship was assessed by the Cramer coefficient, taking values in the interval [0,1]. In interpreting the correlation strength, the Cohen scale was used, where the correlation coefficient's absolute value greater than 0.5 indicates a strong correlation, between 0.3 and 0.5 a moderate correlation, and between 0.1 and 0.3 a weak correlation. However, a correlation coefficient absolute value below 0.1 indicates no correlation (King, Minium, 2009). A significance level of $\alpha = 0,05$ was assumed. Correlation analysis results and hypothesis h5, h6 and h7 verification are presented in Section 4 of the article.

3. Survey results

Respondents' financial condition

In the subjective opinion of respondents in the first crisis phase, the financial condition of 17.6% of them deteriorated significantly, while for 36.8% of respondents, it deteriorated slightly. In the second phase, such changes were indicated by 14.0% and 29.4% of respondents, respectively. A stable financial situation was declared by 39.1% for the first phase and 46.4% of respondents for the second phase. A slight or significant improvement in financial condition was experienced by 6.5% of respondents in the first and 10.2% of respondents in the second crisis phase.

A significant decrease exceeding 20% in earnings was indicated by 7% in the first phase and 8.3% of respondents in the second phase. A decrease in the 10% - 20% range was indicated by 16.8% and 14.0% of respondents, respectively. A slight +/-10% change in salary was indicated for both phases by a similar group of respondents, about 40%, and an increase or significant increase by a group of 8.5% and 10.6% of respondents, respectively. The answer "not applicable - I did not work" was indicated by 27.6% for the first and 25.0% of respondents for the second crisis phase.

In the first, pandemic crisis phase, permanent job loss was declared by 6.4% among working people, and temporary loss by 14.2%. For the second phase, such indications came from 4.4% and 13.5% of respondents.

Using government anti-covid shields either by the employer or directly by the respondent was indicated by 29.5% of the respondents, while non-users but active respondents accounted for 42.9% of the group.

The effectiveness of the anti-covid shields in maintaining jobs and earnings levels was rated positively by 33.2% of respondents under such support, 59.0% indicated half-success (earnings levels were not maintained), and 7.8% of respondents rating was negative (job/business was eliminated).

The possibility of changing jobs/availability of new offers within the industry was virtually impossible or difficult in the first crisis phase according to 41.4% of respondents, did not change compared to the pre-pandemic period according to 26.4% of respondents, and was easier or definitely easier for only 4.6% of respondents. For the second crisis phase, analogous indications were declared by 31.5%, 33.9% and 9.6% of active respondents.

The assessment of the Polish government's economic aspects of its response to the COVID-19 crisis was, according to 26.5% of respondents, definitely or rather positive, 23.1% of respondents had no opinion on this issue, and according to 50.4% of respondents, it was rather or definitely negative. For the second, inflationary crisis phase, analogous indications were declared by 23.3%, 25.5% and 51.2% of respondents, respectively. Among the negative opinions indicated were the misallocation of funds from the anti-covid shields and the excessive increase in public expenditure in the second phase.

The evaluation of the NBP's actions in combating the rising inflation in the second crisis phase was, in the opinion of only 15% of respondents, definitely or rather positive, 24.4% declared no opinion, and 60.6% of respondents gave these actions a negative or definitely negative rating, arguing that they were too late in raising interest rates and that there were no alternative instruments for financial impact on inflation.

Regarding employers' compensation for the effects of inflation with wage increases, only 6% of active respondents said they were satisfactory, 28.3% considered them too small, and 40.7% indicated that they were not.

However, the economic situation did not force most respondents to take out loans/consumer loans in both the first and second crisis phases. In both phases, consumer loans benefited a similar percentage of respondents, approximately 16%.

Respondents' predictions of changes in their own financial situation over the next 12 months were as follows: at the end of the pandemic crisis, improvement was predicted by 28.5% of respondents, stabilization by 40.4%, and fear of further adverse changes was declared by 31.1% of respondents. At the end of the second phase, the aforementioned options for the development of the situation were indicated by 29.5%, 30.5% and 40.0% of

respondents, respectively, which means that the percentage of respondents fearing further unfavorable changes increased significantly.

Choices and consumer expenditure

The survey indicates that both crisis phases significantly increased the consumer expenditure share of respondents' current earnings. An increase and a significant increase were indicated for the first phase by 24.7% of respondents, and for the second phase by 26.7%, while the opposite options, a decrease or a significant decrease, were indicated by 15.6% and 12.4% of respondents, respectively. For about 32% of respondents, the share did not change for both the first and second crisis phases.

Respondents most frequently spent 20-40% of their current income on basic consumption (34.5% of indications in phase one and 32.4% in phase two), and least frequently more than 60% of income (4.7% of indications each in both phases). Shares not exceeding 20% of income were declared by 18% and 21% of respondents, respectively.

Current earnings (79% of indications each in both phases) and savings (34.0% in the first phase and 31.9% in the second phase) were indicated as the main source of financing for basic and current consumption in a two-way choice. Credit/loans were indicated by only 4.1% and 6.3% of respondents, respectively, and leasing was a marginal source (less than 1% of indications).

Credit charges most often consumed up to 20% of respondents' current income (49.0% and 47.4% of indications) or 20-40% of income (17.3% and 19.1% of indications). The share of burdens higher than 40% concerned 6.1% in the first crisis phase and 8.5% of respondents in the second.

The most frequently reported subjective assessment of one's own purchasing power as a consumer in the survey was moderate (73.5% of indications for the first and 69.1% for the second crisis phase). A high rating was indicated by 8.8% and 7.3% of respondents, respectively, and a low rating by 17.7% and 23.6% of respondents.

Among the factors that most strongly influenced changes in the structure and level of consumer expenditure, respondents indicated in phase one: the current income level (39.8% of indications), official pandemic restrictions (27.0%) and the savings level held (20.9%). In the second crisis phase, these were the inflation level and price changes (46.2%) and the current income level (29.1% of indications). Other factors, such as measures from anti-covid shields and the interest rate level had shares of a few percent.

The low interest rate policy in the first crisis phase did not have a strong impact on the respondents' increase in consumer expenditure. Indeed, a significant impact was indicated by 17.7% of respondents, a slight impact by 33.9%, and no impact by almost half of respondents (48.4%). In contrast, dynamically rising interest rates in the second crisis phase significantly reduced consumer expenditure for 36.7% of respondents, or reduced it slightly (44.6% of respondents), and had no major impact for 18.7% of respondents.

In the expenditure breakdown for specific goods and services, spending on basic consumption (food, fees, basic clothing) showed the highest growth rate (40.5% each in both phases). The category in which spending stabilization dominated was spending on home/apartment furnishings (53.2% and 45.6% of indications). The largest declines in spending were in the categories of travel/holidays abroad (55.4% first and 51.1% second phase), travel/holidays at home (52.8% and 44.4%), luxury goods (52.2% and 52.3%) and current consumption - restaurant/cinema/theatre (50.6% and 43.7%). For categories evaluated dichotomously (yes, no), the highest indications for yes were home/apartment renovation (32.2% of indications in the first phase and 24.2% in the second phase). Far lower: buying or changing a car (17.5% and 15.7%) and buying a house/apartment for personal use (13.0% and 13.8%).

Crisis situations have forced large numbers of those surveyed to abandon certain categories of consumer expenditure altogether. Even in the field of basic consumption excluding food, abandonment of expenditure was indicated by 8.5% of respondents in the first and 7.7% of respondents in the second crisis phase. Current consumption, domestic and international travel, luxury goods, and car purchases received indications of more than 40% and more than 50% of respondents, respectively. On the other hand, forgoing housing expenses (purchase, renovation, furnishing) were indicated by more than 30% of respondents. The option "I have not given up any of the indicated categories" received in multiple choice 12.3% of indications in the first and 13.7% of indications in the second crisis phase.

Choices and investment expenditure

The survey revealed respondents' limited willingness/ability to invest. In both crisis phases, the percentage of non-investors was high, amounting to 42% among those working in the first phase and 36% in the second phase. The group of non-investors was supplemented by non-working respondents, accounting for 27.5% of the total respondents in the first and 25% in the second crisis phase.

Individuals who invested were most likely to allocate up to 20% of their current income for investment purposes (15.1% in the first phase and 20.9% of indications in the second phase) or 20-40% (10.4% and 10.7% in indications).

The dynamics of changes in the investment expenditures' share of respondents' income was also small. The most frequent statement was that the share had not changed from the previous period (14.7% and 19.7% of indications). An increase and a significant increase were indicated by the same percentage of respondents in both phases (7.2%), while a decrease and a significant decrease were indicated by 8.9% in the first phase and 11.6% of respondents in the second crisis phase.

The tendencies of saving and using savings under crisis conditions found in the survey were as follows: a significant group of respondents continued to save (43.5% of indications in the first phase and 39.0% in the second phase), quite numerous were those allocating previous savings for consumption purposes (27.0% and 24.0% of indications, respectively), while only a few invested previous savings in investment instruments (4.3% and 5.1% of indications). Those stating that they were not saving were 25.2% and 31.9%, respectively, which seems to confirm that escalating inflation was not conducive to savings accumulation.

Respondents' preferences for specific investment forms as the most favorable income and inflation protection did not change significantly during both crisis phases. In a double choice, the following were indicated in order: investments in apartments/houses (41.5% and 38.2% of indications), land plots/agricultural land (28.1% and 27.7%) and gold/raw materials (26.6% and 24.5%). Also ranked high were government bonds (16.9% and 18.6% of indications), bank deposits (16.7% and 17.8%), and currencies (12.8% and 12.7%). Respondents had less confidence in stocks/stock funds (9.3% and 7.8%), and indications for corporate bonds/bond funds, antiques and artwork were below five percent in both phases.

However, the above declarations are hardly reflected in the respondents' actual investment choices. Those who declared investing (30.5% of the total in the first phase and 39% in the second crisis phase) placed funds mainly (a threefold choice) in: bank deposits (14.5% and 20.6% of indications), currencies (8.9% and 9.4%), stocks/stock funds (8.2% and 8.9%), government bonds (7.3% and 8.8%). Real estate, although indicated as the most profitable, was ranked further down the list, which is probably due to the need for much larger funds.

The above statements seem to confirm the answers to the question about factors determining investment choice. The funds level was ranked highest here (16.9% of indications), followed by: the investment risk level (15.9%), the knowledge necessary to invest (8.4%), the expected rate of return (5.7%) and the investment procedure difficulty (3.8%).

The most common rate of return expected by investing respondents was 6-10% (15.1% of indications in the first phase and 17.0% in the second phase), followed by up to 0-5% (8.4% and 12.3% of indications) and 11-20% (7.6% and 9.3% of indications). Higher rates of return were expected in both crisis phases by less than 6% of respondents each.

Hypothesis verification h1 to h4

According to the survey results cited above, it can be concluded that research hypothesis h1, stating that the Poles' financial condition deteriorated significantly in both crisis phases, was verified partially positively. Although a significant subjective deterioration in condition was declared by several percent of respondents each (more in phase I), the dominant indications were financial situation stabilization. The trends were even less unfavorable in the sphere of changes in real monthly earnings/income, where a significant drop of more than

20% in income was declared by 7% and 8.3% of respondents, respectively, with equally high indications for income stabilization of around 40%, as in the subjective assessment.

Hypothesis h2 can also be considered partially true. In both crisis phases, there were quite numerous cases of permanent or temporary (more numerous) job loss among professionally active respondents, but the cases in question were found not to be massive in nature. A more significant problem, especially in the first crisis phase, was the low availability of new job offers or the possibility of changing jobs, as indicated by more than 40% of respondents. In assessing the Polish government's stabilization efforts, respondents' opinions were divided almost equally, while more than 60% of respondents gave a poor assessment of the NBP's actions in countering inflation.

Hypothesis h3 about the impact of both crisis phases on the significant increase in consumer expenditures in respondents' current income and the change in its structure can be considered true. Increases and significant increases in such expenditures were indicated in both crisis phases by about 25% of respondents each, and the highest growth rate (40% of indications each in both phases) was shown by expenditures on basic consumption (food, fees, basic clothing). Large declines in the share of expenditures or their complete abandonment were noted in several categories, such as travel/holidays at home and abroad, luxury goods, current consumption, buying or changing a car, or buying a house/apartment for personal use. During the second crisis phase, there was an increase (from 17.7% to 23.6%) in the percentage of respondents rating their own consumer purchasing power as low, compared to the first.

Hypothesis h4 stating that the crisis situations significantly affected the dynamics and change in the forms of investment by Poles was not confirmed in the survey. The percentage of respondents who invested in the total number of them was relatively small and similar in both crisis phases (33% and 37%), Those who invested most often allocated up to 20% of their current income for this purpose and mostly declared that this share did not change significantly compared to previous periods. Preferences for forms/instruments of investment did not change significantly, except for the increase in the share of deposits in the second phase.

4. Statistical analysis

Hypothesis h5 verification

To verify hypothesis h5, which considers the respondents' financial situation and expenditures structure to be significantly related to their metric characteristics, a correlation calculation was used between the metric variables (M1 to M9) and the following substantive variables (symbols for the second phase in parentheses):

- P1 (P26) Respondents' subjective assessment of their financial condition;
- P2 (P27) Change in monthly real earnings/income;
- P3 (P28) Temporary or permanent employment loss;
- P8 (P33) The need for taking credit for consumption purposes;
- P9 (P36) Expected change in own financial situation in the next 12 months;
- P10 (P36) Change in current consumption expenditure earnings;
- P11 (P37) Share of consumption expenditure in current income;
- P12 (P38) Main sources of financing consumption;
- P17 (P43) Changes in consumer expenditure by specific goods/services;
- P18 (P44) Resignation from consumption of certain goods;
- P19 (P45) Change in current investment expenditure earnings;
- P20 (P46) Share of investment expenditures in current income;
- P23 (P48) Dominating investment forms/instruments;
- P25 (P49) The expected rate of return on the investment.

For the relationships indicated in grey in Table 5, the null hypothesis H0 regarding the absence of a dependence between the characteristics can be rejected for the alternative hypothesis H1 that the indicated substantive variables depend on the metric variables. Relationships for which the values of the Cramer coefficient are greater than 0.1, correspond to the lower limit of weak correlation according to the Cohen scale. As the majority of the indicated relationships show very weak correlations, the Cramer coefficient values for those for which it is greater than 0.2 are plotted in Table 5. Such correlations appear to be relatively few and are attributed to two metric variables: age (M1) and respondents' occupational status (M8). Cramer coefficients for the M8 variable in both the first and second crisis phases indicate a stronger correlation than for M1. Comparing their values from the corresponding relationships from the first and second crisis phases, it can be concluded that the correlation strength of the M1 and M8 variables with the substantive variables is similar in both phases.

Table 5.

Significant Chi-square test results between metric and substantive variables in the first and second crisis phases

Phase 1	M1	M2	M3	M4	M5	M6	M7	M8	M9	Phase II	M1	M2	M3	M4	M5	M6	M7	M8	M9
P1										P26									
P2	.23							.41		P27	.21								.38
P3	.30							.53		P28	.27								.49
P8										P33									
P9										P35									
P10	.23							.41		P36	.22								.40
P11	.26							.45		P37	.24								.42
P17.1										P43.1									
P17.2										P43.2									
P17.3										P43.3									
P17.4										P43.4									
P17.5										P43.5									
P17.6										P43.6									
P17.7										P43.7									
P17.8						.21				P43.8									
P17.9										P43.9									
P19	.20							.34		P45	.22								.38
P20	.23							.41		P46	.22								.42
P25										P49									

Source: Own elaboration.

For all variables shown in Table 5, variables P3 and P28 are most strongly correlated with both variable M1 and variable M8. Variables P3 and P28 are related to questions about temporary or permanent job loss in both crisis phases. The detailed results of the Chi-square test, p-value and Cramer coefficients for the relationships of the P3 and P28 variables with the M1 and M8 metric variables are shown in Table 6.

Analyzing in detail the relationships between variables M1 and P3 (P28) shown in Figure 1, it is possible to conclude that the respondents' age only slightly differentiated their job loss in both phases of the crisis. This is because the largest number of people in all age groups stated that they did not lose their jobs or did not work during this period, while the apparent larger share of people declaring mainly temporary job loss from the 25-34, 35-44 as well as 45-54 age groups may be due to the fact that representatives of these groups were more numerous in the research sample (see Table 1).

Table 6.

Correlation analysis example of variables M1 and M8 with variables P3 and P28

	Statistics: M1. Age of respondent (6) x P3. As a result of the COVID-19 pandemic, did you experience a temporary or permanent loss of your job? (4)			Statistics: M1. Respondent's age (6) x P28. In the second crisis phase, did you experience a temporary or permanent loss of your job? (4)		
	chi-square	df	p	chi-square	df	p
Pearson's chi-square	261.4650	15	0.0000	214.1270	15	0.0000
NW chi-square	252.5875	15	0.0000	195.3652	15	0.0000
Cramér V	.2952203			.2671622		
	Statistics: M8. Occupational status (6) x P3. As a result of the COVID-19 pandemic, did you experience a temporary or permanent loss of your job? (4)			Statistics: M8. Occupational status (6) x P28. In the second crisis phase, did you experience a temporary or permanent loss of your job? (4)		
	chi-square	df	p	chi-square	df	p
Pearson's chi-square	835.8332	15	0.0000	711.4958	15	0.0000
NW chi-square	915.5057	15	0.0000	744.6430	15	0.0000
Cramér V	.5278362			.4869962		

Source: Own elaboration.

Similar conclusions are reached by analyzing the distributions of variables M8 and P3 (P28) illustrating the impact of occupational status on job loss (Figure 2). However, individuals declaring that they have not lost their jobs also dominate in numbers at this point, and the increased number of cases of mainly temporary job loss of those employed in the private and public sectors is probably due to the fact that the representations of representatives of these sectors among respondents were the most numerous (see Table 3). Moreover, the similarity of the distributions presented in Figures 1(a) and 1(b), as well as 2(a) and 2(b), allows us to conclude that there is no significant impact of the crisis phase on job loss among respondents.

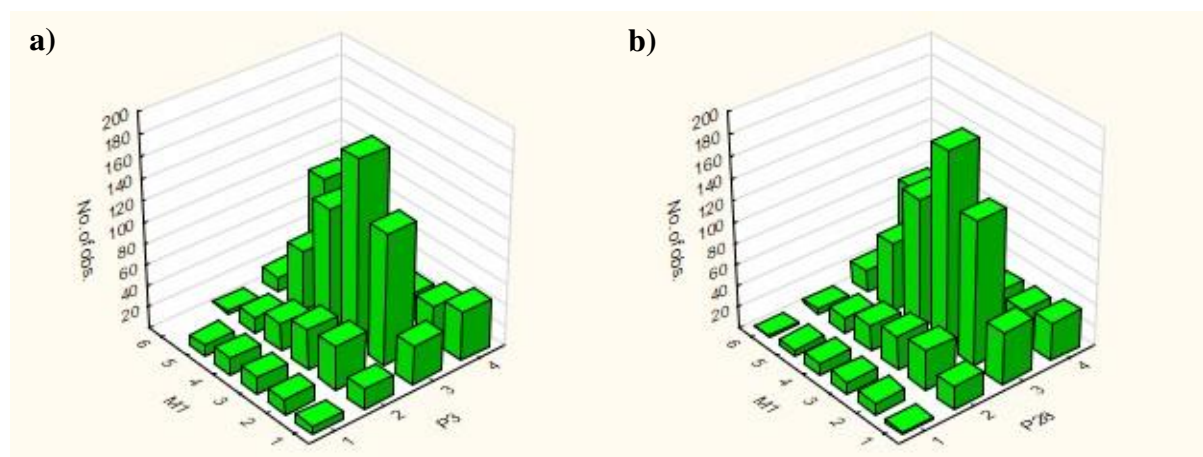


Figure 1. Two-dimensional distributions for the variables (a) M1 and P3, as well as (b) M1 and P28.

- Responses for variable M1: 1. 18-24, 2. 25-34, 3. 35-44, 4. 45-54, 5. 55-64, 6. 65 and more;
- Responses for variables P3 and P28: 1. Yes, permanent loss, 2. Yes, temporary loss, 3. No, 4. Not applicable - I did not work/did not run a business.

Source: Own elaboration.

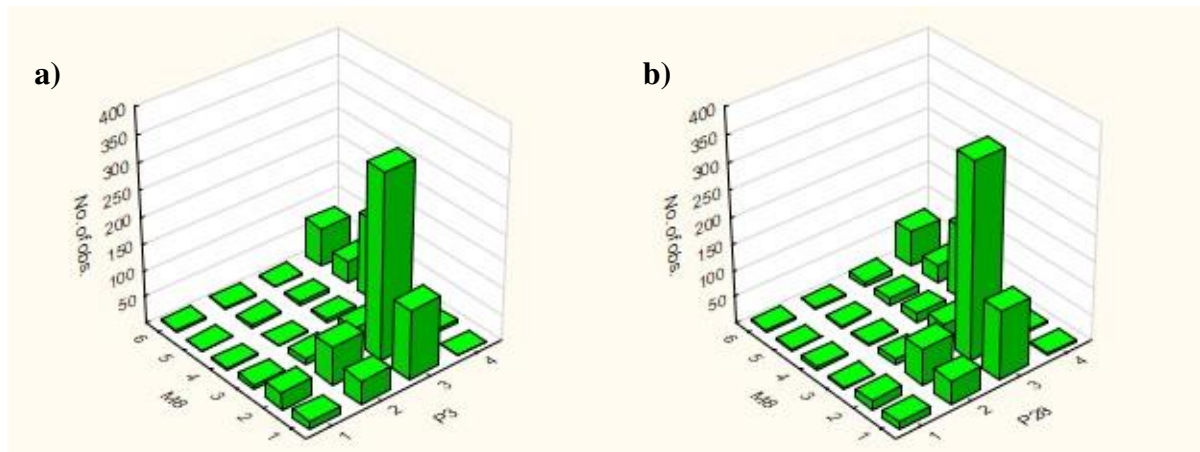


Figure 2. Two-dimensional distributions for the variables (a) M8 and P3, as well as (b) M8 and P28.

- Responses for variable M8: 1. Employed in the public sector, 2. Employed in the private sector, 3. Self-employed, 4. Retired/pension, 5. During education/studying, 6. Unemployed;
- Responses for variables P3 and P28: 1. Yes, permanent loss, 2. Yes, temporary loss, 3. No, 4. Not applicable - I did not work/did not run a business.

Source: Own elaboration.

Table 5 shows that only the correlations of some substantive variables with the metric variable M8 (respondent's occupational status) are moderately strong. Figure 3 shows sample distributions of such relationships for the first and second crisis phases presented in the following order:

- the impact of M8 on the change in monthly real earnings/income of respondents P2 (P27),
- the impact of M8 on changes in consumer expenditures P10 (P36),
- the impact of M8 on the share of investment expenditure in the current income of respondents P20 (P46).

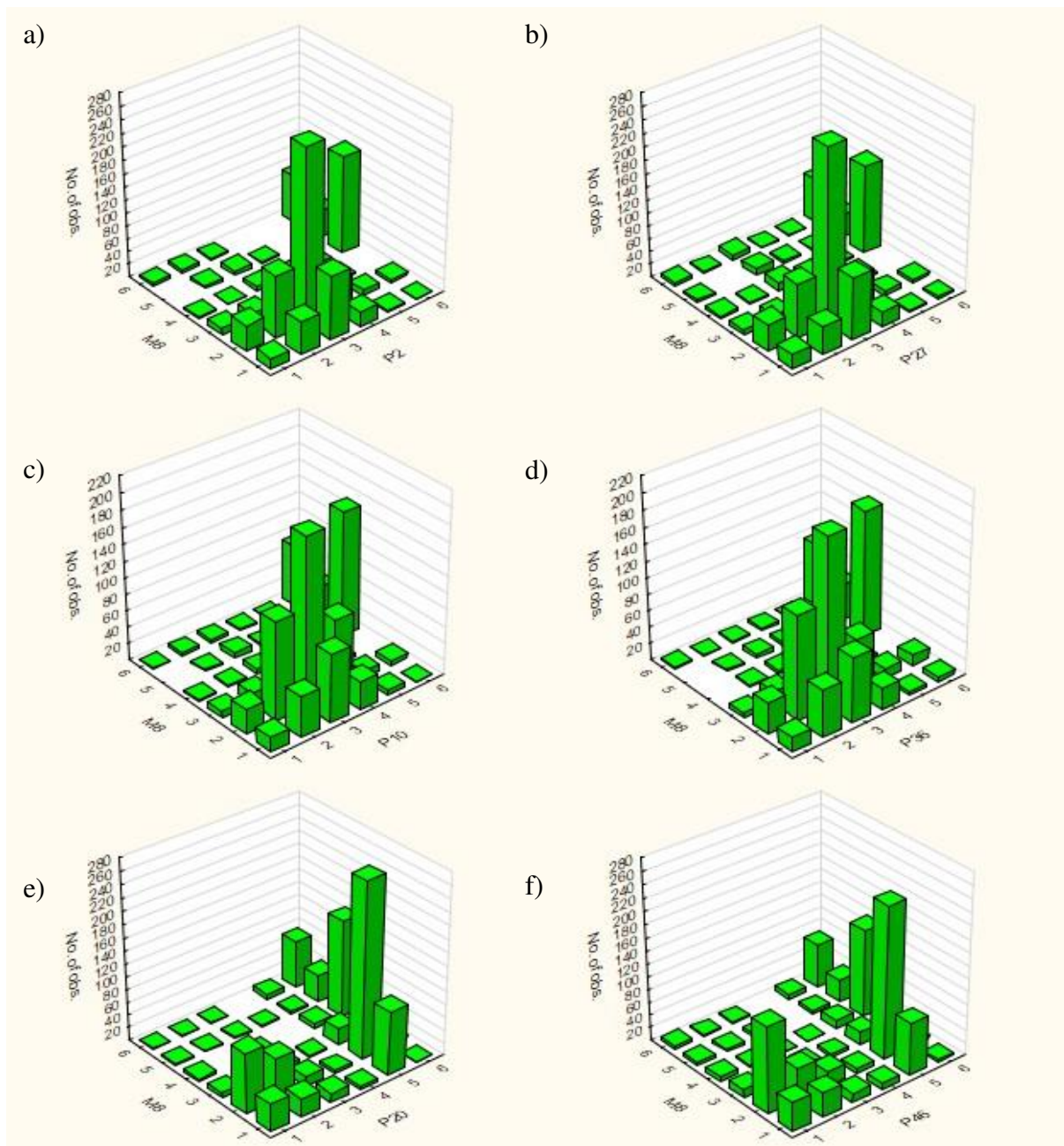


Figure 3. Two-dimensional distributions for the variables a) M8 and P2, b) M8 and P27, c) M8 and P10, d) M8 and P36, e) M8 and P20, f) M8 and P46.

- Responses for variable M8: 1. Employment in the public sector, 2. Employment in the private sector, 3. Self-employment, 4. Retirement/pension, 5. During education/studies, 6. Unemployed;
- Responses for variables P2 and P27: 1. Decrease by more than 20%, 2. Decrease by 11% - 20%, 3. Small change +/-10%, 4. Increase by 11% - 20%, 5. Increase by over 20%, 6. Not applicable - I did not work/did not run a business;
- Responses for variables P10 and P36: 1. Significantly increased; 2. Increased; 3. Has not changed; 4. Decreased; 5. Significantly decreased; 6. Not applicable - I did not work /did not run a business;
- Responses for variables P20 and P46: 1. 0 - 20%, 2. 21 - 40%, 3. 41 - 60%, 4. Over 60%, 5. Not applicable - I did not invest, 6. Not applicable - I did not work/operate/ did not run a business.

Source: Own elaboration.

Figures 3(a) and 3(b) indicate that the typical trends in the change in real respondents' earnings/income in both crisis phases were a small change ($\pm 10\%$) or a decrease in the range of 11-20%. This became apparent mainly in the private and public sectors, as the representation of these sectors among respondents was much more numerous than the others (see Table 3).

The distribution of responses shown in Figures 3(c) and 3(d) authorizes the conclusion that the consumer expenditure share for most respondents increased or remained unchanged during both crisis phases. However, for the second crisis phase, there are more numerous cases of a significant increase in this spending and fewer indications that this spending has relatively declined. These trends became apparent mainly in the private and public sectors for the reasons indicated above.

The two-dimensional distribution of the variables M8 and P20 as well as M8 and P46, presented in Figures 3(e) and 3(f), indicates that in the second crisis phase, the percentage of people investing increased slightly compared to the first. This occurred mainly among respondents employed in the private sector, investing small amounts (up to 20% of current income).

The analyses posted above authorize the conclusion that hypothesis h5, regarding the significant relationship between the financial situation and structure of respondents' consumption and investment expenditures and their metric characteristics, was not confirmed in the research. For only two of the metric characteristics showed a significant correlation with the substantive variables analyzed. Furthermore, the correlation strength of these variables appeared moderate at best (only strong for M8 and P3), and the two-dimensional distributions of the variables from both crisis phases were similar to each other.

Hypothesis h6 verification

Hypothesis h6 assumed that respondents' current financial situation and its future projection significantly influenced the structure and size of consumer and investment expenditures in both crisis phases. Its verification was based on correlation analysis between selected substantive variables reflecting the financial condition of the respondents (variables: P1 (P26), P2 (P27), P3 (P28), P8 (P33), P9 (P35)) and variables reflecting the structure and trends of their consumption and investment expenses (variables: P10 (P36), P11 (P37), P17 (P43), P19 (P45), P20 (P46), P25 (P49)). The symbols of the second phase variables are given in brackets. Similarly, as before, correlation calculus was used, using the Chi-square test. In Table 7, the shaded boxes indicate the relationships between the aforementioned variables, for which the Cramer coefficient values are greater than 0.1, and the numerical values denote those where the coefficient value is close to or greater than 0.5. The table layout indicates the existence of correlations between almost all the substantive variables analyzed, although their correlation is weak in most cases. However, the relatively strong for both crisis phases

correlation between variables characterizing the financial situation of respondents: P2 (P27) and P3 (P28), as well as those depicting the trends and volume of consumer and investment expenditure: P10 (P36); P11 (P37); P19 (P45) and P20 (P46) authorize the conclusion that hypothesis h6 can be positively verified.

Table 7.

Significant Chi-square test results between selected substantive variables

Phase I	P10	P11	P17.1	P17.2	P17.3	P17.4	P17.5	P17.6	P17.7	P17.8	P17.9	P19	P20	P25
P1														
P2	.4865	.5132											.4640	
P3	.5877	.5789										.4957	.5897	
P8														
P9														

Phase II	P36	P37	P43.1	P43.2	P43.3	P43.4	P43.5	P43.6	P43.7	P43.8	P43.9	P45	P46	P49
P26														
P27	.4242	.5056										.4750	.4619	
P28	.5272	.5792										.5988	.6060	
P33														
P35														

Source: Own elaboration.

Hypothesis h7 verification

Hypothesis h7 assumes that the respondents' financial situation and the structure and trends in consumer and investment expenditures in the two crisis phases were significantly different. Correlation analysis between the corresponding substantive variables from the first and second crisis phases indicated in Table 7, i.e. (P1 P25) and (P26 P49), revealed that all results are statistically significant. Furthermore, the Cramer's coefficient and Pearson's contingency coefficient values, calculated additionally for cases of variables with dichotomous cafeterias (yes/no), indicate a stronger correlation of corresponding variable pairs than in the case of h5 and h6 hypothesis verification. The most strongly correlated pair is P3 and P28, for which the detailed results of the Chi2 test and the contingency coefficient and Cramer's value are provided in Table 8. The weakest correlated pair of variables in this analysis were P17.01 and P43.01 (changes in basic consumption), for which the Cramer coefficient was 0.31. Therefore, in the area of these analyses, we have a moderate to strong correlation. The strong relationship between the P3 and P28 variables is confirmed by the two-dimensional distribution presented in Figure 4. The figure shows that in response to questions P3 and P28, respondents most frequently indicated the same response options, stating that they did not lose their jobs in either the first or second crisis phases, or that they did not work/do not run a business. Accordingly, hypothesis h7 should be rejected as false.

Table 8.

Detailed example of correlation analysis between substantive variables P3 from the first and P28 from the second crisis phase

Statistics	Statistic: Q3. As a result of the COVID-19 pandemic, has there been a temporary or permanent loss of your job in your case?(4) x P28. In the second crisis phase, has there been a temporary or permanent loss of your job in your case?(4)		
	chi-square	df	p
Pearson's chi-square	993.5007	df=9	p=0.0000
NW chi-square	917.7556	df=9	p=0.0000
Contingency coefficient	.7059532		
Cramér V	.5754710		

Source: Own elaboration.

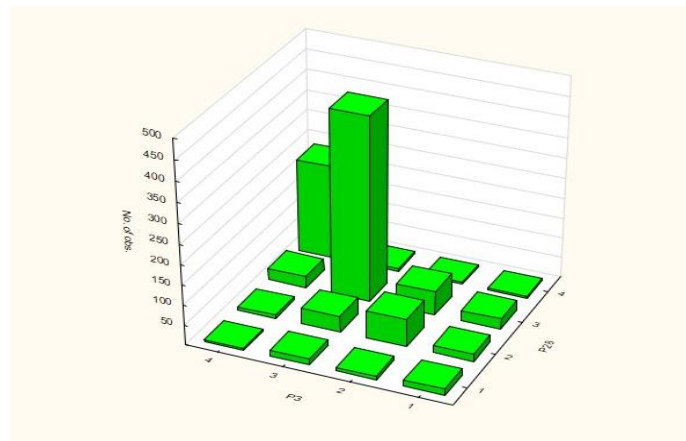


Figure 4. Two-dimensional distribution for the variables P3 and P28.

- Responses for variables P3 and P28: 1. Yes, permanent loss, 2. Yes, temporary loss, 3. No, 4. Not applicable - I did not work/did not run a business.

Source: Own elaboration.

5. Conclusion

The research results and statistical analyses presented in this paper authorize the following conclusions:

- Both the pandemic and inflation crises caused a deterioration in the financial condition of Poles, both as perceived subjectively and as measured by the decline in real income. Such a decline was declared in both crisis phases by approximately 23% of respondents each. However, the dominant phenomenon was the stabilization of the financial situation, as declared by 39% of respondents for the first phase and 46% for the second phase.

- The crises have exacerbated labor market perturbations. About one-fifth of active respondents have been affected by job loss, most of them, however, temporarily. In particular, the pandemic crisis has drastically reduced the possibility of changing jobs and/or the availability of new offers, as stated by more than 40% of respondents.
- The anti-covid shields proved to be an important factor in maintaining jobs and earnings levels for a third of the respondents covered by such support, while about 60% of respondents indicated their half-success (earnings levels were not maintained), and 8% of respondents' assessment was negative (despite the shield, the position/business was eliminated).
- However, in the opinion of the majority of the total respondents, the assessment of the Polish government's and the NBP's performance (in particular) in dealing with the pandemic and inflation crises was not positive. Among the negative opinions were the misallocation of funds from the anti-covid shields and excessive increases in public spending, late interest rate increases in phase two, and the lack of alternative financial instruments to affect inflation.
- However, the respondents' economic situation during the period under study was not quite bad enough to cause them to live on credit. During both crisis phases, the use of consumer credit was declared by a relatively small percentage of respondents, about 16% each. Credit charges generally consumed no more than 20% of current income, and the subjective assessment of one's purchasing power as a consumer was rated as moderate by about 70% of respondents in both phases. Meanwhile, the inflation crisis has exacerbated respondents' unfavorable projection of their own financial situation for the next 12 months. While at the end of the first crisis phase, 31% of respondents feared its deterioration, by the end of the research period this share had risen to 40%.
- Both crisis phases have significantly increased the share of consumer expenditure in current earnings/respondents, as indicated by about a quarter of respondents. Respondents most often spent up to 40% of their current income on basic and current consumption, and these were the main source of consumption financing (about 80% of indications when choosing twice). This was followed by savings (about 30% of indications).
- The factors that most strongly influenced changes in the structure and level of consumer expenditure were the current income level, inflation and price changes levels, savings holdings levels and the official pandemic restrictions of the first crisis phase. Low interest rate policy in the first crisis phase did not have a significant impact on the consumer expenditure growth.

- Dividing expenditure by specific goods and services, spending on basic consumption (food, fees, basic clothing) showed the highest growth rate (40% of indications each in both phases). The category in which spending stabilization dominated was home/apartment furnishings, and the largest spending reductions were in the categories of travel/holidays abroad, travel/holidays at home, luxury goods and current consumption (restaurant, cinema, theater), for which the percentage of indications in multiple choice was close to or above 50%. Expenditures for the car purchase or modification and the home/apartment purchase for personal use have also significantly decreased.
- The research showed that crisis situations have forced certain respondents groups to completely abandon certain consumer expenditure categories. However, even in the areas of basic consumption excluding food, the abandonment of this expenditure category, or a significant reduction in it, was indicated by 8% each of those surveyed in both crisis phases.
- Surveys have indicated a limited Poles' willingness/ability to invest. In both crisis phases, the percentage of non-investors was high, at around 70% of the total respondents. There was also a small share of investment expenditures, not exceeding 20% of the respondents' current income in most cases, and the dynamics of their changes over time.
- The respondents' stated preference for certain forms of investment as the most favorable income form and protection against inflation did not change significantly during both crisis phases. In a two-choice selection, the following were indicated in order of preference as the most advantageous investments: apartments/houses, land/agricultural land, gold/raw materials, treasury bonds and bank deposits. However, the declarations hardly translated into the respondents' actual investment choices, which were, according to frequency: bank deposits, currencies, stocks/stock funds, and treasury bonds. The following factors were identified as the main factors determining the choice of the investment form and limiting the investment process: the level of funds held, the level of investment risk, the knowledge necessary for investment, the expected rate of return and the difficulty of the investment procedure.

The statistical verification of the research hypotheses included in the study allows us to conclude that:

- Hypotheses h1 and h2 were verified partially positively, because although financial deterioration and job loss were found in a significant percentage of respondents, these phenomena were not of a massive, dominant nature.
- The following hypotheses should be considered confirmed: h3 on the impact of both crisis phases on the growth and change in the structure of respondents' consumer expenditures, and h6 assuming that the respondents' current financial situation and its

future projection significantly affected the assortment structure and size of such expenditures.

- Hypotheses h4 on the impact of crisis situations on the change in the forms and dynamics of respondents' investments, h5 on the existence of relationships between respondents' metric characteristics and their financial situation and expenditures structure, and h7 on significant differences in respondents' financial situation and the size and structure of their expenditure from the first and second crisis phases should be rejected as unproven.

Concluding statements that the pandemic and inflation crisis have caused, although not on a massive scale, a deterioration in the financial situation of Poles and a change in the structure and growth of consumer expenditures in their current income are legitimate. However, such changes did not take place in the capital expenditure area. No significant differences in the severity of these phenomena were observed between the pandemic crisis phase and the inflationary crisis phase. Similarly, no clear correlations were identified between the metric characteristics of the subjects and the perceived crisis impacts. In the statistical analyses conducted, the correlation of the various categories of explanatory variables with the explained variables was quite common, but in the vast majority of cases weak.

The research presented here was conducted at a time when the inflation crisis was still growing. Better identification of its effects, including deferred effects, could be achieved by repeating the study on the same research.

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PROFESSIONALIZATION OF THE ACCOUNTING PROFESSION: OPPORTUNITIES AND THREATS RELATED TO CERTIFICATION. EVIDENCE FROM POLAND

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Purpose: The purpose of the article was to assess the attitude of accountants to the process of professionalization based on voluntary certification. As part of implementing the auxiliary objective, a list of arguments for and against voluntary certification of the accounting profession in Poland was developed.

Design/methodology/approach: The research project aimed at determining the current professionalization stage of Polish accountants. A survey method was used in empirical research, and followed by an in-depth secondary analysis of an open question regarding the justification of solutions that, according to the respondents, should be adopted in the future in practicing the accounting profession in Poland. The analyzed question was an extension of a closed question.

Findings: The obtained results indicate a problem of a large diversity in the opinions expressed by the accountants and their willingness to accept various solutions, including voluntary certification. The arguments for and against professionalization of the profession, understood as voluntary certification, were grouped. The obtained results expand the knowledge about the expectations and fears of accountants in the field of solutions for practicing the accounting profession in Poland, revealing various interests and experiences of the accounting community in Polish business practice.

Research limitations/implications: A limitation is no possibility to compare the conducted studies with others due to lack of this type of research in the environment and a limited number of survey questions constituting the basis for diagnosing the diversity of the accounting environment in Poland.

Practical implications: The research is a continuation of studies diagnosing the current status in Poland and the possibility of applying new solutions regarding the practice of the accounting profession in the future.

Social implications: The research results have impact on the development of the accounting profession and the market of accounting services in Poland as well as the role of accountants in sustainable economic and social development.

Originality/value: The research broadens the knowledge about the determinants underlying professionalization of the accounting profession. The article is a voice in the discussion on the need to prepare new solutions for the accounting profession in Poland.

Keywords: accountants, professionalization, accounting, deregulation in accounting profession, certification in accounting.

Category of the paper: research paper.

1. Introduction

In common understanding, the terms "occupation" and "profession" are often considered synonymous. According to sociologists and management experts, a profession is a distinct type of occupation with higher requirements and responsibilities, enjoying social recognition. Following this interpretation, a "profession" denotes a prestigious and highly esteemed occupation, requiring public trust. In Anglo-Saxon countries, the term "profession" corresponds to the French-derived term "liberal profession" (*profession liberte*). Although the boundary between profession and occupation has not been precisely defined, the characteristics of a profession may include specialized knowledge specific to a particular field, a system for acquiring and certifying qualifications, ethical codes, responsibility towards the community, prestige, and self-regulation (Gwózdź, 2013, p. 140; Richardson, 2017, p. 5). According to the functional approach (Larson, 1977 after Richardson, 2017, p. 5), a profession is a separate occupational structure, which is a way "to translate one order of scarce resources - knowledge and skills - into another - social and economic rewards" (Larson, 1977, p. xvii).

The evolution of a profession from an occupation is termed as "professionalization". It is assumed that it usually includes the following stages (Łabieniec, 2016, p. 4):

1. an occupation becomes the main or sole source of income for those practicing it,
2. entering the profession requires meeting certain requirements (e.g. education, experience),
3. organizations associating people practicing the profession are established,
4. codes of professional ethics for people associated with the profession are created,
5. practicing the profession is subject to a certain form of statutory regulation (statutory regulation or self-regulation, e.g. certification scheme or license).

What is the current professionalization stage of the accountants in Poland? With a few exceptions, e.g. in the public finance sector, Polish regulations do not define entry requirements for the profession under study, theoretically allowing anyone to become an accountant. However, in practice, education and experience are required from accountants, as evidenced by a cursory analysis of job postings in the accounting industry. Assuming that the practice in Poland has established entry conditions for the profession, the professionalization process for accountants in Poland is at the final, sixth stage from the aforementioned list. The only missing

element is the formalization of entry requirements for the accounting profession and oversight of its practice. This formalization can be performed through legislative regulation of the profession or the creation of a voluntary professional certification system with the widely accepted standards. Implementing either solution requires consultations within the accounting and business communities. Therefore, in 2022, the Ministry of Finance initiated public consultations on the future of the accounting profession in Poland. The largest organization of accountants, the Accountants Association in Poland (AAP), also participated in the consultations. AAP's Scientific Council prepared a survey, which was completed by over 3,300 accountants from across Poland between March and September 2022. This article analyzes responses to an open-ended question: "Which method of regulating or certifying the accounting profession do you propose, and please justify your answer?" The article aims at evaluating accountants' attitudes toward the professionalization process linked to voluntary certification.

For the purposes of the study, the following hypothesis was formulated: Accountants accept the need of professionalization process based on voluntary certification of the profession.

The obtained results broaden the knowledge about accounting expectations and concerns regarding the solutions related to the practice of the accounting profession in Poland. Our study is also a continuation of the research carried out so far, diagnosing the current state of practising this profession and exploring the conditions of new solutions. Our findings give a picture of expectations, but also concerns of the accountants related to the feeling of various interests.

The content of the article has been structured for the purpose of achieving the adopted goal. It has been divided into the following parts: literature review on the process of professionalization among accountants, discussion of regulations referring to the accounting profession in terms of certification obligations in Poland in the context of European requirements, empirical part in connection with the discussion and final conclusions.

2. The process of professionalization among accountants – literature review

The accounting profession has been perceived differently over the years. Hońko (2022) draws attention to a certain simplification in the use of the term "accountant". From the perspective of formal qualification for professions and specialties used by the European Commission, originating in Anglo-Saxon countries, two terms describing work performed by accountants can be indicated, i.e. a bookkeeper and an accountant (Fulks, Staton, 2004; Hońko, 2022). A "bookkeeper" is the person responsible for making entries in the books, usually a lower level employee. In turn, an "accountant" is a person presenting both specialist knowledge and appropriate skills, allowing for bookkeeping and preparation of financial

statements, as well as involvement in management accounting and financial analysis (Fulks, Staton, 2004; Hońko, 2022).

However, the term accountant is commonly used to describe people who perform both areas of the accounting work. This simplification results in a distorted picture of the accounting profession, often detached from the real intellectual commitment, specialist knowledge and skills as well as responsibility. In Poland, the discussion addressing the accounting profession has been additionally strengthened by the deregulation introduced in 2014, the effects of which are the subject of research (the research of the Accountants Association in Poland, Ministry of Finance, Buszko, Ciechan-Kujawa, 2020; Ciechan-Kujawa, Szczechowska, 2018). Against this background, the question about the process of professionalization in accounting in Poland is particularly important.

T. Lee (1995) defines the term “professional” as occupations organized in institutional form, whose practitioners are committed explicitly to serve the public interest, and who offer client services related directly to an intellectually based body of knowledge. The author, referring to the example of the UK and the USA, points to the phenomenon of conflict between accountants' economic self-interest and public duty. T. Lee (1995) highlights the evolution of the accounting profession towards the externalized defenses of the professional mission. Gallhofer and Haslam (2017) emphasize the formal side of certification. In turn, Fournier (1999) describes the desired model of accounting professionalism, which is based on appropriate professional competence and control, but also takes into account the public good and social attitude.

The factors influencing the process of professionalization in accounting were addressed in many studies. West (1996) draws attention to the consequences of factors such as gender, social class, and political aspects on the process of professionalization and the professional status of accountants. Extensive literature research conducted by Yapa (2022) concerned the problem of professionalization of accounting in developing countries. Significant importance was attributed to the process of globalization. The author also indicates other determinants subjected to research, e.g. state and political ideology, religion, racial/class discrimination. He draws attention to the problem of accounting work monopolization, which appears in the research, and the role of British/international professional organizations in it (Yapa, 2016, 2022). At the same time, the author points out new aspects of the professionalization process, such as environmental accounting, competition with Western professional organizations, and accounting of government institutions.

The process of professionalization is associated with the problem of legal regulations in the field of accounting and auditing. An important role is assigned to professional organizations and entities related to them, which, as opinion-forming bodies, develop professional standards and influence legislative processes (Cooper and Robson, 2006). The attitude of the accounting community to the process of professionalization varies (Hastings, Hinings, 1970).

Cooper and Robson (2006) emphasize that the experience of multi-national professional service firms, known as the Big 4, is not sufficiently used in the process of professionalization. They believe that these global actors can play a significant role in disseminating the right approach to the problem of professionalization, as well as its proper understanding. Accountants working in corporate structures perceive the need, or rather the indispensability, to constantly update and expand their competences, which is also associated with the possibility of promotion. The professionalization of accountants can also be seen in the context of imperialism (Annette, 2000). The author, using the example of the Association of Chartered Certified Accountants (ACCA), presented an opinion on the impact of this organization in the education and certification of professional accountants in Trinidad and Tobago. The author identifies post-colonial effects in this influence.

In the opinion of Hastings and Hinings (1970), the accountants employed by large industrial firms have a different sense of responsibility comparing to the accountants employed by small firms, smaller public offices or those in the public, voluntary or community sectors.

Korzeniowska et al. (2022) conducted research on professional reference groups among the accountants in Poland. The researchers used the in-depth interview method. Their findings are very interesting in the context of the professionalization process, and in particular the need to return to certification or partial certification. The researchers identified two professional reference groups among accountants: accountants working in accounting offices and accountants employed in enterprises who conduct accounting independently. Importantly, both groups attached great importance to the standards of the profession and taking responsibility for the reliability and credibility of information generated by the accounting system. From the viewpoint of professional norms, the respondents indicated the requirement to have appropriate competences, including knowledge. Differences occurred in the formulated mutual opinions about these groups. The opinion about accountants working in accounting offices expressed by the accountants working in enterprises was distancing. They pointed out that this group uses easy solutions, preferably those that require minimal involvement and comply with tax regulations, even if they are not optimal for companies, e.g. from the perspective of financial statements. Lower quality of work performed by this group of accountants was generally emphasized, which was justified, i.a. by lower competences, resulting, e.g., from not participating in appropriate trainings, as well as taking an attitude towards "easy solutions".

In turn, the accountants working in enterprises were perceived by a group of people working in accounting offices as applying higher standards, including ethical ones. They also pointed to their easier access to training. Such research results seem to be particularly important in the context of the need for continuous improvement of qualifications, and thus the idea of lifelong learning (e.g. Green, 2006).

Pokojska (2009) and Klamut (2012a), evaluating the opinions of the accounting community on certification, indicated an important argument for such a solution, namely making it easier for entrepreneurs to assess people employed in accounting departments, especially in the

positions requiring high qualifications. Klamut (2012b) analyzed the risk of the activity of accounting offices. As part of the internal risk, she indicated, i.a., insufficient level of intellectual capital and as a danger - insufficient qualifications of employees, tax advice burdened with errors, etc.

Another important study covering the problem of professionalization of the accounting profession was conducted by the Accountants Association in Poland (AAP) - the largest Polish professional organization of accountants, concerning the effects of deregulation of the accounting profession carried out in 2014 and the directions of further changes in the field of professionalization (AAP, 2022).

Our study can be considered as a specific continuation of the research described above. In-depth research is focused on accountants' opinions on further professionalization of the profession.

The following hypotheses were adopted: Accountants accept the need of professionalization process based on voluntary certification of the profession.

3. Regulations of the accounting profession in terms of certification obligations in Poland in the context of European requirements

The essence of perceiving the accounting profession and the services it provides consists in their quality and public confidence in this line of work. Due to the deregulation of the profession in Poland in 2014, the question arises about its impact on the security of business transactions in the context of the lack of formalized requirements as to the knowledge, experience and competence acquired by accountants. For several years, a decrease in the quality of offered services has been noticed, which negatively affects the approach to the analyzed profession. Therefore, it is also worth looking into the issues of regulating the profession in the EU countries and, against this background, refer to the possibility of exploring vocational education in Poland.

Extensive research in this area was carried out by M. Michalak's team (Michalak, Walińska, Kaczmarczyk, Jastrzębowski, 2022, pp. 6-7), which verified 20 European countries, dividing them into those setting requirements for candidates in the form of appropriate regulations and the ones not imposing such requirements. Tables, figures and formulas – continuous numbering in the text.

Table 1.*Summary of the rules governing the accounting profession*

Country	Type of regulation	Requirements	Examination
Austria	Statutory regulation, including that of an accountant, management and a payroll accountant	No requirement for the level lib of the education profile, Practical experience 3 years and 1.5 years, Externally acquired qualifications must be confirmed by a minimum of 22.5 hours of professional work per year	yes
Belgium	Statutory provisions	Higher education requirement, work experience, exam, 200 days of internship (1000 hours) over a period of 12-36 months	yes
France	Statutory and environmental regulation, two paths: 1. Education/practice 2. Exam	Requirement of higher education, 3 years of practical experience, exam, The second path does not require directional education	yes
Portugal	Statutory delegation for a professional organization to confer authorizations	Requirement of higher education (bachelor's or postgraduate studies), 1.5 years of work experience	
Romania	Statutory delegation for a professional organization to confer authorizations	No data available	No information
Serbia	Statutory delegation for a professional organization to confer authorizations	No data available	No information
Italy	Regulation of requirements at the statutory level	Higher education, practical experience requirements and state examination	yes

Source: (Michalak, Walińska, Kaczmarczyk, Jastrzębowski, 2022, pp. 6-7).

As it follows from the above, regulations are delegated both to national authorities and are created in the form of laws, as well as to professional organizations which, based on their rank are entitled to accept candidates for the accounting profession. These countries predominantly derive their solutions from the continental accounting system, where legal regulations constitute the essence of functioning in the profession. As opposed to this approach, the Anglo-Saxon model presents greater flexibility in such requirements based on industry and environmental regulations, e.g. Great Britain, the Netherlands.

The approach of Polish legislation, as part of the accounting profession deregulation, has cancelled the certification requirement issued by the Minister of Finance and now, in order to be accepted to perform bookkeeping services, the candidate has to meet the following conditions:

- full legal capacity,
- no convictions by a final court judgment for an offence against the credibility of documents, property, business transactions, money and securities trading, a fiscal offence and offences specified in Chapter 9 (Article 76, UoR).

In addition, the entrepreneur is obliged to conclude a civil liability insurance contract for the damage caused in connection with the conducted business. In turn, there are no requirements for his education, which is left to the discretion of the person concerned (Wołujewicz, Woźniak, 2016, p. 54)¹.

Since the proposal to introduce deregulation to the present, numerous concerns have been raised about the impact of deregulation on the quality of provided services and the security of business transactions (Świetla, Jonas, 2015, pp. 585-596; Klamut, 2013, pp 137-150). The issues related to the aforementioned quality were the basis for analyses also carried out by the author of the deregulation, i.e. the Ministry of Finance, which in March 2019 presented a report from a nationwide survey assessing the effects of deregulation. When asked about the qualifications and the level of knowledge presented by an accountant, 43% of the respondents indicated seniority and practice, but more than half of them noted deterioration in the quality of services, and 58% of the respondents changed their service provider as a result (Report from a nationwide survey, 2019). These results initiated a renewed discussion on the introduction of regulations for the profession.

At the moment, however, there are no guidelines for accountants to obtain certificates confirming knowledge, experience and competence. It is up to a voluntary need for education undertaken by the accountants themselves.

Currently, as part of the voluntary career path, people who want to expand their knowledge and obtain a professional certificate can use the four-stage professional path developed by the AAP.

- level I – accountant – profession code 331301,
- level II – accounting specialist (independent accountant) – profession code 241103,
- level III – chief accountant – 121101 profession code,
- level IV – certified accountant profession code 121101 (Resolution No. 757/202/2010, 2009).

Table 2 indicates entry requirements for candidates applying for individual professional levels of proficiency.

¹ Since 10 August 2014, i.e. from the date of entry into force of the provisions of the Act of 9 May 2014 on facilitating access to exercise certain regulated professions (Journal of Laws, item 768).

Table 2.*Entry requirements for candidates applying for qualification levels in the AAP certification*

Level	Professional title	Education	Documents confirming experience
And	Accountant – Accounting Assistant	at least medium	not necessary
II	Accounting Specialist	at least average	a certificate of qualification in the field of the first level, obtained after the examination ending the education conducted by the Association or: the title of accounting technician or: another form recognized by the education provider as equivalent
III	Chief Accountant	higher or medium	a qualification certificate obtained after the examination at the end of education conducted by the Association in the field of the second cycle or: accounting certificate entitling to perform bookkeeping services, issued by the Ministry of Finance or: a master's degree with a specialization in accounting or a bachelor's degree with a specialization in accounting, obtained at a university whose study program has been recognized by the Main Professional Examination Board as meeting the requirements (accreditation of the Association) or: a master's degree or a bachelor's degree and a completed test in the scope of requirements specified for the second cycle, carried out by the education provider
IV	Chartered Accountant	higher or medium entitling to enter higher education	a certificate of qualification obtained after the examination at the end of education conducted by the Association in the field of level III (chief accountant) or: passed test in the scope of requirements specified for the third qualifying level, conducted by the education provider, as well as: having practice in the field of accounting: - at least two years in the case of higher education, - at least five years in secondary education.

Source: Authors' compilation based on: Appendix No. 1 to the resolution No. 732/111/2009 of the Main Board of the AAP of 20 July 2009. Regulations of qualification requirements and professional practice for the purposes of certification of the accounting profession.

The prerequisites indicated in the Table are the basis to start training within specific levels. The first level requirements, i.e. to become an accountant, cover the following:

- basics of financial accounting with elements of professional ethics,
- selected public law issues.

In the case of the second-cycle course entitling to use the title of an accounting specialist, these are:

- financial accounting with elements of professional ethics,
- tax law,
- selected problems of labor law, social security and economic law.

A chief accountant (third level) is required to acquire such issues as:

- advanced financial accounting with elements of professional ethics and IT technology - based on the Accounting Act, Polish Accounting Standards, IFRS and tax law,
- cost accounting, management accounting and financial management basics,
- financial statements and their analysis,

- tax law, taking into account current case law and interpretations,
- business law, selected issues.

The highest - IV professional level - a certified accountant can be awarded to a person who passes exams in the area of:

- advanced financial reporting with elements of professional ethics and IT technology,
- financial management - selected issues,
- management accounting,
- tax settlements – selected issues.

In the latter case, the respective qualification may also be awarded to a person holding the post-doctoral academic degree (habilitation), which exempts from taking examinations. The award of the chartered accountant qualification is preceded by the candidate's taking an oath, and in order to maintain it in the future, it is necessary to participate in continuing education (Resolution No. 732/110/2009, 2009).

As part of the professional certification path for accountants, the AAP issued over 126,000 certificates in the years 2010-2022. The number of people obtaining certificates is lower because many people have chosen to obtain several certificates. Information on the number of certificates obtained, broken down into individual certification levels, is presented in Fig. 1.

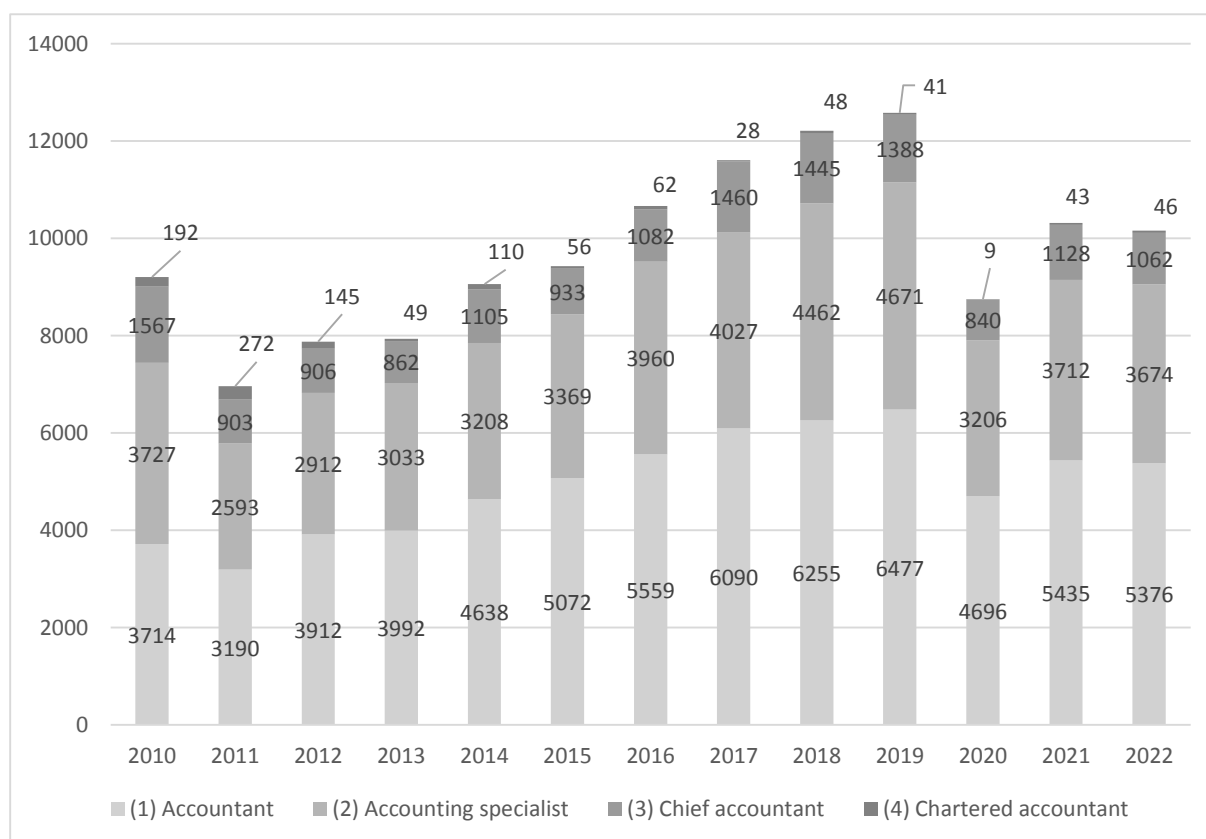


Figure 1. Number of the AAP certificates issued in 2010-2022.

Source: Authors' compilation based on: The AAP training activity reports.

4. Pros and cons of the accounting profession certification – analysis of the research results

The survey was conducted by the AAP's Scientific Council between March and September 2022. The survey was prepared using an online form (MS Forms). Attendees of courses, webinar participants, and the AAP members were encouraged to complete the survey. A broad promotional campaign resulted in 3,307 responses from the accountants across all regions of Poland. The survey included 10 closed-ended questions, 5 open-ended questions, and a demographic section. The consolidated survey results are available on the AAP's website. Closed-ended questions used a 5-point Likert scale. Responding to the closed-ended questions was optional.

Considering the purpose of this article, analyzing responses to the following open-ended question is particularly significant: "Which method of regulating or certifying the accounting profession do you propose, and please justify your answer." The question served as a comment to a closed-ended question where the respondents could assign numbers from 1 (completely disagree) to 5 (completely agree) to one of the following response options:

1. lack of regulation and definition of the accounting profession (maintaining the current state),
2. popularization of market qualifications within the Integrated Qualifications System (ZSK) (defined qualifications entered into the register, ministerially supervised),
3. professionalization of the accounting profession (voluntary professional certification, certificates issued by the state institutions or professional organizations),
4. regulation of the profession (certain activities would be reserved for the authorized accountants only, and authorizations would be granted by the state authorities),

The summary of responses to the above closed-ended question is presented in Figure 2.

As shown in Figure 2, the most preferred option for change is the introduction of voluntary certification as part of the professionalization of the accounting profession. The sum of responses 4 and 5 for professionalization is 74.2%, and for regulation is 64.8%. It should be explained that the respondents could select multiple response options.

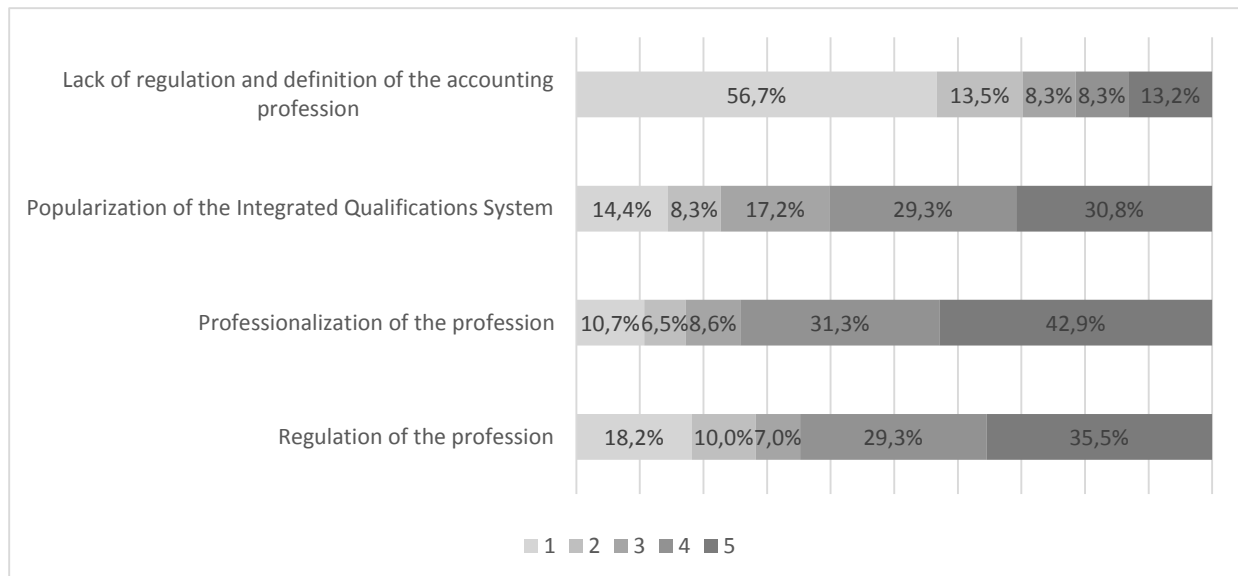


Figure 2. Answers to the closed-ended question regarding the professionalization of the accounting profession.

Source: own elaboration.

472 individuals responded to the open-ended question, where accountants could justify their position (i.e., 14.3% of respondents). It is worth noting that those who chose to provide their justification were more skeptical about the professionalization of the accounting profession (Table 3).

Table 3.

Summary of responses from the respondents who chose to justify their position on the closed-ended question (n = 472)

Response option	Disagreement (1+2)	No opinion	Support (4+5)	Total
Lack of regulation	60.6%	7.1%	32.3%	100%
Popularization of IQS	31.1%	15.1%	53.8%	100%
Professionalization of the profession	26.2%	8.9%	64.9%	100%
Regulation of the profession	39.6%	6.8%	53.6%	100%

Source: Authors' compilation.

The analysis of responses to the open-ended question allows for the formulation of arguments for and against the professionalization of the accounting profession, understood as voluntary certification. Supporters of certification emphasize that regulating the profession would enhance the quality of accounting services, increase client trust, raise wages, and protect against the actions of incompetent "pseudo-experts". The supporters' arguments are as follows:

- Certification would raise the prestige of the accounting profession, positively impacting its image.
- Certification would ensure professionalization manifested in high-quality accounting services.
- Increased trust of clients in certified accountants, allowing for the elimination of incompetent individuals.

- Specified entry requirements (education or exams) would eliminate incompetent individuals, increasing trust in accountants.
- Many accountants continually update their knowledge, so documenting training would not be an additional burden.
- Voluntariness enhances professionalism and offers a choice to entrepreneurs.
- Ongoing qualification verification should be established.
- Quality of regulations would improve - certification would frame the professional development of accountants.
- Certification would ensure that working accountants are qualified and appropriately educated, ensuring reliability and financial security of transactions.
- Certification would encourage continuous professional development among those in the field and may attract new individuals to the profession.
- Certification would introduce oversight of the profession by appropriate authorities, potentially eliminating individuals lacking adequate knowledge from the market.
- Certification could reduce the number of low-quality accounting offices, to the benefit of clients.
- Prevention of financial abuse: Certification would help limit financial abuse and fiscal errors, positively impacting the public interest.

Among opponents of the professionalization of the accounting profession, the following arguments are repeated:

- Fear of excessive bureaucracy due to oversight by the state authorities or professional associations.
- Limitation of competition: Some opponents believe that the profession regulation could limit competition and lead to higher service prices.
- Exams and training related to certification may generate additional costs for accountants and entrepreneurs.
- Certification may hinder newcomers to the field with skills and experience but lacking certificates.
- Certificates do not always guarantee the quality of accounting services.
- The market verifies the quality of accounting services, obviating the need for exams or certificates.
- Concern about the continuous need for qualification improvement due to certification requirements.
- Lengthy experience and practice are more important than possessing a certificate.
- Due to frequent changes in tax and accounting regulations, the opponents of certification fear that regulating the profession will pose a challenge to implement and hinder accountants' work.

- Introducing certification may result in closing the professional market and a lack of interest in the profession.
- Deregulation of the accounting profession increased service availability, benefiting entrepreneurs.

Many respondents fear that certification would necessitate re-acquiring authorizations for individuals with ministerial certificates issued before 2014. Some respondents assume that professionalization would involve reinstating ministerial certificates as before deregulation. These certificates were issued indefinitely, and their holders were not required to document continuous professional development. Many individuals opposing certification presuppose that it would cover all accountants, including those handling simplified tax records.

5. Discussion

Our results partially confirm the adopted research hypothesis. The vast majority of accountants (over 74%) perceive the need to professionalize the profession and combine this process with professional certification, which is consistent with the formulated hypothesis. However, in-depth analyzes based on an open question regarding the grounds for the presented open-ended opinions justifying this result show a lower score. Among the respondents justifying their position, 64.9% were in favor of professionalization.

However, the interpretation of this result is more complex, as only 14.3% of the respondents chose to answer the open question. This may indicate the reluctance of the respondents to justify their opinion or the lack of specific arguments. At the same time, the findings indicate a differentiated approach of the accounting community to the problem of solutions concerning the practice of the profession in the future. More than half of the respondents accept the adoption of the IQS (60.1%) and the regulation of the profession, meaning that some activities would be reserved only for authorized accountants, and authorizations would be granted by the state authorities (64.8%).

The open question was answered by 53.85 and 53.6%, respectively. It is worth emphasizing that only 21.5% of respondents were in favor of no regulation, but this group was definitely active in presenting their arguments - 32.3%.

Our findings indicate a diversified approach of accountants to solutions concerning the practice of the profession. These results are similar to the conclusions drawn by Korzeniowska et al. (2022) and Hastings and Hinings (1970), on the diversity within the accountants' community, their attitudes and opinions. Klamut (2012b) points to one of the reasons for such differentiation in relation to accounting offices.

Klamut (2012a) presents arguments for the certification of accountants, proposing the introduction of one "universal" certificate. Some of the arguments presented by the author are consistent with those provided in the answers to the open question in our research. This applies in particular to the perspective of the employers. Our research confirmed the adopted hypothesis in a general scope, but at the same time indicates the complexity of the problem and the need to conduct further research in order to develop new solutions regarding the practice of the accounting profession in Poland. The obtained results revealed the diversification of interests and attitudes among accountants, and this requires more detailed research focused on the arguments for and against specific solutions. We plan to continue research in this direction using the interview and experiment method.

6. Conclusions

The research we conducted allowed us to assess the attitude of accountants to solutions in the field of practicing the profession in the future, including the process of professionalization closely related to voluntary certification. Based on the obtained research results, two main conclusions can be drawn. The first concerns the process of professionalization. The vast majority of respondents positively assessed the professionalization of the profession through voluntary certification. However, not much less accepted such solutions as regulating the profession and adopting the IQS. In our opinion, this indicates a strong need to move away from the current state, but at the same time it indicates a positive attitude of the majority of respondents to various solutions within the framework of abandoning the deregulation of the profession. The results obtained by us broaden and deepen the knowledge about the attitude of the accounting community to solutions related to the practice of this profession, in particular to professionalization by means of voluntary certification. The analysis of the answers to the open question concerning the arguments for and against the indicated solutions gives a picture of expectations, but also concerns of the accountants related to the feeling of various interests.

The research is another step towards diagnosing the current state and the direction of changes from the point of view of perception of accountants. For this reason, our study is a voice in the discussion on the need to prepare new solutions regarding the practice of the accounting profession in Poland.

With regard to the conducted research, limitations can be indicated. The most important is no possibility to compare the obtained results with the results of other studies, which is due to the lack of this type of research. The second limitation is the limited number of survey questions regarding the diagnosis of the diversity of the accounting environment in Poland. In the next stages of research, we intend to explore this problem.

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IMPROVING MEDICAL PROCESSES IN HEALTHCARE FACILITIES IN POLAND

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Purpose: The work aimed to identify problems occurring in a Polish medical facility, and then to take action to improve its functioning to improve the quality of services and staff satisfaction with work in standard conditions and a crisis.

Design/methodology/approach: The research identified communication bottlenecks and delays caused by them. The action was taken focused on improving communication between employees and at the level of the medical facility - patient. A strategy of actions improving logistic and organizational processes for the medical facility was adopted.

Findings: The implementation of Lean Management (LM) tools in a medical facility improves its functioning, which is also evidenced by literature studies of completed projects.

Research limitations/implications: The medical staff of the medical clinic was examined: communication problems were found that hinder the work and quick service of patients were found. The problems at the facility were found to be due to a lack of standards.

Practical implications: Improving the efficiency of a medical facility is of particular importance during a pandemic, when work is carried out in an increased sanitary and time regime, most often with a shortage of medical staff.

Social implications: The use of lean tools in health care improves the efficiency of medical staff, making them more efficient and more focused on the patient. This ultimately improves not only the comfort of work but also its safety.

Originality/value: The training game for medical facilities (Koromo LeanHealthcare) developed during the research will be a tool supporting the efficient implementation of LM tools in professional medical practice.

Keywords: Lean Healthcare, Lean Management, Six Sigma, Koromo Lean, flow efficiency.

Category of the paper: Research paper.

1. Introduction

The aim of the project, the course and results of which are described in the article, was to support the health service during the crisis of the COVID-19 pandemic. After analyzing the domestic and foreign literature (Wiśniewska, Konieczńska, 2011; Reijula, Tommelein, 2012; Byrne, 2013; Modig, Alstrom, 2014; Preś, Dudek, 2018; Koczor, 2020; AB, 2022; Góral, 2022 and others), it was found that standards, improve its functioning at all levels. It was found that these standards are not commonly used, but only in those institutions that have undertaken training among medical and medical-related personnel, implementing quality tools in the field of Lean Management. Lean Management once again turned out to be a universal philosophy that reduces all waste and can be applied in every aspect of human activity, both in production systems and in services.

Based on good examples of the implementation of lean tools and the effects achieved for small medical facilities (e.g. Koczor, 2022), an attempt was made to implement lean tools in the NZOZ Nasza Poradnia Sp. z o.o. in Chorzów. After the audit and interviews with the employees of the facility, the biggest problem with communication on two levels was found: employee-employee and medical facility-patient, and it was decided to improve them.

The brainstorming allowed us to generate a research question: "Will the implementation of at least one lean tool in the facility significantly improve communication?".

Due to the sanitary regime, the examinations were carried out with great restrictions, each time allowing a small number of employees and team members to contact each other, in compliance with all recommendations of the Sanitary Inspectorate. Therefore, training was conducted several times in small groups: staff was familiarized with the theory of lean philosophy and examples of its functioning in medical facilities; Lean workshops were conducted with the use of the Koromo Leanhealthcare training game improved as part of the project.

To accurately diagnose communication problems in the facility, surveys were conducted: directly among the employees of Nasza Poradnia and via the Internet among potential patients of the medical clinic. The results made it possible to isolate the main problems of the facility, which turned out to be: communication within the facility and communication between the facility and the patient, which directly affects the diagnosed problem of too frequent prescription complaints.

To solve the diagnosed problems, it was proposed to use a simple Visual Management tool in the facility, namely a "meeting board" (board), which involves the organization of weekly, very short organizational meetings and the purchase of a magnetic board on which reported problems and people responsible for solving them will be recorded. It would seem that this is a trivial and easy-to-implement method. In practice, it is completely different, because such a new practice involves a change in the habits of the staff and forces them to take the trouble to

introduce a new way of functioning. An additional challenge is the fact that each medical facility is characterized by a different specificity of functioning, therefore, no detailed studies are reporting step-by-step how to implement such a change in a very diverse environment of employees within one medical facility.

A board was purchased, weekly meetings were initiated and the arduous process of implementing a new way of communicating in the facility began, periodically checking the effects during the project and after.

2. Literature review

2.1. Lean Healthcare

Healthcare costs are rising around the world, so there is a need to bring them down by improving traditional ways of treating patients. Many healthcare processes are poorly designed with unnecessary duplication of services, long wait times, and delays, which impact treatment outcomes (DeKoning, Van Den Heuvel, Does, 2006). There are various methods of improving traditional ways of treating patients, but the concept of lean deserves special mention (Reijula, Tommelein, 2012).

Lean Healthcare is a philosophy dedicated to medicine, in which people are the most important: both patients and healthcare professionals. Lean Healthcare tools use the achievements of Lean Management (LM) and Six Sigma. The goal is to meet the expectations of the patient (client), who, as in any business venture, is placed in the center of interest in activities improving the quality functioning of the medical facility. Through the patient's perspective, the following effects are achieved directly: an increase in process efficiency and elimination of waste, and thus - a reduction in the number of errors until their complete elimination, a shortening of waiting time for a service, and improving patient and staff safety. It all translates into the improvement of financial results and continuous development of the medical unit (Preś, Dudek, 2018). Improving efficiency through LM tools focuses on reducing bottlenecks, which improves the work of medical staff, but at the same time requires continuous improvement in internal communication through the use of multiple tools: from the simplest, organizational, to professional IT systems dedicated to medicine, which bind the entire system. Attempts to implement Lean Management tools in medical facilities have been going on since the 1990s. and are widely described in the literature. An example is the Seattle Children's Hospital in Washington (Preś, Dudek, 2018), where the implementation of the LM concept saved 180,000. dollars for hospital expenses. Virginia Mason Medical Center Hospital in Seattle, which started implementing LM tools in 2001 (Byrne, 2013), can boast such achievements as, for example, that nurses currently spend 95% of their time with the patient,

with the average Seattle, which started implementing LM tools in 2001 (Byrne, 2013), can boast such achievements as, for example, that nurses currently spend 95% of their time with the patient, compared to the hospital average of 35%; waiting time by patient response to test results was reduced by 85%, and the cost of medical supplies was reduced by \$1 million per year, and many others showing, above all, shortening the duration of procedures and reducing the cost of their implementation. Effect changes are mutually beneficial: for the patient - shortening the time of contact with the facility, and for the facility - lowering the cost of patient service, but also huge profits: the hospital's income of \$ 700,000 in 2000 is now \$ 40.9 million in 2010, which translates into to higher quality of services and higher salaries for employees.

As a result of the combination of two groups of two tools (Lean Management and Six Sigma), the Canadian Lean Healthcare Six Sigma project achieved very spectacular results. In 2011, the Canadian Ministry of Health implemented a project in Quebec, obtaining: reduction of patient registration time by 42%, increased the number of operations per day by 3, shortened the patient's waiting time in the emergency room by 75%, and the time of the patient's stay there was shortened by an average of 20%; a very significant decrease in absenteeism among staff and a reduction in the number of costly overtime hours by almost 50% was achieved (AB, 2022).

Both in Polish and British realities (Góral, 2022), projects aimed at reducing the financial problems of medical facilities have proven that cost reduction consisting in dismissing employees or limiting purchases, used as the most popular ways of dealing with financial problems, do not lead to positive changes, but only create inconvenience, mainly for patients (longer waiting time for treatment). Experiences of these institutions that have implemented LM tools, prove that the positive effects of changes are achieved through proper organization of work, and not only costly investments. The use of lean tools in medicine focuses on improving flow efficiency, which is most evident in shortening the time of consulting patients from the first contact with the facility to obtaining a full diagnosis, which only makes it possible to start the proper treatment process. As the examples described in the literature show (Modig, Alstrom, 2014), this time can be significantly shortened, e.g. from 42 days to 2 hours. The results also show a significant reduction in waiting time for surgery, which was shortened, for example, at Theda-Care Hospital in Appleton, from 14 weeks to 31 hours. Ian Glenday stated that "50% of all patients present with conditions that require only a few types of medical procedures (exactly 5% of all performed in a given facility)" (Góral, 2022). At the same time, it was indicated that the demand for the health service is predictable, and all patients can be classified into several groups of medical procedures, the frequency of which can be very precisely determined.

Successful attempts to implement Lean Management tools in the healthcare sector are indicated by researchers of the subject in numerous examples from Great Britain, Spain, Sweden, Italy, the USA, and Australia (Wiśniewska, Koniecznyńska, 2011), as well as from countries such as Japan or aforementioned Canada (Koczor, 2020). Koczor particularly

emphasizes the possibility of implementing LM in small medical facilities with the same success as in large ones, and cites such experiences, especially in Poland: reduction of laboratory testing costs by 50%, increase in monthly revenue from the sublease of offices for private services, or a decrease in the number of missed telephone calls by 67%. For both small and large facilities, it will be important to note the undeniable fact that the implementation of LM in a medical facility translates into a 10-20-fold return on each zloty spent in the next 5 years of operation, which is confirmed by numerous project experiences and literature reports (Koczor, 2020).

The scale of savings is always an interesting topic, but especially here, because it can be analyzed from the point of view of the facility itself, which can redirect the saved money to, for example, very expensive equipment or other needs, but also from the point of view of insurance companies.

Due to the constantly growing costs of medical services, the possibilities of cost reduction by using methods that do not require high-investment investments are very attractive, hence the pressure to implement them, which has been observed for many years, e.g. in American hospitals (Byrne 2013). Byrne points to the huge role of communication in the process of implementing LM tools. Without proper communication, i.e. a uniform system that supports the entire health service, it is practically impossible, but above all, it may result in errors that endanger human health and life. Efficient communication is like a nervous system that logically connects all the stages of treatment that the patient must go through. It combines them into a fluid stream of value.

Examples of Lean Management implementation in Polish medical facilities indicate only positive aspects of such a change. One of them is the implementation of LM in the Medical Services Center DIALIZA Sp. z o. o. (Preś, Dudek, 2018). As a result of the introduced changes, the clinical risk was reduced by 90% compared to the initial state, the inventory level was reduced by 30%, and overprocessing - by 50%, which was achieved by reducing the number of steps necessary to perform specific processes. Expenses were reduced by 40%, and the savings achieved in this way are over 78% compared to the expenses incurred in the previous year in the main processes of the facility (warehousing and cleaning processes). An example of a positive implementation of LM tools only in the operating theater at the EMC Regional Health Center in Lublin is an incentive to extend the project area to the entire hospital, as well as an inspiration for other facilities (Leśniewski, 2017). The problem in the operating block was the poor flow of information and unclear communication, which resulted in problems with the flow of surgical instruments between the block and the sterilization ward - they did not appear in the block on time, as well as incomplete or poorly marked sets. Of course, the implementation of LM required the involvement of all employees of the sterilization block and ward in the process, who defined the bottlenecks and proposed solutions themselves. Lean Management is a process of continuous improvement. One success and the involvement of some employees is the beginning of changes, especially because it forces changes in subsequent areas where

disorganization and lack of effective action are successively exposed. Successes involve more and more employees because each one of them observes and feels the clear benefits of changes in the LM area.

2.2. Lean Six Sigma methodology in medicine

Lean Management has great potential, but it is very difficult to implement in the Polish reality, in the health care system, which is neglected in many respects. Another problem is that the LM methodology is popular in production systems (Lean Manufacturing). A serious barrier is a mental barrier of hiding behind the specificity of the medical industry, and its approach to the patient. But it turned out that typically production concepts, such as: "takt time", "standardized work", and "pull system" (Byrne, 2013), also characterize the way the medical industry works. Implementing them gives the same results as in production in terms of eliminating waste, saving time, and introducing flow. Because the same goal guides every organization: "obtaining ever better results in terms of both efficiency and quality" (McLaughlin 2022). It is vital for hospitals to emulate the Toyota Production System model of adapting what they learn to their own situation and developing methods to solve all sorts of problems. It's important to learn from other hospitals and other lean companies in other industries (Graban, 2016).

Six Sigma, in turn, is a methodology that uses statistical tools, striving to achieve perfection, assuming the identification of mistakes and errors before they appear (McLaughlin, 2022; Mydlarz, 2017; Ingaldi, 2019). The reduction of costs resulting from faults, errors, shortages, etc. takes place by excluding them. The starting point is the measurement of defectiveness as a deviation from the central value. A 6sigma deviation is the probability of a few defective products (processes) per million produced, which is considered to be an acceptable level (Mydlarz, 2017).

The Six Sigma implementation process must always follow strictly defined stages: defining the problem (using relevant data), measuring using statistical methods, analyzing them to detect the causes of errors and sources of variation, making improvements (reduction of the level of deviations), monitoring to maintain the achieved results. Changes in processes are implemented in a Six Sigma approach using a fixed life cycle (DMAIC): Define, Measure, Analyze, Improve, Control (Ingaldi, 2019), according to six principles: 1-customer direction, 2-information-based management, 3-process, management and improvement, 4-active management, 5-unlimited cooperation, 6-excellence, tolerance for failure.

Implementation of Lean Management tools in an organization also follows a set logic that can be defined in the same way as the DMAIC flowchart. The inclusion of statistical analysis in the process facilitates the diagnosis of errors, accelerates the process of changes, and enables constant monitoring of processes. Six Sigma was created precisely to improve the management system by constantly identifying errors and constantly eliminating them (Ingaldi, 2019).

The combination of methods translates into specific benefits (Świtek, 2016): it guarantees "statistical control" of loss reduction processes implemented using LM tools.

In the first stage of LM implementation, it is necessary to map the processes and select those that will be improved. In the next step, responsible and committed teams should be created and the tools and techniques to be used should be selected.

Using Six Sigma tools, each subsequent step brings us closer to achieving perfect quality. The use of Six Sigma and LM methodology together, as stated, makes great sense, because it doubles the achieved effects (Kamińska, 2021).

Production and service companies of various industries have been successfully using the Lean Six Sigma methodology for many years, developing their unique ways of proceeding (Świtek, 2016). The medical industry, using Lean Six Sigma, checked the usefulness and application of individual tools. Lean Six Sigma tools most often used in healthcare projects (Wiśniewska, Koniecznyńska, 2011; Bukowska-Piestrzyńska, 2018; Preś, Dudek, 2018; Koczor, 2020; Złotowska, 2020; Kamińska, 2021; McLaughlin, 2022): Visual Management (VM), Value Stream Mapping/Analysis (VSM/VSA), 5S method, Kanban, 5 Why, Kaizen (Action list), Poka-Yoke, Ishikawa diagram, and many others.

Visual Management is a technique for visualizing and evaluating all processes. For this purpose, the following are used: boards, charts, work instructions, marking of workstations, storage areas, tool storage places (e.g. using shadow boards), and failure reporting systems (signaling).

VM helps in identifying problems and irregularities by introducing solutions that will effectively increase the transparency of processes and how they are performed.

An example of visual management in health care is, for example, the patient identification system - Triage (Wiśniewska, Preś, 2011), which consists of categorizing patients using colors indicating the level of injury and the minimum time to assist. VM is also the use of all kinds of maps (VSM/VSA - mapping/value stream analysis), which facilitate the management of the ward, e.g. identification of free places for patients (beds, treatment equipment, etc.), allowing for the illustration of all processes. The map contains a chronological description of the ongoing processes, their duration, the number of people involved in individual processes, the way information flows, and the amount of resources moving between processes. To optimize processes, two maps are created: a map of the current state (which requires an audit) and a map of the future state, where changes are introduced to improve the efficiency of the process. The audit, necessary to be carried out in the first stage, supports the identification and increase of added value in the improved activities; supports the creation of process diagrams, which allows, among others, to improve internal communication at all levels (Dziembała, Pańkowska, 2017).

The 5S method - is a tool that allows you to organize and maintain order in the workplace; in medical facilities, often implemented through the use of VM tools, e.g. shadow boards (Preś, Dudek, 2018), but mainly through organizing workplaces, preparing instructions, plans and procedures, and continuous improvement (Wiśniewska, Preś, 2011).

Kanban - a logistics management system that allows you to maintain the right amount of all resources necessary for the implementation of processes (Preś, Dudek, 2018), electronically supported and cooperating with the 5S method, elements of visualization, and Just in Time (Wiśniewska, Preś, 2011).

5Why - a simple research method in which the source of the problem is reached by asking the question "why?", which ultimately allows you to take appropriate action to eliminate it (Preś, Dudek, 2018).

Kaizen - a philosophy based on the assumption that LM tools can bring the expected results through the commitment of all employees and their pursuit of excellence. It is a constant introduction of changes and improvements with small steps (Bukowska-Piestrzyńska, 2018; McLaughlin, 2022,) and specific actions, which are: audits ensuring compliance with labor standards, consisting in the observation and evaluation of processes; ongoing measurement of process performance indicators, which enables immediate feedback and helps to eliminate root causes of problems; daily short team meetings to present the current situation and collect suggestions for improvement follow a specific pattern and last 5-10 minutes; management of suggestions – implementing improvements on an ongoing basis to improve everyday work, using tools such as Poka-Yoke, which helps to eliminate errors by introducing the principle "processes are responsible for mistakes, not people", or the Ishikawa diagram, a tool for identifying a problem in terms of cause and effect (Kamińska, 2021).

Lean Management methods improve internal audits of the management system and enable changes to be made by the following course of action: defining the expected goal, establishing a value stream eliminating redundant elements, creating an integrated coherent fluid sequence of value-creating activities, continuous improvement (Sobczak, Rydlewska-Liszkowska, 2012). The most important stage of the audit concerns the identification of inefficiency: lack of coordination of activities in time, causing patients to wait, defects in services, e.g. poorly performed examination, etc., unnecessary activities, omissions or delays in their performance (e.g. lack of promotion and prevention), bad organization (wastes of time and energy), overburdening employees, as well as burdening them with unnecessary duties. The following reasons for the implementation of LM tools in the health service are rising costs of health services, legal and organizational difficulties in obtaining funds for the health service, inappropriate practices in the management of medical facilities, lack of incentive systems for employees, lack of internal coordination, problems in the use of modern equipment: coordination at the medical and technical level, the discrepancy between the need to introduce standardization and the need for an individual approach to each patient.

Successful implementations of Lean Six Sigma in medical facilities indicate that such projects analyze current processes with great accuracy and indicate areas where costs can be reduced and efficiency improved. Such a solution, seemingly easy to implement, was implemented at the Mater Hospital in Dublin and consisted in replacing the entire fleet of printers (OKI, 2022). The extensive IT and communication network of the hospital posed a challenge for the implementers with a high degree of complexity, covering all departments of the hospital. Only this one area of change allowed to fully optimize the management of consumables, significantly reduce the costs resulting from, among others, color printing and reducing energy consumption, and improve communication by integrating all devices and enabling remote management of equipment and materials.

The report on the improvement of processes in the service sector (Horbal, Drozd, Góral, 2022) indicates that in the opinion of employees and managers, the most important disruption in the work environment is stopping the IT system. In fact, it turned out to be the least significant disruption in terms of lost time. The productivity of companies was improved using two tools – A3 Sheet and TWI (Training Within Industry) methods.

Processing time, i.e. performance of activities that meet customer demand, was reduced by 46%, productivity (calculated as the number of orders processed by one person per day) was increased by 81%, and the number of operations that make up the order fulfillment task was reduced by 48%.

2.3. Lean Healthcare training

Implementing Lean Management tools in an organization, just like any change, is always associated with changing old habits among employees and management. The implementation of this most difficult task, concerning human resources, is carried out as part of training. Their organization, frequency, and manner of carrying out pose many difficulties. What must be overcome is the natural resistance to change of employees who must engage in the training process by devoting their working time and private time to it. For the training to be effective, its form must be attractive, adapted in every respect to various employee groups, and as little interfering with other duties as possible.

Training conducted as part of such programs as e.g. Healthcare Lean Management (Koczor, 2020) or Lean Lider of Healthcare Academy (Złotowska, 2020), aims to combine the transfer of knowledge in the field of LM with practical training in identifying and eliminating waste and constantly improving operational efficiency in the area of customer service. The aspiration is to create the foundations of a new culture, based on the principles of LM, which will be subject to continuous improvement at every level of functioning. For this to be possible, employees must join the changes. Such an opportunity, apart from the training program, is provided by the employee suggestions program - employees can submit proposals to improve their workplace and other areas and processes in the organization. To motivate all employees to cooperate, it is first necessary to diagnose the so-called "low-hanging fruits", i.e. those changes that will

be possible to implement immediately, at no cost, or with a very low financial outlay, using already existing organizational habits. Such changes are easy to implement, and since they are proposed by the employees themselves, they are implemented by them at their workplaces. Employee motivation is best supported by the ideas bonus system. Here, employers have at their disposal a whole range of possibilities, from cash gratification to a whole range of in-kind prizes (shopping vouchers, entertainment passes, tickets to events, and others).

A training game can be used to speed up and make the process of acquiring knowledge in the field of LM more attractive. An example is the Polish game "Koromo-Japanese workshop" (koromo.pl, 2022). It is a training simulation game in which participants improve their work and at the same time learn LM methods and tools. Koromo's proprietary training program has been developed since 2015 and constantly improved based on hundreds of competitions conducted, during which several thousand employees from various industries were trained.

The first version of the game is about improving the car workshop. Participants of the simulation game repair vehicles, and during the game, problems and challenges are solved by gradually introducing LM methods and tools, such as: Just in Time, Standardization, Kaizen, Kanban, Jidoka, Visual Management, and TPM. In addition to the fact that games are conducted as a proven training method, teaching the rules of LM using the Koromo game is also introduced by the Polish Universities of Technology in Warsaw, Silesia, Białystok, and Opole. Currently, as a result of conducted research, the game also has a second version - dedicated to the health service. After that, tests were carried out in two medical facilities: Non-public health care facility Nasza Poradnia Sp. z o. o. and the Public Psychiatric Health Care Center - Doctor's Stanisław Deresz Hospital in Choroszcz, it was possible to develop a full version of the game for the medical community. The final version of the game was very well evaluated by doctors and staff.

One of the definitions of "lean management" cited in the literature (Wiśniewska, Konieczńska, 2011) implies, above all, the need to carry out profound changes in the culture of the organization, i.e. those that will change the way of thinking and thus the functioning of all its members so that they are involved in continuous cost reduction and quality improvement from they think about meeting the expectations of customers (patients) as much as possible while adapting to changing environmental conditions. This approach is complemented by the message quoted by other definitions (Wiśniewska, Konieczńska, 2011) of avoiding all kinds of waste through the process of continuous rationalization of the company and its relationship with the environment, consisting in reducing the scope of the company's internal functions to necessary activities. The patient is interested in quick diagnostics and then providing professional help (from diagnosis to cure, then rehabilitation/follow-up visits/maintaining the effect of treatment, or further diagnostics). The most strategic period in the entire complex process is the time from the patient's reporting to the facility (by phone or in person) to full diagnosis, which enables the launch of the next process, which is providing the patient with professional assistance. In the entire process, activities that do not add value to the services

provided should be eliminated. Therefore, the essence of action in Lean Healthcare is understanding the needs of the client/patient (Wiśniewska, Koniecznyńska, 2011), and then identifying and eliminating waste. In every medical facility, there are the same typical wastes related to processes specific to the medical industry (Wiśniewska, Koniecznyńska, 2011).

The effect of the changes implemented with the use of Lean Six Sigma tools is standardization, which in health care is understood as an activity aimed at achieving an optimal degree of order by developing and establishing requirements, standards, rules, characteristic conditions, technologies, work, services used in the medical industry (Wiśniewska, Preś, 2011). Standardized work consists of the development and implementation of procedures describing the most effective and at the same time the simplest way of performing individual activities (McLaughlin, 2022). The standard enables proper functioning from the point of view of both the medical facility and the patient. However, standardization in medicine has many limitations, and research shows (after Zuiderent-Jerak, Maroń, 2018) that unified, universal standardization in medical facilities does not work, and even fails. It is possible and even desirable, but only in identifying places where it will improve the operation of medical care.

This so-called situated standardization, which introduces the integration between universal and individualized (patient-centered care/medicine) approaches, is so necessary for each patient. The need for such an approach is a major challenge. Not without significance here is the implementation of management systems according to ISO 9001 and accreditation by the requirements of the Quality Monitoring Center in Krakow, increasingly commonly implemented in Polish medical facilities (Wiśniewska, Preś, 2011).

3. Research part

3.1. Introduction

The research (Project Based Learning - PBL) was carried out as part of the project "Silesian University of Technology as a Center of Modern Education Based on Research and Innovation" by a team of tutors (teaching and research and teaching staff of the university), experts/practitioners and students. PBL, i.e., Project Based Learning – project-oriented education, consists in replacing part of the classes with interdisciplinary projects conducted in small groups on authentic research material.

The main assumption of the conducted research was to improve the functioning of selected medical facilities to improve the quality of services, patient safety, and staff satisfaction in standard conditions and a crisis. Due to the ongoing pandemic and the related restrictions, one facility was selected - a medical clinic (Nasza Poradnia Sp. z o.o. in Chorzów - Fig. 1).



Figure 1. Non-public health care facility Nasza Poradnia Sp. z o.o.

Source: own photo.

The processes implemented there were analyzed in terms of problems in functioning, to improve the way services are provided, reduce delays, and eliminate sources of waste. The goal was to improve access to medical care, reduce the waiting time of patients for a visit/procedure, streamline processes supporting the main value streams - which was assumed to translate into lower operating costs of the facility, as well as improve its functioning in extreme conditions (in any crisis related to the natural or industrial disaster. As part of the research, it was assumed to develop a strategy that would increase the efficiency of a medical facility, assuming that employees would not be overloaded with work, but would have a more rational workload, and the client (patient) would be provided with a product (service) as expected. The research was also supposed to contribute to the development of a simulation game dedicated to the diagnosed problems.

To achieve the assumed goal, a six-stage research methodology was developed:

- 1) Analysis of problems in a selected medical facility during the COVID-19 pandemic - surveys;
- 2) Identification of losses in terms of work organization and logistic flows - audit and survey results;
- 3) Identification of losses in terms of the quality of patient service and patient and staff safety - audit and survey results;
- 4) Suggesting ways to eliminate waste - audit and survey results;
- 5) Designing a simulation game dedicated to healthcare;
- 6) Development of analysis results and formulation of conclusions.

3.2. Selection of research methodology and tools

The research began with an audit of a selected medical facility. Nasza Poradnia Sp. z o.o. is a medical clinic located in Chorzów, Poland. The facility (family counseling center) operates from 7 a.m. to 4 p.m. during the week. The patients during the PBL project (Covid-19 pandemic) were seen by family doctors on a teleconsultation basis. The gynecological (and to the midwife nurse) patients were admitted without changes by contact, also all the patients to vaccinated. The employees of the facility always work in two shifts: from 7 am to 12 am (family doctors, registration - first shift - two nurses) and from 1 pm to 4 pm (specialist doctors, registration - second shift - two nurses and technical and cleaning workers); additionally, a midwife nurse is on duty from 12-13. The organizational structure of the clinic consists of: President - supervising and managing functions and Vice-President – a coordinator of the facility and the employees: doctors (8), nurses and midwives (6), and maintenance workers (2), in a total of 20 people. Doctors are employed on a mandate contract; other employees have employment contracts. The facility also uses the services of external entities e.g., an accounting office.

The audit of the facility consisted in conducting interviews with the management and selected employees; the premises of the facility and the layout of the equipment were also reviewed; the functioning of employees during work was observed; a survey was then carried out and the selected employees were interviewed again during the final audit. The aim was to identify the functioning of the facility, organizational structure, communication channels, relationships, and duties of individual employees.

Input information was provided by the management of the Clinic. The audit was carried out during four visits to the facility. During the first visit, a detailed interview with employees was conducted. The results of the interview were communicated to the entire team during the meeting. Based on the observations and conclusions from the interview, a questionnaire was developed, which was handed over to the employees of the facility during the second visit to the clinic (Questionnaire no. 1: Questionnaire of an employee of the clinic Nasza Poradnia Sp. z o.o.). During the third visit, the questionnaires were collected and a detailed vision of the entire facility was made. Based on the survey results, interviews with selected employees were deepened and observations for selected processes during the fourth visit to the clinic were made in detail. The performance of duties and the flow of communication between employees was observed every time during each visit to the Clinic. The findings were discussed with the team at weekly meetings.

During the research, a situation related to the unusual functioning of the facility due to the ongoing pandemic and lockdown was observed. Particular attention was paid to the resulting changes in the functioning of the facility, restrictions and their observance, and unusual and exceptional situations.

Due to the pandemic, it was not possible to survey the patients of the researched medical facility. Therefore, a decision was made to conduct surveys via the Internet. 24 people responded. It was assumed that each of the respondents uses the services of medical facilities that function in the Polish healthcare system. In addition, every patient, regardless of the choice of medical facility, has the same expectations of medical care when they are forced to use its services (Questionnaire No. 2: Patient opinion during the COVID-19 pandemic) and everyone is facing the same problems due to the ongoing pandemic.

3.3. Research and results

Based on the initial interview and observation, problems with communication between employees and at the following levels: facility - patient, patient - facility were diagnosed. Two most important problems faced by the clinic have been identified: prescription complaints and patient service hindered due to the pandemic (the so-called "difficult patient"). A series of detailed interviews led to the determination of the main cause of the diagnosed problems, which turned out to be communication. After conducting interviews with employees servicing the reception desk during two shifts (four nurses), operating on the first line of communication between the patient and the medical staff, it turned out that all information is recorded in a special notebook, on sheets of paper stuck to the reception counter or is passed on orally. According to what the employees signaled, the information provided in the manner described above does not always reach the employees working on the second shift (it happened that it was not written down, a piece of paper peeled off and got lost, or an employee forgot to provide the information). In addition, it was established that the management communicates with all staff on an ongoing basis - daily, in person on-site, and by phone with employees working remotely.

To fully analyze the problems of the medical facility, a survey was conducted among its employees.

Based on the survey (Questionnaire No. 1), the following problems were identified, the causes of which were determined using the 5Why analysis:

- Problems finding items/tools for work. Such problems were signaled by a specialist doctor and a maintenance worker:
 - 1W:** Why is it difficult to find items/tools for work? Answer: Devices/tools/equipment necessary for work are shared by many people.
 - 2W:** Why don't shared items/tools have a specific place? Answer: they have, but they are not put back.
 - 3W:** Why aren't they put back every time? Answer: Existing job instructions and work standards are not sufficient and require changes, as indicated by the maintenance worker, employees do not follow the existing recommendations when it comes to doctors and do not put tools away where they are marked with special markings.

Conclusion: New workplace instructions should be developed, and shadow tables introduced; employees should be trained in the use of job recommendations; it is necessary to check and enforce compliance with the workplace instructions.

- The problem of prescription complaints was signaled by both the medical staff and the administration:

1W: Why do prescription complaints arise? Answer: Patients wait too long for prescriptions and mistakes in the content of prescriptions are often reported by patients.

2W: Why do patients wait too long for prescriptions and why do mistakes happen? Answer: at the doctor's and nurse's workplace, these activities are performed without the use of a computer system. The reason is the lack of skills in operating the computer system by medical staff.

3W: Why do doctors have trouble using the computer system? Answer: There has been a rapid shift in prescription dispensing since the pandemic - from traditional to digital - doctors have not been trained; when it comes to patients - some documents need to be printed for them because patients have not set up electronic accounts (Individual Patient Account - IKP).

4W: Why have doctors not been trained? Why didn't patients set up electronic accounts? Answer: due to time pressure, oversight, and lack of skill.

Conclusion: doctors should be trained to use the new system and patients of the facility should be encouraged to set up accounts, but also a simple instructions should be prepared for them, and help should be offered.

The survey results also provided information on:

- Changes in working conditions during the pandemic: differences typical for all medical facilities were identified: teleconsultations instead of contact visits to doctors, the need to use protective clothing, masks, and disinfectants; at the same time, there was no need to take any extraordinary measures due to operating in high-risk mode. All employees described their job security as very good, good, or average, but no change compared to the state before the pandemic.
- Information flow on the following levels: doctor - nurse, doctor - doctor, nurse - nurse. The suggestion to improve communication appeared in an open question in which the respondents could submit their observations regarding the improvement of the functioning of the facility.
- The other answers did not indicate any problems in the examined areas (patient registration, waiting time for admission, stocks).

Surveys have shown that from time to time (if necessary) meetings are organized in a medical facility, during which current topics are discussed, e.g., related to improving the workplace. To motivate employees to cooperate, the so-called "low-hanging fruits", i.e., changes that will be possible to implement immediately, at no cost, or with a very low

financial outlay, using already existing organizational solutions. It was proposed to implement visual management - a meeting board (Fig. 2) and change periodic organizational meetings to regular, weekly - organizational meetings of several minutes in the presence of everyone starting the shift, twice a week.



Figure 2. The meeting board and the place where it was placed - the main corridor next to the registration desk.

Source: own photo.

To fully diagnose problems in the field of patient service in medical facilities in Poland, a second questionnaire was developed and disseminated via the Internet (Questionnaire No. 2).

24 people (67% men, 33% women) took part in the study. 75% of the respondents are people over 39 years of age living in cities or on their outskirts. 62.5% of respondents declared that they are not chronically ill; 37.5% - that they are in constant contact with a family doctor. As the biggest inconvenience during the pandemic, patients report the so-called. "teleconsultations", the problem with calling the doctor, and very distant dates of direct contact with doctors. Only 30% declared that access to a family doctor is the same as before the pandemic. When it comes to access to specialist doctors, 37.4% of respondents indicated difficult to access during the pandemic and 25% interrupted treatment or diagnostics due to the pandemic. In 20.8% of the respondents, the lack of access to a doctor or delay in the visit resulted in health consequences.

70.8% of respondents know how to complete an e-prescription or e-referral; 8.3% do not know and their doctor does not issue such prescriptions. During the Covid-19 infection - 41.7% of respondents did not have any medical care, 20.8% were looked after only by their family; only 4.2% of patients had good medical care (1/3 of the respondents suffered from Covid-19, 21% do not know if they were ill because they did not take the test). 16.7% of the respondents did not receive an ambulance despite being summoned. Only 4.2% of people who contracted covid-19 were provided with rehabilitation care. 41% of respondents do not have an Internet

Patient Account (IKP), 12.5% have not heard of IKP, 8.3% cannot activate it; 41.7% of respondents do not know where to turn for help in activating it. Only 4.2% of respondents positively assessed the functioning of the health care system in Poland during the pandemic; the attitude of doctors during the pandemic was positively assessed by 41.7%, 25% had no opinion, and 34% - assessed it negatively. The last question of the survey concerned suggesting the direction of changes in the current patient service: the biggest problem for patients is the so-called "teleconsultation". Patients have indicated that they need real contact with a doctor.

Frequent complaints about prescriptions were identified as the most important problem, and at the same time possible to be eliminated in a short time. Complaints force patients to contact the medical facility again (difficult due to the pandemic), which causes conflicts and increases the risk of infection. The patient, who does not fulfill the prescription on time, does not take the medicine on time, which delays the treatment process and may lead to deterioration of health.

Ishikawa's cause and effect diagram was used to identify the causes of frequent prescription complaints (Fig. 3). Brainstorming was carried out, which allowed for a global review of each area that has a potential impact on generating the most significant problem, which is frequent prescription complaints. Potential causes that have a direct or indirect impact on prescription complaints were identified in four areas of the medical facility's operation: "Management", "People", "Environment" and "Methods".

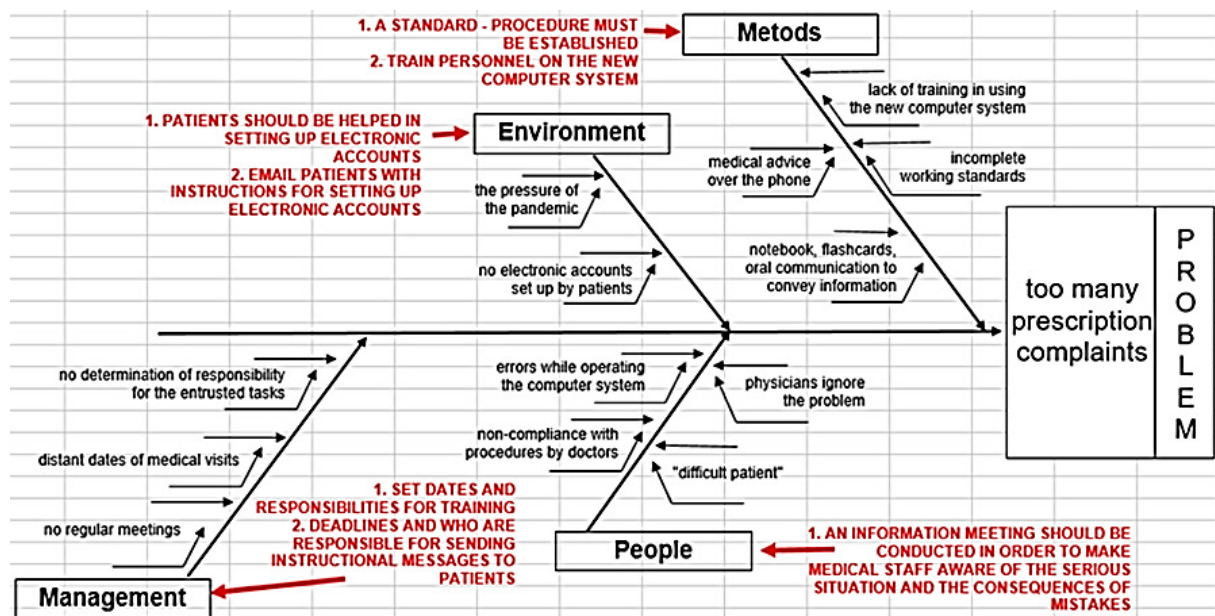


Figure 3. Ishikawa's cause-and-effect diagram for the problem of too frequent prescription complaints.

Source: own elaboration.

Solutions were generated for each group of problems:

- In the "Methods" area, first of all, staff should be trained in the use of the new IT system, and then supplemented with work standards that will improve communication within the facility (was a suggestion to organize regular meetings of employees, several minutes a week, with the meeting board located in the administrative part of the facility; the following will be recorded on the board: the most important indicators regarding the number of unrealized visits, the number of prescriptions advertised, tasks for the current week, those responsible for their implementation and deadlines);
- In the "Environment" area, assist patients in setting up IKP by sending instructions via e-mail;
- In the "Management" area, set the dates for training and those responsible for conducting them among the staff of the facility, and the dates and responsible for sending instructional messages to patients via e-mail;
- In the "People" area, employees should be informed about the adopted procedure as soon as possible.

3.4. Staff training

Training meetings for employees of the medical facility were divided into two parts: the theoretical part, during which the employees were familiarized with the idea of Lean Management, and the practical part, conducted using the Koromo training game in the demo version. For the development of the full version of the game for medical services, information on the specificity of the functioning of the medical industry was particularly important. Modified game proposals have been verified by the creators of the Koromo game. The prototype copies of the game were tested. Another more refined version was used to train the medical staff of the facility: NZOZ Nasza Poradnia Sp. z o.o. in Chorzów. Soon, a basic version of the Koromo Health game was created, which was used in the second part of the training for the employees of Nasza Poradnia - in the practical part of the training (Fig. 4). The practical part of the training at NZOZ Nasza Poradnia was carried out in four sessions due mainly to pandemic restrictions, but also because the Koromo game allows you to simulate a group of up to 12 people and that the employees of the tested facility work in two shifts. Thus, employees were divided into four training teams (4 x 5 people), which were supplemented by project participants also divided into four teams. Each training session was therefore attended by a maximum of six people, a trainer, and an assistant trainer.



Figure 4. Koromo Health game prepared for practical training and two of the game participants during the training.

Source: own photo.

The Koromo game, dedicated to the medical service, deals with issues related to the Lean Management system, but embedded in the medical reality. The main principles discussed in the game are Just in Time (patient service time) and Jidoka (approach to process quality, patient satisfaction, and problem-solving). All elements of the game were developed by the above assumptions. The game is distinguished by simple and clear rules, enabling participants to focus on the subject of the training, and not on trying to understand the game.

The use of the Koromo game enabled the trained employees of the medical facility to solve problems by the LM concept. They showed great interest in participating in the game and very quickly became involved in the competition between the teams. Very fast learning of the rules of the game and understanding of the operation of LM tools in terms of their usefulness in the medical area was observed. In the future, it will be worth confronting reflections on the game of medical staff of various institutions trained with it.

4. Discussion

The implementation of Lean Healthcare in a medical facility and the development of standards increase work efficiency, which leads to time savings that medical staff can spend on direct contact and patient care. In this way, the level of safety of clinical processes is mainly increased, which is of particular importance during the increased sanitary regime. The standards ensure that the organizations operate without any visible disturbances during crises, while the lack of them, during such situations, is particularly severe, causing disorganization and the creation of procedures "quickly". During crises, standards are crucial for the efficient

organization of work, which must then proceed with an increased time regime, in situational stress, and also requires quick training of a large number of volunteers.

There is a lot of “wastes” in medical facilities. We can call “wastes” that activities do not add value. We divide them into two types. Type I are necessary losses, i.e. those that must be made due to the process, but do not add value in the process (e.g. time of transporting the patient to the facility, preparing the workplace, printing documents, etc.). Type II is the so-called unnecessary losses, i.e. all activities that should not occur (e.g. correcting errors in prescriptions, documents, patient records, waiting time for various materials, postponing work "for later").

Based on the research results and information collected in the medical facility, losses were identified in terms of work organization and logistic flows, quality of patient service, and patient and staff safety, as well as losses in terms of eliminating waste. It was found that there are serious communication and organizational problems within the facility. They result from various reasons: lack of standards regarding the functioning of the reception desk, improper communication with doctors - as employees on a mandate contract, doctors impose their way of functioning by failing to comply with the established rules, which causes organizational problems (failure to put tools away causes problems with finding tools for work, failure to comply with the requirements of the new way of dispensing prescriptions - lack of training - causes frequent complaints about prescriptions and extends the waiting time of patients for the service, failure to report shortages causes logistical problems with replenishment of stock).

From the patient's point of view, the main purpose of communication, resulting from the restrictions related to the pandemic, is to introduce the so-called "teleconsultation". Visits to the doctor are possible only in exceptional situations and for a limited period. Patients understand that medical advice must be provided over the phone, but they do not accept that the registration in the clinic sometimes doesn't answer the phone, but when it does, registration books them for a very long waiting time appointment. Many patients (questionnaire no. 2 - over 40%) do not have an Internet Patient Account, which hinders the prescription dispensing system. Older people often do not know how to report a shortage of medicines or make an appointment online. Any protections are necessary for the safety of both patients and medical staff but that can't make communication difficult. During the pandemic, security measures were introduced, such as: hand disinfection, protective masks, and disposable gloves, which were used before in exceptional situations, e.g. interventions, and vaccinations; health questionnaires were introduced, which patients must complete before entering the clinic (surveys replace documents, which relieves staff from completing additional documents), designation of safe distance zones, use of special curtains enabling safe conversation.

The solution that was used to improve internal communication in the facility was the purchase and launch of a meeting board, which was placed in a place visible to all employees and on which any problems that should be communicated to all employees are recorded. The board is one of the Visual Management tools that can facilitate communication and it is

worth using it for this purpose. Importantly, the information must be factually correct. Falsification or lack of information leads to wrong decisions and ineffective actions.

The last action is the introduction of cyclical, weekly staff meetings near the board. As a result of this, it is possible to quickly and easily identify deviations of results from the assumed goals, and thus identify the factors that influenced them. The team meeting is also an effective way to communicate the progress of work and the opportunity to launch improvement actions aimed at achieving goals. According to the LM concept, the use of the board was to improve the functioning of the facility. The effects of the changes introduced for a longer time perspective are planned to be analyzed in the next project.

Nevertheless, the possibility of implementing LM in a small medical facility was confirmed. It was found that the implementation of changes depends primarily on the favor and motivation of the management staff. The biggest problem in maintaining changes lies in the habits of the staff, which is problematic and takes time, but with consistent implementation, it brings the expected effect. The greatest resistance was caused by the change in the area of medical staff - the lack of motivation of this most important group of employees is a serious challenge for managers when it comes to all processes in the area of a medical facility. Each medical facility is interested in reducing operating costs, and so are its employees, except doctors who are not permanently employed in a given facility and which is why perform its tasks without getting involved in its internal problems. The creation of standards in the facility to which the doctor will have to adapt must be taken into account before signing the contract with a given person and accepted by him. It will then be important to create a training system that will raise awareness of the newly adopted standards - what is their role and how their implementation affects the improvement of work comfort and efficiency. Awareness of the benefits of implementing LM in the facility will encourage you to get involved, as evidenced by the numerous examples of implementations cited earlier.

The benefits of the changes introduced in Nasza Poradnia in Chorzów will be confirmed after a longer time. Any results showing a decrease in its operating costs will be interesting. For Nasza Poradnia, these will be, for example, the costs of laboratory tests, monthly income from the subletting of offices for private services, a decrease in the number of missed telephone calls, a decrease in the number of prescription complaints, and an increase in the number of declared patients.

The main author of the project has planned further research, in which the effects achieved in this project will be related to the achievements of another facility that has already implemented quality tools and developed operating standards and can be an example of properly introduced changes. The comparison will be carried out mainly to create know-how for medical facilities that will want to implement lean tools as quickly and smoothly as possible.

5. Summary

In the examined medical facility, to minimize the diagnosed losses (waiting, unnecessary movements, excessive processing, shortages), solutions such as training with the game "Koromo Lean in Medicine" were used, which taught employees how to implement the lean tools and quick solutions to problem situations, and also weekly meetings at a board that was purchased and placed in a visible place, on which all current problems are written and people who are ordered to. According to the LM concept, these solutions are designed to improve and optimize the functioning of the facility, mainly in the area of internal communication, because this problem was selected as the most urgent to be removed.

The implementation of the meeting board (Visual Management tool) in Nasza Poradnia improved internal communication:

- enabled the liquidation of the three existing methods of communication between the first and second shifts of staff - through a notebook, yellow sticky notes placed on the reception desk, and verbally;
- recording the problems occurring in the facility and those responsible for their solution which contributed to more efficient and faster elimination of them;
- recording the number of prescription complaints on the board at weekly intervals and discussion during weekly meetings at the board highlighted the problem and enabled the joint generation of factors influencing its escalation and ways to minimize it.

The introduced changes will also be analyzed after the time has elapsed, which will allow the medical staff to function properly in the new reality, translating into real, measurable effects.

It is planned to regularly check the implementation of the changes introduced in the area of communication in the Nasza Poradnia in Chorzów.

Unresolved problems in the facility, such as the need to prepare/extend workplace instructions, e.g. with shadow boards, the need to train employees in the application of workplace recommendations, and in the longer term - checking and enforcing employees to comply with workplace instructions, were left to be implemented by the facility manager. Their implementation will be confirmed in the longer term.

The need to train doctors in the use of the new system due to the lack of cooperation on the part of the medical staff has not yet been resolved.

The lack of online accounts for some patients turned out to be a temporary problem.

Interest in the results of the research, as well as cooperation on the part of medical institutions, mainly in the direction of training with the use of the Koromo LeanHealthcare game, inspired the project supervisor to submit another PBL, which will enable the continuation of the research. The planned comparison of the effects of implementations and planned changes in our clinic with the effects achieved in the same area by a selected medical facility that is

successful in implementing lean tools and developing know-how will be a set of valuable tips for medical facilities that want to streamline processes, improve efficiency and, above all, become more patient-friendly.

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SUSTAINABLE CONSUMPTION AMONG CHILDREN IN THE FOOD MARKET

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Purpose: The aim of the study was to identify consumption patterns among children. It was also crucial to determine the conditions influencing the behaviour of young consumers in the market.

Design/methodology/approach: The paper uses a critical analysis of the literature and survey research based on a prepared questionnaire. The survey was conducted among 1326 children in age groups from 9 to 15 years old. The questionnaire consisted of two parts, i.e. the substantive part and the respondents' particulars. The first part of the questionnaire contained a set of questions concerning e.g. children's ability to identify products with better environmental parameters, behaviours related to nutrition, saving, shopping, spending free time, waste management and implementing pro-ecological solutions in their households.

Findings: The research showed a relatively good knowledge of the basic principles of sustainable consumption and labelling of organic products among children. This picture is somewhat simplified. The results of the study also showed that for many children healthy eating still means only eating fruit and vegetables (leaving aside the issues of regularity and portions of meals, drinking the right amount of water or maintaining a balanced diet).

Practical implications: Modification of curricula in primary school to a greater extent emphasizing content related to the principles of sustainable consumption. It is important to increase the amount of information provided on the principles of proper nutrition. This knowledge should be comprehensive and coherent, and not only refer to individual aspects of a healthy lifestyle. It is necessary to involve whole families in such activities through workshops, meetings and other events, because as shown by this research, but also the professional literature, attitudes and skills in children are transmitted and consolidated in this way.

Social implications: Shaping sustainable consumption patterns among children.

Originality/value: The article provides up-to-date knowledge on consumption patterns in the area of food products functioning among children. This is particularly important in the context of the need to build sustainable consumption patterns among the surveyed group of market participants.

Keywords: sustainable consumption, food products, a child as a consumer, food market, ecolabelling.

Category of the paper: Research paper.

1. Introduction

Young consumers play an important role in the processes taking place in the consumer market. Although they cannot fully participate in transactions made on it, due to numerous barriers related to e.g. legal conditions, age, or perception and understanding of market mechanisms. However, they constitute a significant group of consumers who have mostly their own funds, coming from various sources, i.e. pocket money, doing housework. They exert an increasing influence on purchasing decisions made in the household, taking various roles in it, becoming initiators, advisors, decision makers, as well as buyers and users of goods and services. Knowledge of the conditions influencing the decision-making process, recognizing the roles they play in these decisions not only allows for the appropriate shaping of the offer, affecting their market behaviour, but above all, it enables shaping the behaviour considered in the education process. The behaviour of young buyers is influenced by a number of factors, such as: psychological, socio-cultural, economic and demographic. A significant role is played by the family, which as the primary group shapes consumer behaviour and attitudes in the strongest way. It is worth emphasizing here that school plays an equally important role in the process of conscious and prudent purchasing decisions. Moreover, young people make acquaintances and friendships at school, create social groups, friends whose opinions they take into account when going shopping. It should also be mentioned that human consciousness is shaped throughout life, however, its basics are acquired from an early age, hence it is so important to focus on ecology, healthy lifestyle, shaping habits, patterns and activities that will be cultivated in adulthood.

2. The role of environmentally sustainable food consumption (ESFC) in the implementation of sustainable development goals - discussion

Sustainable development usually refers to activities that meet the needs of the present without compromising the ability of future generations to meet their own needs. The key idea of this concept is innovation and proactive decision-making to maintain a balance between ecological stability, economic growth, political justice and cultural vitality to make the world harmonious for all inhabitants (Purvis et al., 2019). There are three key dimensions of

sustainable development: environmental sustainability, economic sustainability and social sustainability (Moschis et al., 2020). These three dimensions are interdependent and influence each other. For instance, economic development leads to overconsumption in society, which has an impact on the environment and the level of social well-being.

One of the areas of sustainable consumption that has received much attention in research and public debate is sustainable food, which allows consumers to realize their environmental and ethical values (Halder et al., 2020). Despite the increased emphasis on sustainable food, there is a clear need for more research in this area. For example, it is crucial to understand how knowledge about sustainable food contributes to shaping consumer attitudes (Verain et al., 2015).

Environmental knowledge or knowledge on environmental issues refers to the information held by individuals on relevant environmental concepts, environmental problems and the ecological effects of consumption and production (Saari, Ulla et al., 2021). A lot of researchers agree that knowledge of the environment does not directly affect behaviour, but acts as an attitude modifier.

An attempt to define the concept of sustainable consumption allows determining the market activity of consumers contributing to the generation of positive economic, social and environmental effects through conscious and responsible purchase and consumption of goods and services (Kazmierczak-Piwko et al., 2022). The excessive consumption behaviour of the privileged twenty percent of the global community is considered unsustainable from an environmental and social perspective (Jackson, 2006), requiring drastic changes in collective consumption practices. Children adopt modern consumption practices from an early age, through the ubiquity of overt and covert marketing, and exposure to family consumption habits. From birth, they learn that spending time on related activities with consumption, for example through shopping, product selection or indirectly through branding on baby bottles, diapers, films and goods, is what they should spend their time on (Donavan, 2016).

An interesting approach to the issue of environmentally sustainable food consumption (ESFC) was indicated in the work of Vermeir et al. 2020 these authors indicated that „The proposed theoretical framework makes explicit the sequential steps or hurdles that need to be taken for consumers to engage in ESFC. Consumers need to positively value the environment, discern a discrepancy between the desired versus the actual state of the environment, opt for action to reduce the experienced discrepancy, intend to engage in behavior that is expected to bring them closer to the desired end state, and act in accordance with their intention” (Vermeir et al., 2020). Figure 1 shows these steps and roadblocks to ESFC.

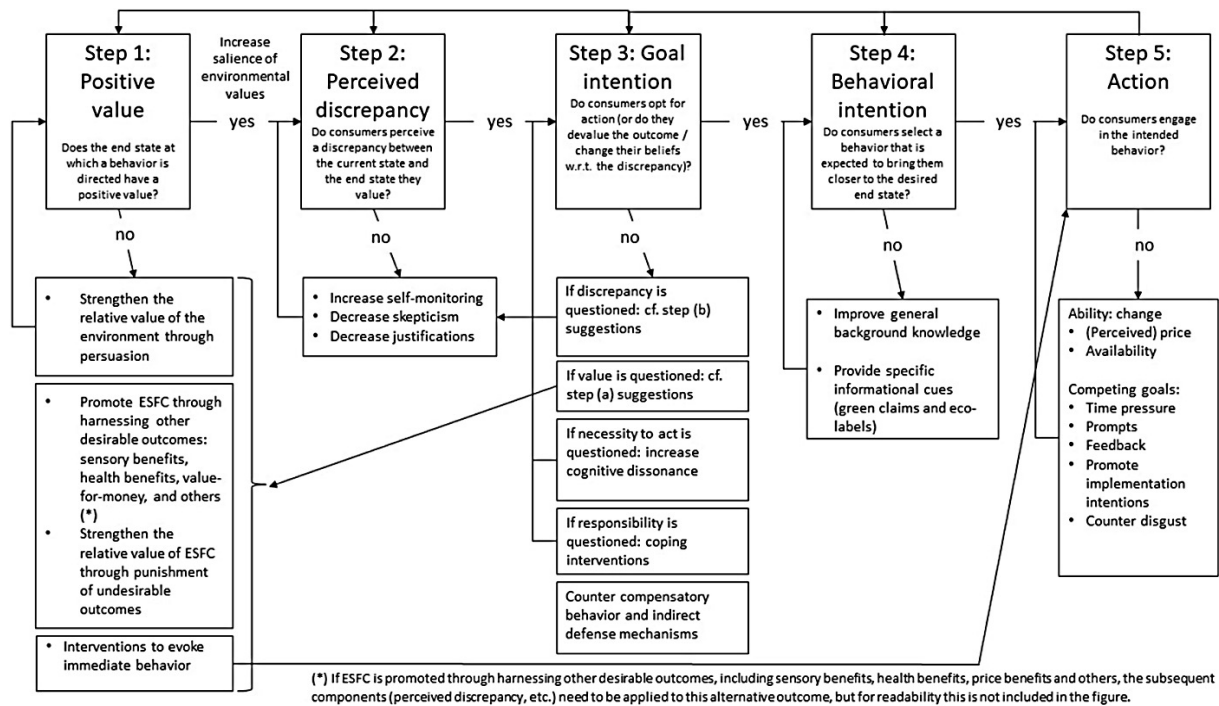


Figure 1. A Goal-Directed Framework Applied to ESFC.

Source: (Vermeir et al., 2020).

On the other hand, Halicka et al. (2019), analyzed food consumption among families with children in early school age. The authors conducted research in the context of sustainable consumption, paying particular attention to the level, frequency and conditions of consumption of products that significantly affect the environment, i.e. the so-called sustainable consumption markers such as fruits and vegetables, meat, milk and dairy products, and bottled mineral and spring waters. However, these studies, although they were also related to the consumption of children who made up the studied families, were more general in nature, being limited to the study of families with children, and not the young consumers themselves (Halicka et al., 2019).

Research on sustainable consumption among children was also carried out by Banerje J. et al. (2023). These authors focused on researching the importance of encouraging children to "sustainable" consumption. The conclusions of their research identified ten impulses that could be used to encourage the youngest to adopt a sustainable lifestyle. These authors observed that this influence was strongest in the school environment (Banerje et al., 2023). In this context, it can be considered that the selection of a group of young consumers of school age for further research is a logical continuation of this approach, aimed at gaining additional knowledge, allowing for the modification of curricula, treated as a set of impact tools that can effectively build sustainable consumption patterns among young consumers.

In the perspective of striving to build sustainable consumption patterns among children in relation to food products, extremely interesting research was conducted by Nazzaro C. et al. (2018). The aim of their research was to identify parental traits that can positively influence children in terms of healthier, more balanced and responsible eating habits (Nazzaro et al.,

2018). These studies confirmed the influence of parental characteristics on consumption patterns among the study children to promote more balanced and responsible eating habits. However, the selection of the research method (questionnaire) and cohort did not guarantee representativeness (including one age cohort, one school). Therefore, as the researchers themselves noted, future research could extend the study to a larger sample and different age cohorts (Nazzarro et al., 2018).

3. Research methodology

The aim of the study was to identify consumption patterns among children. It was also crucial to determine the conditions influencing the behaviour of young consumers in the market.

The paper uses a critical analysis of the literature and survey research based on a prepared questionnaire. The survey was conducted among 1326 children in age groups from 9 to 15 years old. The questionnaire consisted of two parts, i.e. the substantive part and the respondents' particulars.

The first part of the questionnaire contained a set of questions concerning e.g. children's ability to identify products with better environmental parameters, behaviours related to nutrition, saving, shopping, spending free time, waste management and implementing pro-ecological solutions in their households. The respondents' particulars sheet took into account such characteristics of the respondents as: gender, age, place of living. The question was open-ended, allowing the respondent to give a short answer.

The surveys were random-stratified. The strata reflected the different age groups of the respondents (7 successive years of students). The selection of students was random. As a result of the conducted research, 1326 correctly completed questionnaires were obtained in the electronic version. With the adopted confidence level of 99% and the standard error of 5%, the minimum sample size is 622 respondents, which is much lower than the number obtained as a result of the undertaken process of their collection.

4. Findings

Schoolchildren were asked to indicate the source from which they obtain information before making a decision to purchase a product. The results have been presented in Figure 2.

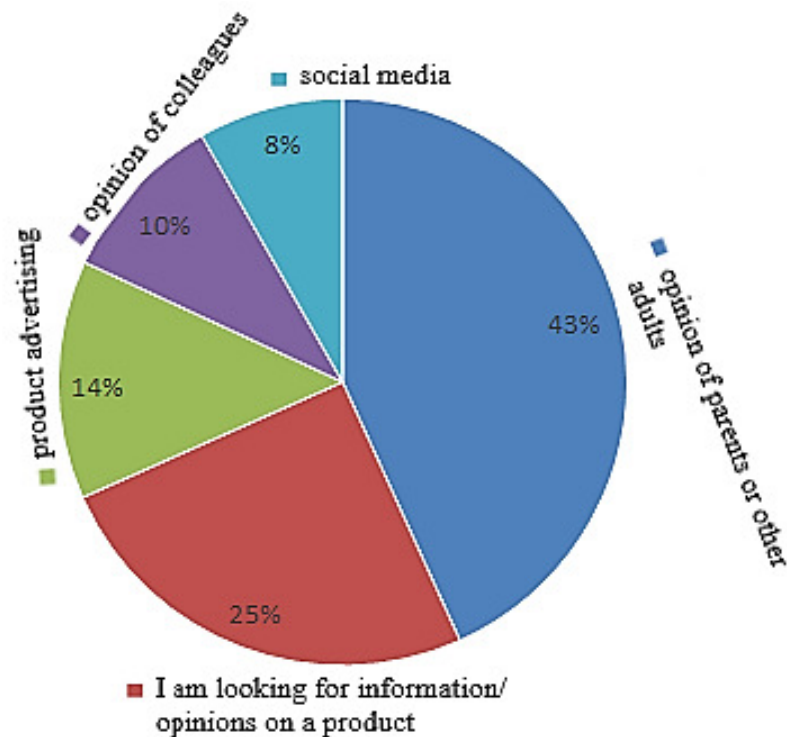


Figure 2. Making decisions on the purchase of food products by respondents in % of indications.

Source: own study based on research results.

When asked what guides them when making decisions about grocery shopping, schoolchildren mostly indicated the opinion of parents or other adults (43%). Every fourth schoolchild looks for information or product reviews on their own (25%). Advertising is also important, as it determines the decision to buy a product in the case of 14% of the surveyed schoolchildren. Some respondents are guided by the opinion of colleagues (10%) or the opinion found on social networks such as *Facebook*, *YouTube*, *TikTok* (8%).

With regard to sustainable consumption, the type of goods consumed is not without significance. Changes in the environment affect consumer behaviour, leading to a multiplicity of attitudes and changes in consumption trends (Kulyk et al., 2017), which is confirmed by this study. It can also be noticed that the awareness of sustainable consumption is weakening for older age groups in the surveyed population. Respondents were asked what they eat between main meals. The results have been presented in Figure 3.

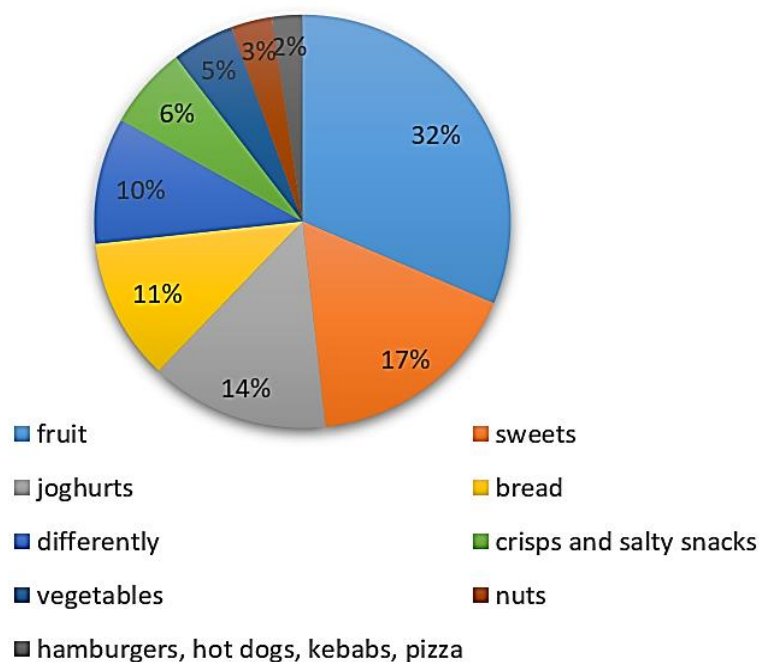


Figure 3. Snacks most often chosen by respondents in % of indications.

Source: own study based on research results.

Respondents mostly choose fruit (32%), sweets (17%) and yoghurts (14%). They also eat bread (11%), crisps and salty snacks (6%), nuts (3%), hamburgers, hot dogs, kebabs or pizza (2%). It should also be added that some people (10%) could not unambiguously indicate the snacks most often consumed between meals, most often making multiple choices, pointing to fruit and vegetables as well as sweets and fast food.

Another analysed aspect was the ability to identify ecolabels. Among them, the recognisability of the ecolabel for organic farming products, the so-called “Euroleaf”, was analysed. The EU organic production logo aims to help consumers identify organic products and help farmers to market them in the community. In practice, this label is to counteract consumers’ confusion and maintain their trust in organic food.

Table 1.

Identification of the “Euroleaf” ecolabel in particular age groups

Answer\age	9	10	11	12	13	14	15
incorrect	7,6	7,5	11,6	12,5	15,8	16,5	20,8
I don't know	16,5	13,9	15,8	14,7	12,7	15,7	4,2
correct	75,9	78,6	72,6	72,8	71,5	67,8	75,0

Source: own study based on research results.

The results of the conducted research showed that young consumers coped very well with the knowledge of this ecolabel. In the analysed age groups, the respondents indicated at least 67.8% of the correct answers - which means that in the process of purchasing food products they are able to correctly identify pro-ecological food products based on the “Euroleaf” ecolabel.

5. Conclusion

Children are recognized as a significant force in the market as consumers, influencers and as future customers. The research showed a relatively good knowledge of the basic principles of sustainable consumption and labelling of organic products among children. This picture is somewhat simplified. The results of the study also showed that for many children healthy eating still means only eating fruit and vegetables (leaving aside the issues of regularity and portions of meals, drinking the right amount of water or maintaining a balanced diet), therefore it is important to increase the amount of information provided on the principles of proper nutrition and make the meals served, including those available in the school canteen, more attractive. This knowledge should be comprehensive and coherent, and not only refer to individual aspects of a healthy lifestyle. It is necessary to involve whole families in such activities through workshops, meetings and other events, because as shown by this research, but also by the results of the professional literature, attitudes and skills in children are transmitted and consolidated in this way. It is also necessary to take care of their quality and the atmosphere in which they are eaten. It is also crucial to encourage schoolchildren to learn about various dishes, and an interesting solution, positively influencing the expansion of children's knowledge in this area, can be organizing culinary workshops, which can be successfully carried out as part of class activities. Encouraging children to prepare meals and snacks on their own will allow them to avoid consuming less valuable products, often easily available, e.g. *fast food*, and the development of appropriate attitudes will ensure that these patterns will be repeated in later life and passed on to subsequent generations.

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**TUNA ORGANISATIONAL ENVIRONMENT AND THE NEEDS
OF MEMBERS OF A CO-OPETITION NETWORK,
USING THE EXAMPLE OF CONSTRUCTION COMPANIES
ASSOCIATED IN THE “STROPY.PL” ORGANISATION**

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Purpose: The purpose of the study is to find out the needs of co-opetition network members in the building material market, under the conditions of the TUNA organisational environment.

Design/methodology/approach: In order to test the research hypotheses, an empirical research method was applied, involving a standardised interview questionnaire carried out using the CAPI technique among the companies associated in the “Stropy.pl” co-opetition network. The survey involved 53 respondents.

Findings: Under the conditions of the TUNA organisational environment, there occurred differences in assessments of the economic situation in the building material market by the members of the co-opetition network. Differences in assessments of the economic situation in the building material market have a moderate to large positive impact on the differentiation of needs of the members of the co-opetition network. Improving the quality of panel floors was more important for those who expected a moderate or high economic situation compared to those who were very or little optimistic. On the other hand, those who were very or little optimistic paid more attention to the clarity of communication, more frequent contact with the head office and new materials regarding the cooperation with “Stropy.pl”. In contrast, those who expected moderate or high economic situation were more appreciative of the improved sales availability of panel floors and the personalisation of fittings.

Research limitations/implications: In order to obtain a more complete picture of the needs of the building material market in Poland, in the context of the TUNA organisational environment, it is recommended to conduct further research with the participation of end-users of these materials.

Practical implications: The applicability of the study relates to the possibilities for company managers to use knowledge about the needs of members of a co-opetition network in the building material market, in the context of the TUNA organisational environment.

Originality/value: The conclusions of the study made it possible to identify the correlation between the TUNA organisational environment, causing discrepancies in assessments of the economic situation in the building material market, and the needs of members of a co-opetition network. Conducting considerations in relation to the building material industry market further enhances the originality of the study.

Keywords: co-opetition, organisational environment, TUNA, building material market.

Category of the paper: research paper.

Introduction

Over the past three years, the world has been struggling with three exceptional phenomena: the COVID-19 pandemic, the war in Ukraine and the economic crisis. These factors have had a huge impact on various sectors of the economy, including the building material market in Poland. The most acute effect of the pandemic in this market was a decline in demand, as many construction projects were halted and construction companies scaled down their operations, resulting in a reduction in demand for building materials. The residential and commercial construction market segments were particularly affected (Staniszewski, 2022). The impact of the pandemic was further exacerbated by problems related to raw material shortages and price increases in the construction industry in Poland, while Russia's invasion of Ukraine in 2022 reduced imports of aggregates, cement and wood, aluminium and steel products (Czech et al., 2020).

As a result of the above factors, the current organisational environment in the Polish building material market is characterised by the TUNA (turbulent, uncertain, novel, ambiguous) concept, which was developed by David Snowden and Mary Boone in 2007 (Snowden, Boone, 2007). This model describes four types of situations in which organisations and leaders need to make decisions and take actions. The TUNA environment is characterised by high levels of turbulence, uncertainty, novelty and ambiguity. Under such conditions, it is difficult to predict the consequences of actions and apply traditional management methods. Leaders must be flexible, creative and able to learn on an ongoing basis. The concept of the TUNA organisational environment is based on the earlier concept of VUCA (volatile, uncertain, complex, ambiguous), which was proposed by the US Army War College (2019) in the 1990s. The difference between these concepts is that TUNA also includes "novelty" as an influencing factor. "Novelty" refers to the emergence of unknown phenomena or problems that require innovative solutions. The TUNA concept is applicable in various fields such as strategic management, leadership, innovation or education.

The aim of the study is to find out the needs of members of a co-opetition network in the building material market, under the conditions of the TUNA organisational environment. In order to meet this challenge, an empirical survey has been carried out among the

representatives of companies affiliated to the “Stropy.pl” co-opetition network. The research questions relate to the predictions, expectations and priorities of the survey participants regarding the economic climate and cooperation within the co-opetition network:

1. Under the conditions of the TUNA organisational environment, are there differences in assessments of the economic situation in the building material market by members of a co-opetition network?
2. What is the direction of actions and the strength of the relationship between differences in assessments of economic situation in the building material market and the differential needs of members of a co-opetition network?
3. What are the differences in the needs of members of a co-opetition network in the building material market, under the conditions of the TUNA market environment?

Conditions of the TUNA organisational environment in the building material market in Poland

Turbulent in the TUNA concept refers to the rate and speed of change in the organisational environment that companies operating in the market face (Snowden, Boone, 2007). This turbulence in the environment can manifest itself in the form of increases or decreases in the prices of products and services occurring at unpredictable intervals, regulatory changes and even natural disasters. One of the areas where turbulence is of particular importance is the construction industry. The building material market is susceptible to price changes, which can be the result of a number of factors, such as currency fluctuations, modifications to tax laws or changes in market demand (Główka, 2011). These changes can have a significant impact on the operations of construction companies and even condition their survival. The instability of construction material prices can lead to difficulties in predicting the costs of construction projects, which in turn can have a negative impact on companies' profitability. Price turbulence can also hinder financial planning and force frequent modifications of project budgets. In addition, the volatility of construction material prices can lead to difficulties in negotiating contracts with clients. Construction companies may find it difficult to set a fixed price for their services, due to the inability to predict the cost of materials in the future. This, in turn, can induce a decrease in confidence from clients and a reduction in the number of orders. Instability in the price of construction materials can also lead to difficulties in hiring and managing a team. High raw material prices may result in the need to lay off employees, which can have a negative impact on team morale and productivity. On the other hand, low prices of construction materials may cause excessive competition in the market, which may prompt companies to reduce wages, which in turn may lead to employee turnover and employment instability (Chen, Miao, 2023). To cope with the

volatility of construction material prices, construction companies can use several different strategies to act. One is to build relationships with suppliers and enter into contracts with long-term price guarantees. It is also possible to conclude short-term contracts, which allows flexibility in responding to changing prices (Surówka-Marszałek, 2010). Another way to deal with the volatility of construction material prices is to increase efficiency in resource management and reduce wastage (Bąk-Sokolowska, 2015). These measures may involve better project planning and more economical use of available materials, as well as ensuring that excessive waste and unnecessary costs are not created. In addition, construction companies may consider diversifying their activities and developing new business areas, such as renovation or modernisation services, which are less susceptible to changes in the price of construction materials (Grudzewski, Hejduk, 2000). This can provide greater financial stability and enable the company to withstand difficult periods better.

Uncertain, according to the TUNA concept, is a characteristic of the organisational environment, determining the inability to predict future events and situations (Snowden, Boone, 2007). It can be caused by the volatility of the environment or lack of knowledge to assess the impact of events. In such a situation, the key is to have information resources that need to be continually expanded to recognise patterns and better understand the possible consequences of situations (Piątkowska, 2021). Bennetta and Lemione (2014) note, however, that it is difficult to infer the future from the past experiences, as new exceptions to the rules and even exceptions to the exceptions keep appearing, while the rules themselves are losing their validity. Uncertainty in the building material market may manifest itself in the inability to predict changes in the price of raw materials, changes in the supply of or demand for given products, as well as modifications to construction laws or changes in customer preferences (Surówka-Marszałek, 2010). Uncertainty can lead to difficulties in planning construction projects and generate additional costs, e.g. due to the need to purchase reserve stocks of materials or changes in the construction schedule. Another effect can be lack of certainty about the achievement of anticipated profits and cause financial problems for companies operating in the construction industry (Skorupka, 2008). In order to minimise the effects of uncertainty, it is important for construction companies to continuously improve their knowledge and monitor changing market conditions (Soniewicki, 2017). It is also worth considering the use of flexibility strategies and avoiding heavy involvement in single projects, as well as protecting through insurance or contracts with contractors (Kotter et al., 2022).

Novel in the TUNA concept refers to the degree of unfamiliarity with the environment and the level of innovation or creativity required of an organisation to cope with the complexity of the environment (Snowden, Boone, 2007). This complexity means that different companies may achieve different results despite following the same procedures. Consequently, it is important to make decisions by considering many different factors simultaneously (Nogalski et al., 2018). Complexity can be a particularly difficult challenge for the construction industry, as it involves a huge amount of data and information that needs to be

taken into account when making decisions (Sharafi et al., 2018). Managers in this industry have to take into account not only the current needs and expectations of clients, but also legislation and safety standards, as well as changing market conditions, such as the price of construction materials or the availability of labour. In addition, in the case of large construction projects, the interaction of many different parties is necessary, which adds to the complexity of the entire project. As a result of complexity, managers are forced to deal with a large amount of information and solve a variety of problems (Sharafi et al., 2018). In such an environment, it is difficult to predict the consequences of decisions, as there is no clear link between causes and effects. Managers have to consider multiple factors when making decisions, which requires them to manage complex situations efficiently. One way to deal with complexity is to use project management tools and techniques, such as, for example, project modelling (Bryde et al., 2013) or scheduling techniques (Adamczewski, 2009). With such tools, managers can better understand and anticipate the consequences of their decisions and better manage risks.

Ambiguous, according to the TUNA concept, refers to a feature of the organisational environment causing difficulty in understanding it and imposing different possible interpretations of situations and events (Snowden, Boone, 2007). It can manifest itself when there are many potential ways to solve one problem, but it is difficult to decide which solution is best. The ambiguity of a situation, the possibility of misreading signals from the environment, the multiplicity of meanings and the lack of experience in a particular area of business mean operating in what is described as an “unknown unknown” (Mack et al., 2015). Ambiguity in the building material market can include a lack of clear and consistent regulations regarding, for example, the sourcing of raw materials, the construction of facilities or the operation of buildings (Deszcz, 2013). It can also refer to lack of clear information regarding the prices of raw materials or a lack of transparent criteria regarding the quality and safety of the products used (Surówka-Marszałek, 2010). Ambiguity can also result from lack of clear guidelines on how companies can access new markets or change their business models (Knop, Brzóska, 2016). As a result of ambiguity, managers face the need to cope with the ambiguity of a market situation, the danger of misreading signals coming from the environment, the multiplicity of meanings and the lack of previous experience in a given area (Piątkowska, 2021). This may include, for example, lack of clarity about the legislation that applies to building in a particular location, lack of certainty about the future prices of building materials, lack of experience in implementing new technologies or ambiguity about future market trends (Bastian, Muchlish, 2012). In such situations, managers need to be able to manage uncertainty appropriately and respond quickly to changing conditions. Attempting to cope with the ambiguity of the business environment may involve continuous monitoring of the situation in the building material market and changes in laws and regulations (Soniewicki, 2017). It is also worth networking with other companies in the industry to access information on their experiences and to exchange knowledge (De Klerk, 2010). Another way to deal with

ambiguity is to create scenarios for different eventualities (Skorupka, 2008). These activities can include preparing contingency plans for unforeseen events or developing strategies for operating in markets with high uncertainty. In addition, managers can enlist the help of specialists in risk management or strategy development to better deal with ambiguity in the construction industry (Pittaway et al., 2004).

Co-opetition in the building material market as an implementation of Taleb's concept of antifragility

The TUNA organisational environment is largely a consequence of the occurrence of the phenomenon of so-called “black swans” – a term popularised by Nassim Nicholas Taleb, an American writer and investor of Lebanese origin, who in 2007 described in his book the phenomenon of unexpected and unpredictable events with a huge impact on the functioning of the modern world (Taleb, 2007). Examples of black swans include the outbreak of World War I, Hitler's rise to power, the 11 September 2001 attacks in New York, or the 2008 financial crisis. Unprecedented, however, is the ongoing period of cumulative black swans, initiated in 2020 by the Covid-19 coronavirus pandemic, followed by other sensitive events, i.e. the war in Ukraine, the global economic crisis and the technological revolution in the field of artificial intelligence. Taleb argues that people tend to ignore or underestimate the possibility of black swans because they rely on simplistic and linear models of reality that do not take into account the complexity and variability of the world. People also frequently try to rationalise black swans afterwards, giving them meaning and cause, which reinforces a false sense of control and predictability. The author suggests instead adopting an anti-fragile stance, i.e. one that is not only resilient to shocks and crises, but also able to benefit from and learn from them. Antifragility is about being open to uncertainty and risk, experimentation and innovation, diversification and decentralisation. Antifragility is also about being able to recognise and take advantage of black swan opportunities (Taleb, 2013).

The search for an anti-fragility formula requires managers and leaders to constantly adapt to changing situations and challenges, and to invent new ways of creating values for customers and stakeholders. One such way is co-opetition – a concept introduced by American economists Adam Brandenburger and Barry Nalebuff in 1996 in their book entitled: “Co-opetition” (Brandenburger, Nalebuff, 1996). The authors defined co-opetition as a value stream or, in other words, a value network in which companies cooperate with competitors to enlarge the so-called “cake”, and competition refers to the sharing of the cake. Thus, co-opetition is a form of business strategy that combines two seemingly contradictory approaches: competitive and cooperative.

The concept of co-opetition has been developed by a number of researchers in different academic fields such as economics, management, marketing or psychology. Three main approaches to the study of coopetition can be distinguished in the literature: strategic, network and relational (Bengtsson, Kock, 2014). The strategic approach focuses on analysing the competitive and cooperative behaviour of market actors and its impact on economic performance. The network approach emphasises the significance of the structure and dynamics of relationships between actors and their impact on value creation and distribution processes. The relational approach focuses on the social and emotional aspects of relationships between partners and their impact on trust, loyalty and commitment.

Co-opetition can take various forms, such as joint research and development of products or technologies, group purchasing of raw materials or services, collaborative use of infrastructure or human resources, combined marketing or distribution activities, or joint participation in publicly funded projects (Czakon, Klimas, 2018). Examples of co-opetition in the building material market in Poland include a consortium of companies producing steel for road and bridge construction, an e-commerce platform linking producers and distributors of building materials, or a network of research laboratories cooperating with producers of insulation materials.

This study adopts a network approach to the study of co-opetition, which was analysed in four areas of cooperation and value distribution: product, advertising, communication and cooperation with a co-opetition network. In order to find an answer to the research question posed, the following hypotheses were formulated:

- H1:** Under the conditions of the TUNA organisational environment, there will be discrepancies in the assessment of economic situation in the building material market by members of a co-opetition network.
- H2:** Differences in assessments of economic situation in the building material market will have a large positive impact on the differentiation of needs of members of a co-opetition network.
- H3:** Differences in the needs of members of a co-opetition network which brings together companies from the construction industry, under the conditions of the TUNA market environment, will occur in most of the four areas of cooperation and value distribution: (product, advertising, communication and cooperation with a co-opetition network).

Methodology

In order to test the research hypotheses, an empirical research method involving a standardised interview questionnaire, carried out using the CAPI technique, was applied, among companies belonging to the “Stropy.pl” co-opetition network, between 22 August 2022 and 30 November 2022. 53 respondents were surveyed.

The “Stropy.pl” co-opetition network was established in 2016 and is the only initiative of its kind in Poland, bringing together construction companies that offer or manufacture floor systems. At the end of 2022, the network comprised 12 partners and 36 distributors. The network operates at two levels: communication with the market and distribution. Communication with the market involves enabling the customer to compare floor systems available in the market, familiarising them with the technical and economic aspects of different solutions, expert advice and the possibility of pricing and ordering them online via the “Stropy.pl” portal (Jasiński et al., 2022). Quotation requests generated on the portal are forwarded by the head office to the network members closest to the notified investment. Distribution involves ensuring that floor solutions are available and can be purchased throughout Poland. Distributors’ range of products include over a dozen different floor systems available exclusively within the network, while partners, in addition to the same range of floors, also manufacture the “Vector” floor system under the network licence. The members of “Stropy.pl” are family businesses from the SME sector, dominating the economic market with different sizes. They range from small contractors, design and construction wholesalers employing a few or a dozen or so people, to multi-branch construction wholesalers and manufacturers of precast concrete products employing up to 250 people. The “Stropy.pl” network supplies products to various market sectors such as B2B, B2C, B2B2C and B2G. Its products are suitable for residential, commercial and industrial construction (Kisiołek, 2017). The network covers entire Poland. Its members support one another in promoting their own products (hence its co-opetitive nature). They also cooperate at various levels (including contractor – floor assemblies, design – advisory and technical services and commercial – brokerage).

IBM SPSS Statistics 28.0 was used for calculations. $\alpha = 0.05$ was adopted as the level of significance. Frequency analysis was used to describe the responses to each question. In order to determine the significance of ratings of different needs related to the product, advertising, communication and “Stropy.pl”, an analysis was carried out using the Friedman test (Friedman, 1937). The Friedman test is a non-parametric test used to compare mean ranks across several dependent groups. The test statistic is calculated according to the following formula:

$$x^2 = \frac{12}{k(k+1)n} \sum_{i=1}^k \left(\sum_{j=1}^n r_{ij} \right)^2 - 3(k+1)n, \quad (1)$$

where:

k – number of measurements (number of activities, devices, tools evaluated),

n – number of observations,

r_{ij} – rank for the j^{th} observation in the i^{th} measurement.

This test examines whether there are differences between the measurements of the variable under study. The null hypothesis shows no such differences and the alternative hypothesis is that at least one pair of measurements differs.

If the Friedman test showed statistically significant differences between the needs assessments, an additional analysis was applied using the Dunn test (Dunn, 1964) with the Bonferroni correction for multiple comparisons. This correction reduces the risk of making a Type I error (Abdi, 2007).

In order to compare those rating the economic situation of building materials in 2022 and 2023 as very low/low or moderate/high in terms of needs assessment, analyses were performed using the Mann-Whitney U test (Mann, Whitney, 1947). For a large sample, the statistic is calculated according to the following formula:

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{(n_1 + n_2 + 1)}{12} - \frac{n_1 n_2 \Sigma(t^3 - t)}{12(n_1 + n_2 + n_2 - 1)}}}, \quad (2)$$

where:

$n_1 n_2$ – number of samples,

U – Mann-Whitney test statistic for small samples calculated from the following formula:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1, \quad (3)$$

where:

R_1 – sum of sample ranks,

t – number of cases included in the tied rank.

Results and discussion

Fifty-three people were surveyed, two of whom rated the current economic situation in the building material market as very low. One of them expected no change in the following year and the other forecast stagnation. Most of the respondents (34.9%, N = 18) considered the current market situation as low. Of this group, 10 people did not change their ratings for 2023, 5 people expected stability, 1 person expected growth and 2 people expected depression. The most frequently the respondents (58.5%, N = 31) believed that the building material market was currently stable. Among them, 58.1% (N = 18) predicted no change for the following year, 19.4% (N = 6) expected stagnation and 22.6% (N = 7) anticipated development. Only two people assessed the current market situation as high and both predicted it to remain stable in 2023. Table 1. shows the detailed distribution of economic situation ratings for 2022 and 2023.

Table 1.

Frequency analysis of respondents' expectations in relation to the economic situation of the building material market

Expectation rating	This year (2022)		Next year (2023)	
	<i>n</i>	%	<i>n</i>	%
Very low (depression)	2	3.8	3	5.7
Low (stagnation)	18	34.9	17	32.1
Moderate (stabilisation)	31	58.5	25	47.2
High (development)	2	3.8	8	15.1

Source: own study.

First, the respondents were divided into two groups – those who rated the economic situation of building materials very low or low and those who rated the economic situation moderately or high. For these groups, analyses were carried out using the Mann-Whitney U test, comparing their assessments of product, advertising, communication, sales and cooperation needs with “Stropy.pl”.

The analysis showed one difference in the ratings – for those who rated the economic situation as moderate/high, the improvement in the quality of the panel floors was more important than for those who rated the economic situation very low/low. The strength of the effect for the difference was moderate. In terms of other needs, there were no differences between the groups (Table 2).

Table 2.

Comparison of respondents rating the economic situation in 2022 as very low/low and moderate/high in terms of needs assessment

Dependent variable	Very low/low (n = 20)			Moderate/high (n = 33)			Z	p	r
	average rank	Me	IQR	average rank	Me	IQR			
Product									
General product quality assessment	27.53	5.00	0.75	26.68	5.00	2.00	-0.21	0.835	0.03
Accessibility improvement	23.58	4.00	1.00	29.08	5.00	2.00	-1.30	0.193	0.18
Advertising									
More advertising campaigns	28.43	4.00	1.00	26.14	3.00	1.00	-0.54	0.586	0.07
More incisive communication	26.38	3.00	1.00	27.38	3.00	1.00	-0.24	0.808	0.03
Advertising to new customer segments	28.18	3.00	1.75	26.29	3.00	1.00	-0.45	0.649	0.06
More online advertising	26.50	4.00	0.00	27.30	4.00	1.50	-0.20	0.840	0.03
More social media advertising	27.50	4.00	0.75	26.70	4.00	1.00	-0.20	0.841	0.03
More mobile advertising	26.45	3.00	1.75	27.33	3.00	1.00	-0.22	0.827	0.03
More advertising in paper press	26.20	2.00	1.00	27.48	3.00	1.00	-0.32	0.749	0.04
More outdoor advertising	27.33	3.00	2.00	26.80	3.00	2.00	-0.13	0.900	0.02
Communication									
Communication frequencies	29.65	3.00	1.00	25.39	3.00	0.50	-1.08	0.282	0.15
Clarity of message	28.68	3.50	1.00	25.98	3.00	1.00	-0.65	0.515	0.09
Better audience outreach	30.38	4.00	0.75	24.95	4.00	1.00	-1.37	0.172	0.19
Sales needs for panel floors									
Lower price	24.58	4.00	2.00	28.47	4.00	1.00	-0.94	0.345	0.13
Accessibility improvement	26.75	4.00	1.75	27.15	4.00	2.00	-0.10	0.922	0.01
Quality improvement	20.73	2.00	1.00	30.80	3.00	1.00	-2.43	0.015	0.33
Sales needs for beam-and-block floors									
Lower price	23.20	3.00	1.00	29.30	4.00	1.00	-1.45	0.147	0.20
Accessibility improvement	24.50	3.00	0.75	28.52	3.00	2.00	-0.97	0.331	0.13
Quality improvement	24.98	3.00	0.75	28.23	3.00	1.00	-0.84	0.403	0.11
Requirements for fittings and lintels									
Lower price	26.15	4.00	1.50	27.52	4.00	1.50	-0.33	0.738	0.05
Quality improvement	27.48	3.00	1.50	26.71	3.00	2.00	-0.18	0.857	0.02
Personalisation of fittings (fittings with your logo)	24.08	4.00	2.75	28.77	5.00	1.50	-1.16	0.247	0.16
New types of fittings	24.28	3.00	1.00	28.65	3.00	1.50	-1.07	0.284	0.15
New types of lintels	26.70	3.00	0.75	27.18	3.00	1.00	-0.13	0.900	0.02

Cont. table 2.

Cooperation needs with Stropy.pl									
More frequent contact with customer service consultant	29.65	3.00	2.00	25.39	3.00	1.00	-1.02	0.310	0.14
More frequent contact with headquarters	26.90	3.00	1.75	27.06	3.00	1.50	-0.04	0.969	<0.01
Improving the quality service by customer service consultants	29.45	3.00	2.00	25.52	3.00	2.00	-0.93	0.353	0.13
Improving the quality service by headquarters	26.80	3.00	1.50	27.12	3.00	2.00	-0.08	0.939	0.01
Development of new promotional materials (leaflets, boards, banners, displays)	31.23	3.00	1.00	24.44	3.00	0.50	-1.71	0.088	0.23

Source: own study.

Analogous analyses were carried out to compare those who rated the economic situation of the coming year as very low/low and moderate/high. Those who rated the economic situation as very low/low attached more importance to clarity of message in terms of communication, as well as to more frequent contact with the head office and the development of new materials in terms of cooperation with “Stropy.pl”. On the other hand, those evaluating the coming economic situation moderately/high rated the importance of improving the availability of sales of panel floors and the personalisation of fittings higher. The strength of the effect for the differences was at the weak or moderate level. For the other needs, differences between the groups were found to be insignificant (Table 3).

Table 3.

Comparison of respondents rating the economic situation in 2023 as very low/low and moderate/high in terms of needs assessment

Dependent variable	Very low/low (n = 20)			Moderate/high (n = 33)			Z	p	r
	average rank	Me	IQR	average rank	Me	IQR			
Product									
General product quality assessment	27.33	5.00	1.75	26.80	5.00	1.00	-0.13	0.897	0.02
Accessibility improvement	24.20	4.50	1.00	28.70	5.00	2.00	-1.07	0.287	0.15
Advertising									
More advertising campaigns	29.83	4.00	1.00	25.29	3.00	1.50	-1.08	0.281	0.15
More incisive communication	29.35	3.50	1.00	25.58	3.00	1.00	-0.92	0.360	0.13
Advertising to new customer segments	30.95	4.00	1.00	24.61	3.00	1.00	-1.53	0.126	0.21
More online advertising	25.60	4.00	1.00	27.85	4.00	0.00	-0.57	0.571	0.08
More social media advertising	28.53	4.00	1.00	26.08	4.00	0.50	-0.61	0.540	0.08

Cont. table 3.

More mobile advertising	28.70	3.00	1.00	25.97	3.00	0.50	-0.68	0.499	0.09
More advertising in paper press	29.58	3.00	1.00	25.44	2.00	1.00	-1.03	0.304	0.14
More outdoor advertising	29.13	3.00	2.00	25.71	3.00	2.00	-0.82	0.413	0.11
Communication									
Communication frequencies	29.65	3.00	1.00	25.39	3.00	0.50	-1.08	0.282	0.15
Clarity of message	32.13	4.00	1.00	23.89	3.00	1.00	-1.99	0.046	0.27
Better audience outreach	28.80	4.00	1.00	25.91	4.00	1.00	-0.73	0.466	0.10
Sales needs for panel floors									
Lower price	21.98	3.50	1.75	30.05	4.00	1.00	-1.96	0.050	0.27
Accessibility improvement	19.73	3.50	1.75	31.41	5.00	1.00	-2.87	0.004	0.39
Quality improvement	25.93	3.00	1.00	27.65	3.00	2.00	-0.42	0.677	0.06
Sales needs for beam-and-block floors									
Lower price	25.00	3.00	1.00	28.21	4.00	2.00	-0.76	0.445	0.10
Accessibility improvement	25.55	3.00	0.00	27.88	3.00	2.00	-0.56	0.573	0.08
Quality improvement	27.43	3.00	0.00	26.74	3.00	1.00	-0.18	0.861	0.02
Requirements for fittings and lintels									
Lower price	28.38	4.00	1.00	26.17	4.00	2.00	-0.54	0.588	0.07
Quality improvement	27.18	3.00	0.75	26.89	3.00	2.00	-0.07	0.947	<0.01
Personalisation of fittings (fittings with your logo)	21.65	3.00	2.75	30.24	5.00	1.00	-2.12	0.034	0.29
New types of fittings	26.13	3.00	0.75	27.53	3.00	2.50	-0.34	0.731	0.05
New types of lintels	27.95	3.00	0.00	26.42	3.00	1.00	-0.40	0.691	0.05
Cooperation needs with Stropy.pl									
More frequent contact with customer service consultant	31.55	3.00	1.75	24.24	3.00	1.00	-1.74	0.081	0.24
More frequent contact with headquarters	33.53	3.00	1.00	23.05	2.00	1.00	-2.51	0.012	0.34
Improving the quality service by customer service consultants	28.78	3.00	2.00	25.92	3.00	2.00	-0.67	0.501	0.09
Improving the quality service by headquarters	30.50	3.00	1.00	24.88	3.00	2.00	-1.34	0.180	0.18
Development of new promotional materials (leaflets, boards, banners, displays)	33.08	3.50	1.75	23.32	3.00	0.00	-2.46	0.014	0.34

Source: own study.

The results of the study show that the conditions of the TUNA organisational environment have an impact on the formation of the needs of members of a co-opetition network.

H1: Under the conditions of the TUNA organisational environment, there will be discrepancies in the assessment of economic situation in the building material market by members of a co-opetition network. The study has confirmed that under the conditions of the TUNA organisational environment, there are discrepancies in the assessment of economic

situation in the building material market by members of a co-opetition network (positive verification of hypothesis H1).

H2: Differences in assessments of economic situation in the building material market will have a large positive impact on the differentiation of needs of members of a co-opetition network. The analysis has showed that differences in assessments of economic situation in the building material market have a moderate but not large positive impact on the differentiation of the needs of members of a co-opetition network (negative verification of hypothesis H2).

H3: Differences in the needs of members of a co-opetition network which brings together companies from the construction industry, under the conditions of the TUNA market environment, will occur in most of the four areas of cooperation and value distribution: product, advertising, communication and cooperation with a co-opetition network. The study has confirmed that differences in the needs of members of a co-opetition network bringing together companies from the construction industry, under the conditions of the TUNA market environment, will occur in most of the four areas of cooperation and value distribution (positive verification of hypothesis H3).

Conclusion

In order to find out the needs of members of a co-opetition network in the building material market, under the conditions of the TUNA organisational environment, an empirical survey was conducted among the representatives of the companies affiliated to the “Styropy.pl” co-opetition network.

The research allowed all research hypotheses to be verified and the research questions to be answered:

1. Under the conditions of the TUNA organisational environment, are there differences in assessments of economic situation in the building material market by members of a co-opetition network?

Under the conditions of the TUNA organisational environment, there was a divergence in the assessments of economic situation in the building material market by members of a co-opetition network. Regarding the situation of the building material market in 2022 and 2023, most respondents showed moderate or low expectations. Some respondents rated the economic situation in the building material market as low (in 2022 – 39.4% of the respondents, in 2023 – 32.1% of the respondents) and some rated it as moderate (in 2022 – 58.5% of the respondents, in 2023 – 47.2% of the respondents).

2. What is the direction of actions and the strength of the relationship between differences in assessments of economic situation in the building material market and the differential needs of members of a co-opetition network?

Differences in assessments of economic situation in the building material market have a moderately positive impact on the differentiation of the needs of members of a co-opetition network.

3. What are the differences in the needs of members of a co-opetition network in the building material market, under the conditions of the TUNA market environment?

Improving the quality of panel floors was more important to those who expected moderate or high economic situation than to those who were very or lowly optimistic. On the other hand, those who were very or lowly optimistic paid more attention to the clarity of communication, more frequent contact with the head office and new material regarding the cooperation with “Stropy.pl”. On the other hand, those who expected moderate or high economic situation were more appreciative of the improved sales availability of panel floors and the personalisation of fittings.

In order to obtain a more complete picture of the needs of the building material market in Poland, in the context of the TUNA organisational environment, it is recommended to conduct further research with the end users of these materials. This research should cover the same thematic area as the previous one, i.e. identifying the needs of market participants, but it should focus on the B2C sector, which has not been covered before. Such a research scope would allow the formulation of holistic conclusions, taking into account both major stakeholder groups of the construction market in Poland.

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THE SWOT-TOWS ANALYSIS AS A TOOL FOR QUALITY MANAGEMENT FOR AN ENTERPRISE WITH PKD 85.59B – EXTRACURRICULAR FORMS OF EDUCATION

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Purpose: The aim of the article is to present the practical application of the SWOT-TOWS analysis in assessing the prospects of starting a business in the field of extracurricular forms of education.

Design/methodology/approach: The research includes the identification of factors of the internal and external environment for a company operating on the market for a year in the field of extracurricular forms of education in accordance with the classification of the selected research method and based on observation, calculation of standard and additional links and, based on the resulting strategy, making decisions on quality management.

Findings: The analysis of the links between the factors of the internal and external environment indicated that in the case of an enterprise in the education industry, a competitive strategy should be adopted in terms of quality management, which means currently favorable external conditions for this type of activity, the use of which will enable the reduction of weaknesses. The focus should be on a high level of quality at the core of the service - in the learning process.

Research limitations/implications: The presented research results may be the basis for further research in the field of quality management in enterprises from the analyzed sector.

Practical implications: The presented analysis can be successfully used by entrepreneurs conducting a similar type of business activity and by people analyzing the education market both in terms of business and science.

Originality/value: Simultaneous use of the SWOT-TOWS analysis with other analytical tools may allow for effective market analysis by economists and may facilitate quality management for business practitioners.

Keywords: market analysis, SWOT-TOWS analysis, quality management.

Category of the paper: research paper, case study.

1. Introduction

Recent years have been a challenge for people running their own business. The COVID-19 pandemic, the war in Ukraine, the rapid increase in inflation, the legal changes directly or indirectly related to these events and the increase in business costs caused significant changes in the structure of the domestic market. A situation worthy of scientific attention concerns the sector of educational services. As PKD 85.59B there are registered enterprises providing "other extracurricular forms of education, not classified elsewhere". This part of the list includes enterprises providing services supporting education, mainly additional classes and tutoring. Online platforms have been informing about the growing potential of this type of business (mainly due to the low quality of home education, changes in the core curriculum and the busy lifestyle of modern parents), which means a growing supply. A multitude of advertisements has been identified on the Internet, and individual offers differ in many features that make it difficult to compare them. Referring the theory of management and economics to this sector, the issues of quality management are worth considering as one of the important factors supporting the success of enterprises (Chen et al., 2022; Chudziński et al., 2022).

Quality management is a concept currently treated as interdisciplinary. Its individual issues are an area of interest and require knowledge from various fields of science. For example, quality planning is an area of management, marketing and sociology, which is also an element of motivation and communication. The contribution of economics (resources), statistics (assessment), accounting (costs), law (standards) and many others is also distinguished, which contributes to the various definitions of the indicated concept (Mantura, 2012; Sridevi, 2021).

The technical definition contained in the ISO standard defines quality management as coordinated activities in the field of managing an organization in terms of quality. They can be characterized in a slightly broader way as managerial activities undertaken in relation to quality issues, consisting in setting objectives in its scope and through the use of management functions, achieving them in an efficient manner. The managerial activity in this area is derived from a planned and organized management system, the purpose of which is to meet specific quality requirements. It is the performance of specific management functions in a purposeful manner, taking into account the optimization of the use of the organization's resources, focused on obtaining high-quality goods that will be subject to continuous improvement (Bieńkowska, Zabłocka-Kluczka, 2005; Rogala, 2014).

Quality management functions also include improvement as the last, constantly iterative step. Continuous improvement is an inseparable element of quality management, which has been emphasized by authorities dealing with this issue for many years, according to the assumption that higher quality can always be achieved, and perfection does not exist (Maldonado et al., 2020; Schiavone et al., 2023).

The research gap made it possible to indicate an area worth attention. The study presents the use of the SWOT-TOWS analysis for quality management in the enterprise from the education sector.

2. Methodology of research

The SWOT-TOWS analysis is perceived as one of the most basic and prevailed method with a fairly undocumented history that is used in different areas of management. Its name is an acronym of internal (strengths and weaknesses) and external (opportunities and threats) factors of enterprise's environment that are analyzed (Nasreen, Afzal, 2020; Puyt et al., 2023). The objective of this method is to choose the most matching strategy which enables enterprises to function and develop in the currently difficult market conditions (Büyüközkan, Ilıcak, 2019; Harris, 2018).

In accordance with the theoretical assumptions of the chosen research method, the first step is to identify the factors and classify them to the listed dimensions. Then, the researcher assigns a weight to each factor based on his knowledge, and the sum of the weights in each dimension is 1 (Kowalik, 2020; Panteleiev, 2023).

The next step is to identify, usually in a tabular form, the links between the individual factors listed in the four presented areas. In this part of study, the classic form of identifying dependencies (1) or no dependencies (0) was chosen. Each table contains the calculated number of interactions and the weighted value of interactions between individual factors as well as the total number and weighted value of interactions for a given association. In each table there is also a rank, where 1 is the most important, and 5 - the least significant factor (Brycht, Ulewicz, 2023).

The results from all tables, summed up in the appropriate dependency areas, by identifying the highest number of interactions and the highest weighted value, indicate one of four strategies: aggressive (recommends taking advantage of opportunities using strong points - means a favorable internal and external environment, enables expansion and development), conservative strategy (means that the company has many advantages and using them it can reduce the risk resulting from many threats in the environment), competitive strategy (overcomes weaknesses by using the opportunities) and defensive strategy (means an unfavorable situation of the company and the environment, requiring further analyzes and actions for minimizing weaknesses and avoiding the threats) (Gurel, Tat, 2017; King et al., 2023).

The SWOT factors with their weights are presented in Table 1.

Table 1.
SWOT factors with the weights

S	Strengths	Weight	W	Weaknesses	Weight
S1	competences- knowledge of fields (Maths and English), pedagogical training, studies in the field of management	0,25	W1	a multitude of advertisements for tutoring- competition, lack of recognition	0,25
S2	knowledge transfer skills, good approach to students	0,2	W2	lack of possibility to work full-time (8 hours a day) - provision of services only in the afternoons	0,15
S3	knowledge of the core curriculum and current requirements of CKE for primary school final exam and matura exam	0,15	W3	seasonal demand for tutoring - limited earning opportunities during the holiday months	0,2
S4	classroom in the city center, stationary classes, good access from every district	0,2	W4	little experience in registered business activity - 1 year	0,15
S5	base of current students, good references from graduates, good opinions among parents	0,2	W5	relatively high prices of lessons	0,25
O	Opportunities	Weight	T	Threats	Weight
O1	growing student base through advertising and experience	0,3	T1	increase in competition and saturation of the local market with tutors	0,2
O2	introduction of new social benefits for students for education	0,2	T2	increase in business fees	0,25
O3	more and more busy parents and lack of time - growing popularity of tutoring	0,2	T3	increase in advantage of the advantages of working full-time in another place over the difficulties of running your own business	0,15
O4	increase in requirements for teachers in schools - overloading with material resulting in limited time for processing a given material	0,15	T4	declining financial status preventing parents from paying for private lessons	0,2
O5	new skills - expanding competences and business development with new teaching subjects as part of self-improvement	0,15	T5	decreasing profitability – lack of possibility to raise prices to compensate for inflation and increase in costs	0,2

Source: own study.

3. Results and discussion

The results of the SWOT analysis are presented in Tables 2-5. In the first part of the study, analyzed links answer the following questions: whether a specific strength allows the use of a given opportunity (Table 2), whether a specific strength limits the threat (Table 3), whether a specific weakness limits the possibility of taking advantage of an opportunity (Table 4) and whether a specific weakness magnifies the threat (Table 5).

Table 2.
Dependence strengths/opportunities

S/O	O1	O2	O3	O4	O5	Weight	Number of interactions	Interaction weighted value	Rank
S1	1	1	1	1	1	<u>0,25</u>	5	1,25	1
S2	1	1	1	1	1	<u>0,2</u>	5	1	2
S3	1	0	1	1	0	<u>0,15</u>	3	0,45	5
S4	1	0	1	1	0	<u>0,2</u>	3	0,6	4
S5	1	1	1	1	0	<u>0,2</u>	4	0,8	3
Weight	0,3	<u>0,2</u>	<u>0,2</u>	<u>0,15</u>	<u>0,15</u>				
Number of interactions	5	3	5	5	2		40		
Interaction weighted value	1,5	0,6	1	0,75	0,3			8,25	
Rank	1	4	2	3	5				

Source: own study.

Table 3.
Dependence strengths/threats

S/T	T1	T2	T3	T4	T5	Weight	Number of interactions	Interaction weighted value	Rank
S1	1	0	0	0	1	<u>0,25</u>	2	0,5	1
S2	1	0	0	0	0	<u>0,2</u>	1	0,2	3
S3	1	0	0	0	0	<u>0,15</u>	1	0,15	5
S4	1	0	0	0	0	<u>0,2</u>	1	0,2	3
S5	1	0	0	1	0	<u>0,2</u>	2	0,4	2
Weight	<u>0,2</u>	<u>0,25</u>	<u>0,15</u>	<u>0,2</u>	<u>0,2</u>				
Number of interactions	5	0	0	1	1		14		
Interaction weighted value	1	0	0	0,2	0,2			2,85	
Rank	1	4	4	2	2				

Source: own study.

Table 4.
Dependence weaknesses/opportunities

W/O	O1	O2	O3	O4	O5	Weight	Number of interactions	Interaction weighted value	Rank
W1	1	1	1	1	1	<u>0,25</u>	5	1,25	1
W2	1	1	1	1	1	<u>0,15</u>	5	0,75	3
W3	0	0	0	0	0	<u>0,2</u>	0	0	5
W4	1	0	0	0	0	<u>0,15</u>	1	0,15	4
W5	1	1	1	1	1	<u>0,25</u>	5	1,25	1
Weight	0,3	<u>0,2</u>	<u>0,2</u>	<u>0,15</u>	<u>0,15</u>				
Number of interactions	4	3	3	3	3		32		
Interaction weighted value	1,2	0,6	0,6	0,45	0,45			6,7	
Rank	1	2	2	4	4				

Source: own study.

Table 5.
Dependence weaknesses/threats

W/T	T1	T2	T3	T4	T5	Weight	Number of interactions	Interaction weighted value	Rank
W1	1	0	0	0	0	<u>0,25</u>	1	0,25	5
W2	1	0	1	0	1	<u>0,15</u>	3	0,45	3
W3	1	0	1	0	1	<u>0,2</u>	3	0,6	2
W4	1	1	0	0	1	<u>0,15</u>	3	0,45	3
W5	1	1	0	0	1	<u>0,25</u>	3	0,75	1
Weight	<u>0,2</u>	<u>0,25</u>	<u>0,15</u>	<u>0,2</u>	<u>0,2</u>				
Number of interactions	5	2	2	0	4		26		
Interaction weighted value	1	0,5	0,3	0	0,8			5,1	
Rank	1	3	4	5	2				

Source: own study.

The table presenting dependence between strengths and opportunities shows worth noticing results. According to the number of interaction, the most important strengths are competences and knowledge transfer skills, the most important opportunities: growing students base, growing popularity of tutoring and overloading with school material. It should also be mentioned that there are as many as five maximum number of connections between factors that resulting in high total number of interaction (40), and high interaction weighted value (8,25).

These results indicate that the strengths will allow the use of opportunities emerging in the external environment on many levels.

The table containing the analysis of links between strengths and threats shows a low number of interactions (14) and interaction weighed value (2.85). The maximum number of links in one line is 2, also lines without the possibility of linking have been identified. This is due to the fact that most of the company's strengths relate to the person of the tutor, and the threats to the economic, mainly financial aspects of running a business. The T1 threat should be distinguished - increase in competition and saturation of the local market with tutors, which can be largely mitigated because each strength weakens it.

This means that threats from the external environment are located in other areas of activity and the strengths within companies allow them to be minimized to a very small extent.

The number of interactions between weaknesses and opportunities is relatively high (32), as is the weighted value (6.7) - slightly lower than in Table 2. This table is distinguished by extremes in interactions - a specific weakness either reduces the possibility of using all opportunities simultaneously, or does not affect any of them or one of them. Weaknesses that should be removed in the first place are: lack of recognition due to high competition, limited hours of service provision and price of services because most opportunities are related to customer growth, and these factors indicate why a potential customer may choose a competitive offer.

The table showing the relation between weaknesses and threats (Table 5) ranks third among the number (26) and the weighted value (5.1) of dependencies. This means that the weaknesses of the analyzed enterprise slightly increase the risk of potential threats to the company. Almost every weakness (except the first one - W1) affects the three identified threats. The weighted values also do not differ significantly from each other. This is not a table that contains critical information in the SWOT analysis.

Supplementary SWOT analysis - part of TOWS is included in Tables 6-9. They present an analysis of associations as part of the answers to the questions: does a given opportunity emphasize a strength (Table 6), does a threat weaken a strength (Table 7), does an opportunity reduce a weakness (Table 8) and does a threat develop a weakness (Table 9).

Table 6.
Dependence opportunities/strengths

O/S	S1	S2	S3	S4	S5	Weight	Number of interactions	Interaction weighted value	Rank
O1	0	1	1	0	1	<u>0,3</u>	3	0,9	1
O2	0	0	0	0	1	<u>0,2</u>	1	0,2	5
O3	0	1	1	0	1	<u>0,2</u>	3	0,6	2
O4	0	1	1	0	1	<u>0,15</u>	3	0,45	4
O5	1	1	1	0	1	<u>0,15</u>	4	0,6	2
Weight	<u>0,25</u>	<u>0,2</u>	<u>0,15</u>	<u>0,2</u>	<u>0,2</u>				
Number of interactions	1	4	4	0	5		26		
Interaction weighted value	0,25	0,8	0,6	0	1			5,4	
Rank	4	2	3	5	1				

Source: own study.

Table 7.
Dependence threats/strengths

T/S	S1	S2	S3	S4	S5	Weight	Number of interactions	Interaction weighted value	Rank
T1	0	1	1	0	1	<u>0,2</u>	3	0,6	2
T2	0	0	0	0	1	<u>0,25</u>	1	0,25	4
T3	0	0	0	0	1	<u>0,15</u>	1	0,15	5
T4	0	1	1	1	1	<u>0,2</u>	4	0,8	1
T5	0	0	0	1	1	<u>0,2</u>	2	0,4	3
Weight	<u>0,25</u>	<u>0,2</u>	<u>0,15</u>	<u>0,2</u>	<u>0,2</u>				
Number of interactions	0	2	2	2	5		22		
Interaction weighted value	0	0,4	0,3	0,4	1			4,3	
Rank	5	2	4	2	1				

Source: own study.

Table 8.
Dependence opportunities/weaknesses

O/W	W1	W2	W3	W4	W5	Weight	Number of interactions	Interaction weighted value	Rank
O1	1	0	1	1	1	<u>0,3</u>	4	1,2	1
O2	1	1	1	1	1	<u>0,2</u>	5	1	2
O3	1	1	1	1	1	<u>0,2</u>	5	1	2
O4	1	1	1	1	1	<u>0,15</u>	5	0,75	4
O5	1	1	1	0	1	<u>0,15</u>	4	0,6	5
Weight	<u>0,25</u>	<u>0,15</u>	<u>0,2</u>	<u>0,15</u>	<u>0,25</u>				
Number of interactions	5	4	5	4	5		46		
Interaction weighted value	1,25	0,6	1	0,6	1,25			9,25	
Rank	1	4	3	4	1				

Source: own study.

Table 9.
Dependence threats/weaknesses

T/W	W1	W2	W3	W4	W5	Weight	Number of interactions	Interaction weighted value	Rank
T1	1	1	1	0	0	<u>0,2</u>	3	0,6	1
T2	1	0	0	0	1	<u>0,25</u>	2	0,5	2
T3	1	0	1	1	0	<u>0,15</u>	3	0,45	3
T4	0	0	0	0	1	<u>0,2</u>	1	0,2	5
T5	1	0	0	0	1	<u>0,2</u>	2	0,4	4
Weight	<u>0,25</u>	<u>0,15</u>	<u>0,2</u>	<u>0,15</u>	<u>0,25</u>				
Number of interactions	4	1	2	1	3		22		
Interaction weighted value	1	0,15	0,4	0,15	0,75			4,6	
Rank	1	4	3	4	2				

Source: own study.

The analysis of the impact of opportunities to highlight strengths (Table 6) indicated a fairly high number of interactions (26) and a relatively high weighted value (5.4). It is worth noting that these figures are lower than in the case of the reverse analysis of the links between these two areas and lower than the relation between weaknesses and opportunities. Three strengths (S2, S3, S5 - knowledge transfer skills, knowledge of the core curriculum, base of current students and good opinions among parents) are relatively susceptible to the influence of opportunities, unlike the other two (S1, S4 - tutor competences and place and nature of activities), which cannot be strengthened with the use of potential opportunities.

The table showing the impact of threats on the weakening of strengths contains relatively lower numbers than the previous table. The number of identified interactions is 22, and the weighted value is 4.3. It is worth noting that the strong point S5 - the base of current students and good opinions among parents - is very susceptible to both opportunities and threats in the environment. This means that this strength is not stable in terms of the impact of the external environment, and as it relates directly to customers, it requires special attention.

The most interesting results are included in the table showing the relationship between opportunities and weaknesses. The highest number of interactions (46) and the highest weighted value (9.25) are presented there. This means that weaknesses are strongly susceptible to reduction by taking advantage of the opportunities that appear in the environment. The external environment is conducive to improving the internal conditions of the company.

Table 10 summarizes the SWOT-TOWS analysis is presented below.

Table 10.
Dependence threats/weaknesses

	Opportunities	Threats
Strengths	<i>Aggressive strategy</i>	<i>Conservative strategy</i>
	Number of interactions 66	Number of interactions 36
	Interaction weighed value 13,65	Interaction weighed value 7,15
Weaknesses	<i>Competitive strategy</i>	<i>Defensive strategy</i>
	Number of interactions 78	Number of interactions 48
	Interaction weighed value 15,95	Interaction weighed value 9,4

Source: own study.

The table shows that the analyzed company should follow the recommendations of the competitive strategy. The highest number of interactions (78) and the highest interaction weighed value (15,95) occur between opportunities and weaknesses, which definitely points to this strategy. According to the assumptions of the strategy, weaknesses should be reduced and opportunities should be exploited. This means that the internal environment of the company requires analysis and improvement, and the external environment is favorable for this business. The most important weaknesses are a multitude of advertisements for tutoring-competition, lack of recognition and relatively high prices of lessons which are at the same time the most susceptible to the influence of opportunities. The most important opportunity is growing student base through advertising and experience, the most ranked: growing student base through advertising and experience, introduction of new social benefits for students for education and growing popularity of tutoring. All opportunities are related to acquiring new customers.

4. Conclusions

The presented article analyzes the issue of quality management in a selected service company from the education industry using the SWOT-TOWS analysis. This analysis made it possible to indicate the general strategy of action - directions and main areas in which it is worth taking action in the field of quality management based on the conditions of the external and internal environment.

The SWOT analysis of the selected company indicated that activities in the field of GDP 85.59B - extracurricular form of education, including tutoring, in the current market conditions are in a favorable external environment. In this environment, significant and exploitable opportunities as well as relatively harmless threats have been identified. Due to the fact that the analyzed enterprise has been run for a short time, the internal aspects point to the advantage of weaknesses over strengths. Competences, knowledge and features of a tutor as the main core of strengths, thanks to the use of opportunities related to the acquisition and retention of new students, can reduce the strength of the price of classes and the disadvantages resulting from this type of activity, such as seasonality and time-limited opportunities to provide services.

To sum up, the analyzed company should focus in the near future on maintaining the highest possible level of quality of services provided - tutoring, which will allow to maintain prices considered relatively high without customer resignation and to regulate quite high fees related to running a business and thanks to recommendations, loyalty and good opinion among parents and students will help attract new customers. This confirms the theoretical assumptions of quality management, according to which in service enterprises quality is shaped mainly in the process of providing the service through the interaction of the client-employee-enterprise, and technical conditions are its additional factors. This article can be the basis for further research in the field of quality management in enterprises from the educational services industry and the basis for a more thorough quality analysis using the methods and tools in question for a deeper study of quality in a chosen enterprise.

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TOWARD GREEN SOCIAL ENTERPRISES: IDENTIFYING KEY AREAS OF GREENING AND FUTURE RESEARCH DIRECTIONS

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Purpose: The main aim of the article is to identify key areas of greening social enterprises. An additional aim is to identify future research directions related to green social enterprises.

Design/methodology/approach: To achieve the stated research aims, a review of the scientific literature collected in the Scopus database was conducted. 433 scientific articles from the period 2000-2022 were analyzed. The methods adopted were a structured literature review (with the original author's Q1 query) and a classic literature review (based on previously defined green areas).

Findings: The ongoing transformation of the current economy (the brown economy) to a green economy presents both opportunities and challenges for social enterprises. Social entrepreneurs must realize that to survive in the changing economic reality, social enterprises must embark on a green growth path. This, in turn, raises the organizational and financial dilemma of how to simultaneously pursue the assumed social goals and make the necessary green changes in an uninterrupted manner. The analysis carried out has shown that the implementation of the idea of sustainable development based on green changes at various levels of the functioning of social enterprises can contribute to their gradual greening.

Research limitations/implications: The considerations presented here were limited to the results obtained based on the analysis of the Scopus database. The results of the scientific analyses undertaken may provide guidance to researchers for further in-depth research on the issue of the greening of social enterprises.

Practical implications: The greening of social enterprises can be based on the greening of various areas related to the operation of such entities. This process, however, in social enterprises should not take place at the expense of the social services provided.

Originality/value: The article is a critical review of the literature. It identifies key areas of greening social enterprises. Future research directions in the field of green social enterprises are also outlined. The article is addressed to all those interested in the issues of social enterprises. The information contained in it can serve researchers in taking up the direction of research around the issue of green social enterprises.

Keywords: green economy, green labor market, green social enterprise, green transformation, sustainable development.

Category of the paper: Literature review.

1. Introduction

Nowadays, one can observe the process of greening the economy taking place at various levels of socio-economic life, which is called green transformation by researchers of the subject (Holt, 2011; Liang et al., 2020). This process is related to the implementation of the idea of sustainable development in socio-economic practice and involves a gradual shift away from the so-called "brown economy" (among other things, based on non-renewable energy sources - especially fossil fuels) and towards a green economy (among other things, based on renewable energy sources) (Kozar, 2019). It should be pointed out here that the green economy in its assumptions not only draws attention to the need to increase attention to the hitherto downplayed impact of economic activities undertaken on the state and quality of the environment, but also emphasizes the problem of social and professional exclusion (D'Amato et al., 2017). Green transformation is conditioned by numerous factors, among which we can mention, for example, cultural conditions, access to modern technologies for business entities, or the knowledge and environmental awareness of society. Hence, the process may occur at different speeds and scales in different countries and their administrative areas.

Changes aimed at green transformation can be observed on the example of any type of business entities that operate in the market. Individual business entities, however, may differ from each other in the pro-environmental solutions adopted and the scale on which they have been implemented. The issue of greening business entities, as the author of this article sees it, is most often discussed through the prism:

- implemented technical and technological solutions - discussing solutions aimed at minimizing an organization's carbon footprint (e.g. Lamptey et al., 2021; You et al., 2023), or green technologies (e.g. Fallah, Soori, 2023; Fernando et al., 2019; Mrkajic et al., 2019),
- products and/or services offered - distinguishing categories of green products (e.g. Borin et al., 2013; Chen, Wu, 2015; Du et al., 2018) and/or green services (Majid et al., 2020), as well as referring to the issue of green consumption (e.g. Ogiemwonyi, Jan, 2023; Pimonenko et al., 2020),
- jobs - creating green jobs (e.g. Kozar, Sulich, 2023a; Scully-Russ, 2015; Stanef-Puică et al., 2022), which are also called green collars by some researchers (e.g. Kozar, Sulich, 2023b; Vickers, Lyon, 2014),
- organizational management - including in the context of human resource management, where the issue of sustainable human resource management (e.g. Macke, Genari, 2019), or green human resource management (e.g. Mishra, 2017; Wang et al., 2023) is pointed out.

In the literature, the solutions indicated above aimed at greening the economy are referred to regardless of their type as sustainable, pro-environmental (e.g. Ansari et al., 2021; Aksen et al., 2012) or simply green practices (e.g. Sayfuddin, 2022; Yousaf, 2021). In addition,

it should be noted that in scientific studies relating to the greening of economic entities, there is also a special attention to the essence of this process in the context of efforts to green transformation of the economy (e.g. Ge et al., 2023; Niu et al., 2022).

The result of implementing green practices in various business entities is their gradual greening. The indicated greening process is observed by researchers at least on the example of the activities of social enterprises (Davies, Mullin, 2011; Jayawardhana et al., 2022; Withisuphakorn, 2017). These entities are a rather specific type of business entity, as their purpose of operation is primarily to achieve the set social goals, and not to maximize the profits made. From such a perspective, the greening of social enterprises becomes an important challenge for social entrepreneurs, as the process should not come at the expense of the social goals pursued by such entities. Nevertheless, some social enterprises manage to enter the path of sustainable development and carry out the process of greening, which is also noted by some researchers of the subject in their scientific considerations, distinguishing the category of green social enterprises (e.g. Descubes et al., 2018; Osti, 2012; van Gils, Horton, 2019). Such specific considerations, in the opinion of the author of this article, are one of the pillars of the green labor market.

In the scientific studies to date, one can see analyses aimed at presenting research areas related to the issue of the operation of social enterprises in the context of sustainable development (Gupta, Srivastava, 2021; Jayawardhana et al., 2022). These are mainly various bibliometric studies based on a structured literature review. Some of such studies use the VOSviewer program (e.g. Contreras, Abid, 2022; Salido-Andres et al., 2022; Schlosser, Volkova, 2022). Still lacking, however, this type of analysis aimed at identifying areas of greening of social enterprises. In the opinion of the author of this article, this may be a result of the fact that the issues discussed are relatively "new", and therefore still in a small number of scientific articles in the titles, abstracts, or keywords there is a direct reference to green issues (these elements are a key area of searches of scientific databases for the purpose of extracting data for further analysis in bibliometric studies). Hence, recognizing the indicated research gap, identification of key areas of greening of social enterprises was set as the aim of the article. These areas will be identified based on the literature review.

The article distinguishes four interrelated sections aimed at achieving the stated research objective. In the introduction, the relevance and timeliness of the research issue undertaken is presented, and the aim of the research is indicated. The second section, in turn, presents a description of the research methodology. Attention is paid here to the selected research methods. An important element of this section is also an indication of the various stages of the research, along with their location in time. The second-to-last section describes the obtained results of the qualitative analyses undertaken, along with a discussion. Future research directions related to the issue of green social enterprises are also outlined in this section. In turn, the last section contains summary.

2. Research methodology

To achieve the set research aim, a review of scientific literature collected in the Scopus database was conducted. The main rationale for choosing this database for the planned research is the fact that by the scientific community this database is considered a high-quality digital bibliometric platform (e.g. Haba et al., 2023; Kozar, Sulich, 2023c). The reliability of this database is due to the strict procedure for indexing individual scientific journals in it (getting into this database does not guarantee continuity of being in it - one must constantly meet strict scientific standards). Hence, the Scopus database is widely used in bibliometric analyses, including those aimed at presenting the issue of sustainable development in the context of the operation of social enterprises. The aspects indicated make it clear that the Scopus database adopted for the analyses should be considered a source of information of adequate quality. Nevertheless, it should be borne in mind that the indicated positive considerations for the choice of the Scopus database for the planned analyses may at the same time contribute to some kind of limitation of the proposed research. Thus, while the process of indexation to the Scopus database is aimed at ensuring high scientific standards of the scientific journals entering the database, at the same time a significant number of journals remain outside the indicated database for various reasons. Thus, the restriction to a specific database adopted in the analyses means that it cannot be ruled out that some of the scientific articles covering the research issue addressed were outside the scope of analysis.

The research procedure conducted consisted of three main research stages (Figure 1). Conceptualization of the study constituted the first stage of the research. During this stage, a review of scientific publications related to the issue of the operation of social enterprises in a sustainability-oriented economy was conducted. This review was aimed at identifying new areas of research on the issue at hand. As a result, a research gap was observed in the form of the need to identify key areas for the greening of social enterprises. To implement the research direction outlined in this way, a structured literature review (SLR) method was chosen, which allows for a synthetic and reproducible extraction of data related to the explored research problem. Hence, an authoritative research query was constructed to the Scopus database to generate scientific articles for further analysis.

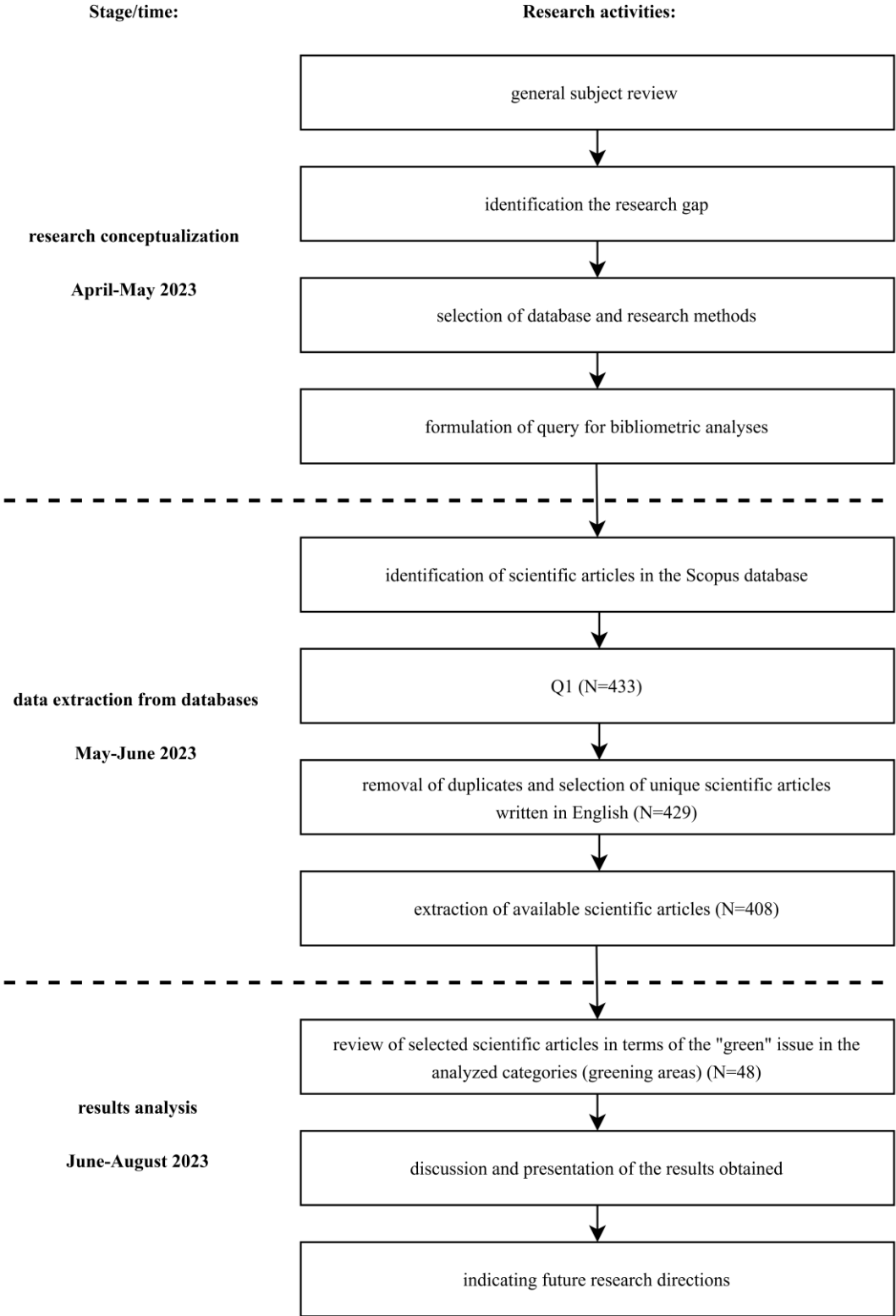


Figure 1. Research procedure stages and timeline.

Source: Authors' elaboration.

The second stage of the research involved data extraction. Based on the Q1 query (Table 1), the titles and abstracts of scientific articles indexed in the Scopus database were searched. Because the third stage of the research analyzed the content of entire scientific articles, it was assumed that only articles written in English would be taken. In addition, to ensure the possibility of repetition of the indicated analyses by other researchers and their future comparison, it was assumed that scientific articles must be indexed until 2022 (inclusive). The query allowed the initial selection of 433 scientific articles for further analysis. These studies were subjected to a preliminary evaluation procedure aimed at removing repetitive publications. Attention was also drawn here to the fact that three publications were incorrectly attributed to English-language articles (only in this language were the abstracts). Next, access to the full contents of scientific articles was verified. The content of 21 scientific articles was found to be unavailable, resulting in a final database of 408 scientific articles for further analysis.

Table 1.

Search queries syntax details

Database	Symbol	Query syntax	No. results
Scopus	Q1	TITLE-ABS ("social enterprise*") AND (sustainability OR "sustainable development" OR green) AND PUBYEAR > 1999 AND PUBYEAR < 2023 AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English"))	433

Source: Authors' elaboration.

The final stage of the research presented in Figure 1 was based on a classic literature review (CLR). It was assumed that articles would be searched for the occurrence of the term "green" in the context of the following 10 categories: products and services, production and industry, jobs and workplaces, consumption, innovations, technologies, management, marketing, supply chain, unfair practices (greenwashing). The indicated categories at the same time should be considered, in the opinion of the author of this article, key areas for the greening of social enterprises. In addition, the selected scientific articles verified whether a social enterprise implementing various types of green practices is sometimes called a green social enterprise.

3. Results and discussion

The analyses carried out indicate that the issue of a greener approach to business (Dixon, Clifford, 2007), or green entrepreneurship outright, is raised in the literature referring to the issue of the functioning of social enterprises (Marjerison et al., 2021; Rahdari et al., 2016). As a result, it can be noticed that some of the researchers directly address the issue of green social enterprises (Descubes et al., 2018; Osti, 2012) or green social entrepreneurship (Jayawardhana et al., 2022) in their deliberations. An important issue raised is the attempt to indicate the role of social enterprises in the transition to a green economy (Hillman et al., 2018). For example, Charles (2021) points out that social economy entrepreneurs play a pioneering role in responding creatively to environmental issues. In addition, it is important to note academic studies that draw attention to the issue of green niches in the context of social enterprise activities (Bretos et al., 2020; Vickers, Lyon, 2014). In some such focused studies, there is even a direct indication of social enterprises as pioneers of the green niche (Oliński, Mioduszewski, 2022).

Of the 408 scientific articles analyzed, 48 publications were assigned to at least one of the 10 analyzed areas of social enterprise greening. This attribution is shown in Table 2, where the original transcript of the identified 73 green words/phrases used by the authors of each scientific article is also indicated. In Table 2, for clarity, only the authors of each article are shown, not their full titles.

Table 2.

Assignment of scientific articles to explored categories and identified green words/phrases

Search category	Articles (authors)	Green words/phrases*
products and services	(Siqueira, Honig, 2019)	green product
	(Ketprapakorn, Kantabutra, 2019; Miemczyk et al., 2016)	green product development
	(Gumulya et al., 2022a, 2022b)	green product innovation
	(Holt, 2011)	green product lines
	(Ambati, 2019; Holt, 2011; Rowan, Casey, 2021; Salido-Andres et al., 2022; van Gils, Horton, 2019; Vohra, 2017; Wu et al., 2022)	green products
	(Rahdari et al., 2016)	green products and services
	(Holt, 2011)	green services
	(Bandyopadhyay, Ray, 2020)	greener products
	(Blancas, 2016)	products' green aspect
production and industry	(Descubes et al., 2018; Osti, 2012)	green production
	(Satar, 2022)	green production methods
	(Campos-Climent, Sanchis-Palacio, 2017)	green production processes
	(Gao et al., 2021)	green-production technologies
	(Rowan, Casey, 2021; Withisuphakorn, 2017)	green industry
	(Withisuphakorn, 2017)	green industry certification
	(Withisuphakorn, 2017)	green industry conceptual model
	(Withisuphakorn, 2017)	green industry promotion
	(Descubes et al., 2018)	green manufacturing
(Alonso-Martínez et al., 2020)	greening of industries	

Cont. table 2.

jobs and workplaces	(Descubes et al., 2018)	candidate's green attitude into account during the selection process
	(Wirawan et al., 2022)	create green employment opportunities
	(Bretos et al., 2020; Descubes et al., 2018; Gholami et al., 2018)	green collar army
	(Descubes et al., 2018)	green efforts as employees
	(Simatele, Dlamini, 2020)	green job creating projects
	(Smith-Nonini, 2016)	promote green job creation
	(Carberry et al., 2019; Colombo et al., 2019; Gelbmann, Hammerl, 2015; Smith-Nonini, 2016)	green jobs
	(Conway et al., 2019)	green skills development
	(Vickers, Lyon, 2014)	creation of 'green-collar' jobs
	(Vickers, Lyon, 2014)	green/sustainable job creation
consumption	(O'Neill et al., 2022)	green-friendly eco-innovative activities for new employment
	(Chang, Chuang, 2021)	consumers' green consumption
	(Gholami et al., 2018)	green behavior among consumers and businesses
	(Lane, Watson, 2012; Vickers, Lyon, 2014)	green consumerism
	(Alonso- Martínez et al., 2020; Lin et al., 2022)	green consumers
	(Alonso-Martínez et al., 2020)	green consumption
innovations	(Gröfke et al., 2021)	classify and communicate products' "greenness" to consumers
	(Alonso-Martínez et al., 2020; Colombo et al., 2019; Eichler, Schwarz, 2019; O'Neill et al., 2022; Rahdari et al., 2016; Rowan, Casey, 2021)	green innovation
	(Alonso-Martínez et al., 2020; Rowan, Casey, 2021)	green innovations
	(Rowan, Casey, 2021)	green-innovative projects
	(Gumulya et al., 2022a, 2022b)	green product innovation
	(Lambert et al., 2019)	green technological innovations
	(O'Neill et al., 2022)	green-friendly eco-innovative activities for new employment
	(O'Neill et al., 2022)	developing green-innovation
technologies	(Rowan, Casey, 2021)	innovative green research
	(Vickers, Lyon, 2014)	green or low carbon technologies
	(Eichler, Schwarz, 2019)	green revolution-based technologies
	(Lambert et al., 2019)	green technological innovations
	(Cavada et al., 2021; Ketprapakorn, Kantabutra, 2019)	green technologies
	(Cavada et al., 2021; Duncan-Horner et al., 2022; Holt, 2011; Rowan, Casey, 2021; van Gils, Horton, 2019)	green technology
	(O'Neill et al., 2022)	framework model for supporting new green technology development
	(Rowan, Casey, 2021)	developing potentially disruptive green technologies
	(Gao et al., 2021)	green-production technologies
	(Lambert et al., 2019)	incorporating new green technologies

Cont. table 2.

management	(Descubes et al., 2018)	green human resources management
	(Campos-Climent, Sanchis-Palacio, 2017; Descubes et al., 2018)	green management
	(Shah, Naghi Ganji, 2019)	green project management
	(Shah, Naghi Ganji, 2019)	green project management processes
	(Miemczyk et al., 2016)	green supply chain management
marketing	(Holt, 2011)	green (environmental) and social branding
	(Wu et al., 2022)	green brand
	(Wu et al., 2022)	build green brand relationship and green brand trust
	(Wu et al., 2022)	green brand benefit
	(van Gils, Horton, 2019)	invest in green brands
	(van Gils, Horton, 2019)	support green brands
supply chain	(Guo et al., 2022)	green industrial chain
	(Ketprapakorn, Kantabutra, 2019)	green supply chain
	(Miemczyk et al., 2016)	green supply chain management
	(Bandyopadhyay, Ray, 2020)	greener supply chain
	(Carberry et al., 2019)	greening of the supply chain
unfair practices (greenwashing)	(Wirawan et al., 2022)	green washing
	(Grimes et al., 2018)	greenwash monitoring
	(Bandyopadhyay, Ray, 2020; Bello-Bravo, Amoa-Mensa, 2019; Dahles et al., 2020; Gidron et al., 2021; Gröfke et al., 2021; Gumulya et al., 2022a; Opatrny-Yazell et al., 2021)	greenwashing
	(Miemczyk et al., 2016)	green-washing

* indicated green words/phrases appeared in the given articles in the indicated form, but it should be borne in mind that the authors may not be the authors of the indicated words/phrases (e.g., they are quoting an issue after someone).

Source: own elaboration based on (Alonso-Martínez et al., 2020; Ambati, 2019; Bandyopadhyay, Ray, 2020; Bello-Bravo, Amoa-Mensa, 2019; Blancas, 2016; Bretos et al., 2020; Campos-Climent, Sanchis-Palacio, 2017; Carberry et al., 2019; Cavada et al., 2021; Chang, Chuang, 2021; Colombo et al., 2019; Conway et al., 2019; Dahles et al., 2020; Descubes et al., 2018; Duncan-Horner et al., 2022; Eichler, Schwarz, 2019; Gao et al., 2021; Gelbmann, Hammerl, 2015; Gholami et al., 2018; Gidron et al., 2021; Grimes et al., 2018; Gröfke et al., 2021; Gumulya et al., 2022a, 2022b; Guo et al., 2022; Holt, 2011; Ketprapakorn, Kantabutra, 2019; Lambert et al., 2019; Lane, Watson, 2012; Lin et al., 2022; Miemczyk et al., 2016; O'Neill et al., 2022; Opatrny-Yazell et al., 2021; Osti, 2012; Rahdari et al., 2016; Rowan, Casey, 2021; Salido-Andres et al., 2022; Satar, 2022; Shah, Naghi Ganji, 2019; Simatele, Dlamini, 2020; Siqueira, Honig, 2019; Smith-Nonini, 2016; van Gils, Horton, 2019; Vickers, Lyon, 2014; Vohra, 2017; Wirawan et al., 2022; Withisuphakorn, 2017; Wu et al., 2022).

The greening of social enterprises, i.e., the process of gradually minimizing their negative impact on the environment, can take place at various levels of the functioning of this type of business entities and is a multidimensional aspect of closely interconnected areas, which is also indicated in Table 2. Nonetheless, social entrepreneurs in the face of the green transformation taking place in the economy face the dilemma of how to achieve their stated social goals and implement appropriate green solutions at the same time. This is because such solutions are, along with the increase in environmental awareness of consumers, increasingly demanded by them from business entities regardless of their type. At the same time, social enterprises, because they allocate their profit to the realization of social goals, do not have

adequate financial capital to implement green solutions. Hence, the greening of social enterprises should be looked at much more broadly than just through the prism of specific cases of social entities.

Researchers of the subject recognize that among consumers it is possible to distinguish a subgroup of consumers characterized by green behavior (Gholami et al., 2018). These types of consumers, in their consumer behavior, pay special attention to the conditions under which the product in question was created and whether it is green. Hence, the challenge on the part of social entrepreneurs managing greening or already green social enterprises becomes how to properly communicate the green features of the products and/or services they offer to potential consumers (Gröfke et al., 2021). At the same time, the information provided should not bear the marks of greenwashing, which, as an unfair practice towards consumers, is increasingly recognized in numerous scientific considerations (Bandyopadhyay, Ray, 2020; Bello-Bravo, Amoa-Mensa, 2019; Opatrny-Yazell et al., 2021). Greenwashing as an unfair business practice, in the opinion of the author of this article, in the long term can contribute to the inhibition of the development of a social enterprise, and even the loss of trust on the part of potential consumers, which may consequently impinge on the existence of this type of business entity. Thus, it should be seen that social entrepreneurs managing social enterprises in the process of their greening should pay special attention to consciously build their green market brand based on social relations and mutual trust (Wu et al., 2022). At the same time, the indicated process of building green brands by social enterprises and the green strategies adopted in this regard is still insufficiently studied. This area, combined with the issue of greenwashing, can be an important area of scientific considerations undertaken in the context of green social enterprises.

Social enterprises, like other business entities operating in the market, can green their operations either through the implementation of new green products and/or services, or the process of greening existing ones (e.g. Bandyopadhyay, Ray, 2020; Holt, 2011; Rahdari et al., 2016). The implementation of green products in a social enterprise's offerings is usually preceded by changes in the manufacturing process. Such changes are associated with the implementation of appropriate green production technologies (Gao et al., 2021), or as some researchers note low carbon technologies (Vickers, Lyon, 2014), and green production methods (Satar, 2022), leading to the greening of the production process (Campos-Climent, Sanchis-Palacio, 2017). A part of such solutions involves the implementation of various types of green innovations (Alonso-Martínez et al., 2020; Colombo et al., 2019; O'Neill et al., 2022) in the operation of social enterprises. At the same time, it should be noted that green solutions implemented in the production and delivery of products to the consumer gradually also contribute to the greening of the supply chain (Carberry et al., 2019). Hence, in the opinion of the author of this article, at least a change in the materials used to fill packages sent to customers to a more environmentally friendly substitute may already constitute an initiated process of greening a social enterprise based on building a green supply

chain. An interesting research thread, but one that is still not fathomed enough in the field of green products and services, is the issue of the continuous pushing of the boundary of the possibility of calling them green because of the technical and technological development, which allows the designation of new, more environmentally rigorous green features of products and services. This raises the question of whether social enterprises are ready and able to cope with such pro-environmental changes in production and services offered.

Implementing green solutions, as shown by scientific considerations from various types of business entities, requires an adequate workforce with the right level of green competencies (e.g. Kim, 2019; Mehrajunnisa et al., 2022; Stucki, Woerter, 2017). In this area, the literature discusses green knowledge (e.g. Abbas, Khan, 2022; Sahoo et al., 2023), green skills (e.g. Di Chiacchio et al., 2023; Paterson et al., 2022), green behavior (e.g. Dumont et al., 2017; Norton et al., 2014), green attitudes (e.g. Gadenne et al., 2009; Schaper, 2002), green abilities (e.g. Awan et al., 2023; Yadav & Mathew, 2023), green awareness (e.g. Cabral, Lochan Dhar, 2019; Khalil et al., 2022). In terms of the reviewed scientific articles, in the context of the issue of greening of social enterprises, the focus on the development of green skills (Conway et al., 2019), as well as the issue of green attitudes during the selection process of job candidates (Descubes et al., 2018) were noticed first of all. Thus, the author of this article recognizes that the issue of forming green competencies among employees of social enterprises is still little explored and can be an important area of research undertaken in the future.

Social enterprises, by embarking on the green path of their development, can be a place to create green jobs (Wirawan et al., 2022). In the scientific articles reviewed, the green jobs (Carberry et al., 2019; Gelbmann, Hammerl, 2015) are sometimes called green collar (Gholami et al., 2018; Vickers, Lyon, 2014) or sustainable jobs (Vickers, Lyon, 2014). The discussion on the naming of green jobs taking place on the pages of articles on the operation of social enterprises in the perspective of sustainable development does not deviate, however, from the general scientific discussion taking place in the indicated area (e.g. Kozar, 2019; Kozar, Sulich, 2023a). Nevertheless, it is interesting to note the view presented in some of the analyzed articles that some social enterprises may adopt a model of operation aimed at creating green jobs (Bretos et al., 2020; Gholami et al., 2018). Hence, one of the future directions of research in this area may be to target what portion of social enterprises adopt such a focused model of their functioning. In addition, there is still a lack of research within social enterprises aimed at finding out the scale of the phenomenon of greening their workforce, the degree of greening of green jobs (distinguishing the green nature of these jobs from one another), assessing the quality of green jobs, or demonstrating the directions for forming green competencies among those employed in green jobs. The indicated areas, in the opinion of the author of this article, will certainly become an area of future consideration given at least the scale of green words/phrases identified with this area, and that considerations of this type are already being studied in terms of other groups of business entities.

The green solutions being implemented require a completely different approach to organizational management, which is referred to in the literature as green management (Abbas, 2020; Bartolacci et al., 2020; Raharjo, 2019). This aspect is also discernible in some of the reviewed articles, in terms of which green words/phrases were identified. For example, Descubes et al. (2018) highlighted the issue of green management of human resources. Thus, an important research question in the context of future research should be whether and to what extent social entrepreneurs are prepared to manage green social enterprises.

4. Summary

Conducted based on the SLR and CLR methods, a review of scientific articles indexed in the Scopus database made it possible to identify key areas of social enterprise greening that are already being explored within the framework of scientific research undertaken by the research subject. Green words/phrases were identified within all ten areas analyzed. Different researchers cite greening in the context of social enterprises to varying degrees and extents. In addition, the triangulation of the research methods used made it possible to show the complexity of the issue of exploring green words/phrases appearing in the context of social enterprises.

The analyses undertaken and the discussion carried out show the multidimensionality of the research problem undertaken. At the same time, correlations can be drawn between the various green areas identified. They make it not an easy challenge for social entrepreneurs to enter the green path by such specific business entities as social enterprises. In addition to the challenges of implementing various green solutions for social enterprises, social entrepreneurs face the challenge of not succumbing to the unfair business practice of greenwashing. In the opinion of the author of this article, greenwashing applied to other business entities can, in the short term, take away potential customers from social enterprises undergoing greenwashing in a fair manner. Nevertheless, in the long term, not succumbing to this negative business phenomenon, in the opinion of the author of this article, can contribute to the stability of a given green social enterprise in the market.

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SUSTAINABLE CONSUMPTION AMONG CHILDREN IN THE ASPECT OF WASTE MANAGEMENT

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Purpose: The aim of the study was to identify consumption patterns among children. The article analyses the concept of sustainable consumption, focusing on children's consumption behaviour patterns in the field of sustainable waste management.

Design/methodology/approach: The paper uses a critical analysis of the literature and survey research based on a prepared questionnaire. The survey was conducted among 1326 children in age groups from 9 to 15 years old. The questionnaire consisted of two parts, i.e. the substantive part and the respondents' particulars. The first part of the questionnaire contained a set of questions concerning e.g. children's ability to identify products with better environmental parameters, behaviours related to nutrition, saving, shopping, spending free time, waste management and implementing pro-ecological solutions in their households.

Findings: The survey conducted among young consumers primarily pointed to the shortcomings of knowledge on waste segregation. Despite the fact that the vast majority declare that waste is collected selectively in their homes, they are unable to correctly indicate what type of waste should be thrown into the appropriate bins. Therefore, it is recommended that in each school, both primary and secondary, there are containers for selective waste collection, along with a description and instructions on what kind of waste should be placed in them. Undoubtedly, this will increase the ecological awareness of children and teach pro-ecological behaviour.

Practical implications: Modification of primary school curricula to a greater extent emphasizing content related to the principles of sustainable consumption in the area of rational waste management.

Social implications: Shaping sustainable consumption patterns among children by building awareness of appropriate behavior in the field of post-consumer waste management.

Originality/value: The article presents the current state of knowledge on consumption patterns among children in the area of waste management. This is a particularly important issue in the context of shaping sustainable consumption patterns among the surveyed group of market participants.

Keywords: sustainable consumption, food products, a child as a consumer, food market, ecolabelling.

Category of the paper: Research paper.

1. Introduction

Sustainable consumption is one of the current, significant problems present in both scientific and public discourse as well as in economic practice. It is an indispensable element of the implementation of the concept of sustainable development to the daily practice of functioning of consumers in the market. In the literature on the subject, it is defined e.g. “as market activity of consumers contributing to the generation of positive economic, social and environmental effects (the triad of sustainable effects) through the conscious and responsible purchase and consumption of goods and services” (Kazmierczak-Piwko et al., 2022). Creating it as a kind of “natural” habit requires a number of actions from an early age in the socialization system of young generations by providing them with models of sustainable market behaviour by providing knowledge, skills and competences in the area of choosing products with probably a better relationship with the environment, proper consumption and, what is very important, proper waste management. This is essential in times of their significant accumulation and the resulting problems. Waste management is regulated by many legal provisions and has a significant impact on the daily lives of citizens, among other things, by motivating them to segregate the waste they produce. Proper waste segregation is a very important element of waste management, as it allows achieving a high level of preparation for reuse or recycling. Waste sorting is nowadays a crucial and lively discussed issue, which is why it is worth analysing this problem, if only because of the goal of increasing public awareness of the principles of operation of sorting plants. Municipal waste is a growing problem, both ecological, regarding its negative impact on the environment, and economic, related to its collection, transport and disposal.

2. The importance of waste management in the implementation of sustainable development goals – discussion

Sustainable consumption understood as consumption in accordance with the principles of sustainable development is currently an important and topical topic of debate in public and scientific discourse. In the public discourse, the debate seems to be primarily about international cooperation in the field of legal instruments of influencing the market and issues related to

broadly understood environmental protection and respect for human rights. On the other hand, as noted by Schrader, U., Thøgersen, J., there is a debate on which of the factors, i.e. the context understood as the availability and attractiveness of alternatives, or perhaps individual values, attitudes and motives of consumers, are more important for changing their behavior towards those consistent with principles of sustainable development. These authors also draw attention to non-consumer factors related to direct and indirect government policy in this area, affecting the very context of consumption (Schrader, Thøgersen, 2011). On the other hand, sustainable consumption among children, which is addressed in this article, is becoming an increasingly important issue due to the perspective of a young group of consumers. Research in this area has been O'Neill, C., Buckley, J. (2019), paying attention to socio-structural factors and sustainable consumption at home, these authors, however, analyzed only children participating in the so-called green schools, i.e. units in which environmental issues are assumed to be more intensively emphasized compared to schools with "traditional programs" (O'Neill, Buckley, 2019). Donovan (2016) explored how children understand sustainable consumption through research on participatory activities and co-designing visual narratives (Donovan, 2016). Hadjichambis A.Ch. (2015) analyzed the effectiveness of an education program aimed at familiarizing children with the concept of sustainable consumption, focusing on environmental representations and decision-making (Hadjichambis et al., 2015). According to Phipps M. et al. (2013), a linear approach based on the VBN (Value-Belief-Norm) model, which conceptualizes behavior as a result of personal norms, developing from antecedent values and beliefs, contributed to the understanding of sustainable behavior. In this context, the impact of factors creating beliefs and values based on environmental education processes seems to be important (Phipps et al., 2013). In this context, it seems crucial to search for universal instruments for the implementation of promoting and shaping sustainable consumption based on a multifaceted impact, especially on young consumers, through environmental education shaping both the context as a result of building environmental awareness of future decision-makers and business managers and influencing the level of environmental awareness among future adult consumers products and services. In this context, international cooperation focusing on the unification of goals and methods of sustainable consumption on a global scale should be of key importance.

The modern world is facing increasing environmental challenges. Climate change, limited resources and the growing amount of waste make the idea of sustainable development more and more important. Sustainable development as a concept of global development is a doctrine of political economy that assumes the quality of life at the level, which is provided by the current civilization development (Gadomska-Lila, Wasilewicz, 2016). This concept is derived from "eco-development" and is defined as the ability to make responsible decisions regarding the use and allocation of resources to meet today's needs and ensure that the needs of future generations are met (Ozili, 2022). The first definition of sustainable development appeared in 1987 in the United Nations report (Brundtland Report), and the clarification of the concept at the Earth Summit in Rio de Janeiro in 1992 made it a description of the most appropriate economic and

social behaviour towards the environment. The idea was disseminated by adopting the principles contained in the “Global Action Program - Agenda 21” (Zakrzewska, 2019). Sustainable development is a multidimensional concept and refers to systems such as society, economy and environment. An important element of a sustainable system is also waste management. The European Union’s interest in these issues increased in the 1970s, and the reason for these considerations was, among the others, population growth, urbanization, industrialization and economic development generating increasing amounts of waste. These considerations quickly took the form of legal regulations in the form of Council Directive 75/442/EEC of 15 July 1975 on waste (Kostecka, Koc-Jurczyk, Garczyńska, 2016). The development of interest in the subject was also influenced by the newly emerging legal acts as well as educational programs that promote proper waste management. As the literature on the subject demonstrates, the production of municipal solid waste by 2050 may reach 2.6 billion tons per year, and the effects of inefficient management may cause a number of damages to public health (Okedu, Barghash, Nadabi, 2022). These damages can be divided into physical, biological, non-infectious and psychosocial health risks (Fadhullah et al., 2022). The accumulation of waste can also cause a number of environmental risks, such as groundwater pollution, air pollution and soil contamination. Waste is also a breeding ground for birds, rodents, insects and anaerobic microorganisms. Biochemical transformations that waste undergoes may affect the environment through such decomposition products as sulphides, carbon dioxide, methane, organic acids or aldehydes, which may result in intensification of global warming, acid rain or depletion of the ozone layer in the atmosphere (Kostecka, Koc-Jurczyk, Garczyńska, 2016). A conscious and responsible waste management strategy is therefore a key element of sustainable development.

In the light of the Waste Act, waste is “any substance or object which the holder disposes of, intends to dispose of or is obliged to dispose of” (Act of 14 December 2012 on waste). In the light of the directives implemented within the scope of the provisions of the Act and waste, the basic classification divides it into hazardous waste and non-hazardous waste. Hazardous waste is medical and veterinary waste, waste containing e.g. asbestos, mercury, cadmium or selenium, waste oils, electronic and electrical equipment, used batteries, batteries and plant protection products. Non-hazardous waste includes municipal waste, packaging waste and waste from industrial activity and its infrastructure (Act of 14 December 2012 on waste, Journal of Laws 2022.699).

The principles of sustainable municipal waste management in the European Union aim to reduce its negative impact on the environment and human health, and also ensure the improvement of resource efficiency. The waste management hierarchy was introduced in Directive 75/442/EEC and applies to all member states of the European Union (Figure 1). It recommends the desired sequence of actions in relation to waste management.

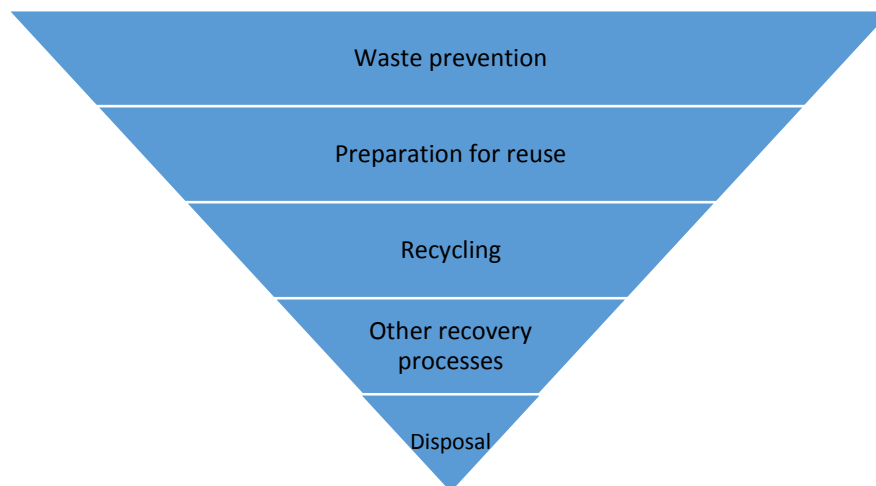


Figure 1. Waste management hierarchy.

Source: Council Directive of 15 July 1975 on waste (75/442/EEC), EU Journal of Laws of 25 July 1975.

The preferred, rational action is the action located higher in the hierarchy, i.e. waste prevention in the first place, then preparing for re-use, recycling, other recovery methods (e.g. energy recovery), and disposal is located at the very end. The long-term goal of modern and pro-ecological waste management is to transform societies into recycling societies that use waste as recovered resources and strive to reduce its amount (Widad et al., 2022). In the case of problems with accumulated waste, recycling becomes a key issue. According to the provisions of Polish legislation, i.e. the Act of 14 December 2012 on waste, recycling is understood as “recovery under which waste is reprocessed into products, materials or substances used for the original purpose or for other purposes; this includes the reprocessing of organic material (organic recycling) but does not include energy recovery and reprocessing into materials to be used as fuels or for earthworks”. As noted by Satpute, S.K., Płaza, G.A. and Banpurkar, A.G. “According to the analysis, recycling and incinerating the more than 2.5 billion tonnes of waste produced annually in Europe currently captures only about 5% of the original raw material value” (Satpute et al., 2017). The implementation of the principles presented in this chapter to everyday, habitual, sustainable behavior of young consumers requires systemic provision of knowledge about, among others, issues of waste management and its role in the sustainable development process. Undoubtedly, for this process to be effective, it should take place from the earliest years of school education. In this context, the work of Janusz Nowak (2017) is very interesting, the aim of which was, among others, to an attempt to assess to what extent issues related to sustainable development include the content of the core curriculum of general education. In his work, the author also indicated the tasks for teachers who are to conduct education, guided by the principles of sustainable development. Nowak noted that “Intensifying the pace of this development and its dissemination in society requires the creation of a new category of citizens - sustainable consumers and producers, for whom ecological and social goals are as important as economic goals. To achieve this, it is necessary to conduct an appropriate educational policy” (Nowak, 2017). Whereas P. Maddox, C. Doran,

I.D. Williams, M. Kus (2011) in their article examined the theory of intergenerational influence in relation to school education about waste (Maddox et al., 2011). A.R. Shaheen Hosany, Sameer Hosany, Hongwei He reviewed research on sustainable child behavior. Their important and current work synthesizes the core themes of sustainable child behavior into an organizational framework and offers implications for theory, policy, and practice. In their article, these authors recognized the importance and interplay of family and other socialization factors in shaping sustainable behavior (Hosany et al., 2022).

3. Research methodology

The main objective of the study was to identify patterns of behaviour among children, e.g. in the context of waste management, when the products they consume enter the “post-consumer” phase, becoming waste. In this aspect, the research process focused on factors related to the recycling process, such as determining the motivators influencing the decision to segregate waste as well as identifying the reasons for not segregating waste by the surveyed group of children.

The survey was conducted among 1,326 children from primary schools in the age groups from 9 to 15 years old. The questionnaire consisted of two parts, i.e. the substantive part and the respondents' particulars. The first part of the questionnaire contained a set of questions concerning e.g. children's ability to identify products with better environmental parameters, behaviours related to nutrition, saving, shopping, spending free time, waste management and implementing pro-ecological solutions in their households. The particulars sheet took into account such characteristics of the respondents as: gender, age, place of living. The question was open-ended, allowing the respondent to give a short answer. The developed questionnaire was tested on a sample of 35 people (respectively 5 in each age group), which allowed verifying the correctness of the questions and variants of the answers provided.

The surveys were random-stratified. The strata reflected the different age groups of the respondents (7 successive years of students). The selection of students was random. As a result of the conducted research, 1326 correctly completed questionnaires were obtained in the electronic version. With the adopted confidence level of 99% and the standard error of 5%, the minimum sample size is 622 respondents, which is much lower than the number obtained as a result of the undertaken process of their collection.

4. Findings

The respondents were asked to assign the types of waste to the appropriate colour of the container. 851 schoolchildren (64.2%) correctly identified the colours of the containers, 475 (35.8%) of the respondents incorrectly identified the colours of the containers assigned to individual waste groups. In table 1 schoolchildren's answers are presented depending on the colour of the waste container.

Pupils had the greatest difficulty in correctly marking the container for mixed waste, nearly half of the respondents (47.3%) incorrectly indicated the type of waste that should be placed in it. The least trouble was the identification of waste that should be collected in blue containers; 1,065 schoolchildren declared it a paper container. Table 1 shows the children's detailed answers and how the colours of the containers were assigned to the individual waste.

Table 1.

Identification of container colours by the surveyed group of young consumers [in%]

Container colour	Correctly identified	Incorrectly identified
Blue	80,3%	19,7%
Green	53,9%	46,1%
Brown	62,7%	37,3%
Black	52,7%	47,3%
Yellow	71,4%	28,6%
Total	64,%	35,8%

Source: own study based on conducted research.

Table 2.

Detailed identification of container colours by the surveyed group of young consumers [in%]

Waste type	Container colour				
	blue	green	brown	black	yellow
Paper	80,3	1,7	1,7	1,1	8,5
Glass	5,8	53,9	2,8	4,4	9,6
Plastic/metals	6,0	4,5	4,2	8,4	71,4
Organic waste	0,6	5,8	67,2	8,2	2,3
Mixed waste	0,7	29,1	12,0	52,7	1,9
I don't know	6,6	5,0	12,1	25,2	6,3

Source: own study based on conducted research.

In the survey, schoolchildren were asked to identify the main types of waste containers. It may be surprising that more than ¼ of the schoolchildren marked the answer "I don't know" with the waste that should be placed in the black container. The content of the blue container is for plastic and metals. Even more mistakes, because as many as 386 children incorrectly identified the purpose of the green container, indicating that it is a container for organic waste. In addition, the respondents were also asked whether they disposed of used batteries in special containers. 78.43% of respondents declared that they segregate batteries properly, and 21.56% replied that they did not use appropriate containers.

Striving to minimize the amount of waste and achieve a high level of its segregation is currently a serious challenge for every local community, also because it is in line with the postulates of intergenerational justice, considered to be the core of the idea of sustainable development in its modern understanding (Dacko, M., Dacko, A., 2018). Waste segregation is still a big problem for the possibility of selective waste collection. The awareness and knowledge of people in the field of caring for the natural environment is increasing. More and more people are convinced of the need to segregate their waste, but each of them could have been guided by other factors in making the decision.

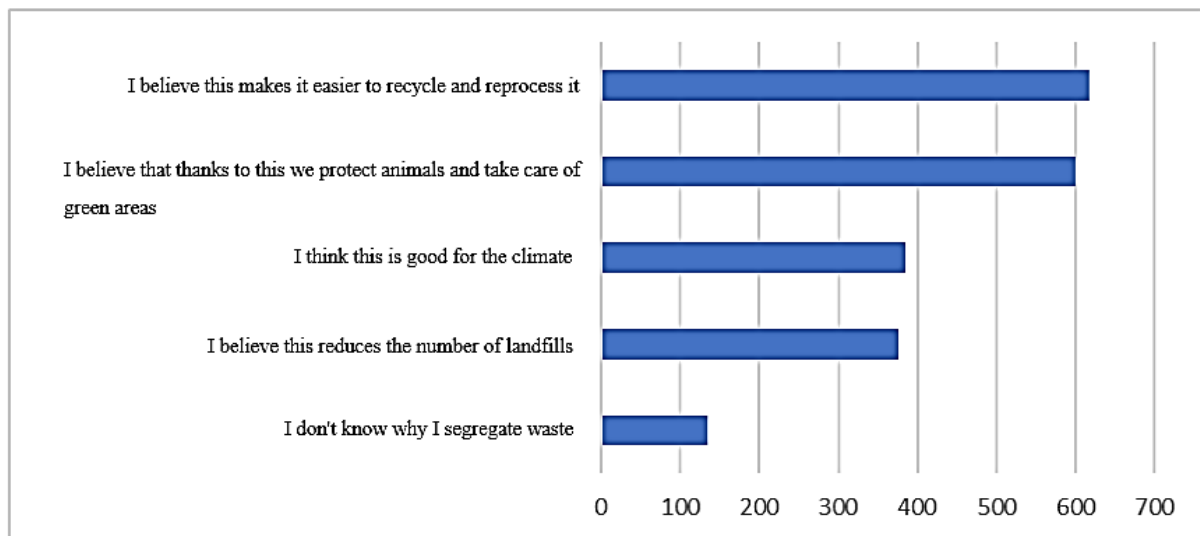


Figure 2. Declared factors affecting the decision on waste segregation by young consumers.

Source: own study based on research results.

Nearly 80% of schoolchildren declare that waste is sorted in their homes. The chart below shows the reasons behind them. Respondents could comment on why they segregate waste. It is encouraging that 617 schoolchildren, which constitutes 58.9% of all answers, claim that thanks to selective collection of waste, it is easier to recycle and reprocess the product. The next place was taken by the statement that “thanks to this, we protect animals and take care of green areas”, such an answer was given by 600 respondents (57.3%). Only 36.6% of children believe that selective waste collection can contribute to improving the climate. A lot of schoolchildren segregate waste in an “automatic” way – 134 children (12.8%) do not know why they segregate waste.

Not everyone declares that they segregate waste. When asked why they do not conduct selective waste collection, respondents most often emphasize that there are no containers for this purpose in the vicinity of their place of living (48%). Pupils’ lack of willingness to segregate waste is also motivated by the fact that they do not have time for it or lack of influence from the environment, because few people they know make such a selection. 11 people also indicated that they did not know how to properly segregate waste, which is confirmed by Tab. 1.2. on identifying the colours of the containers by schoolchildren.

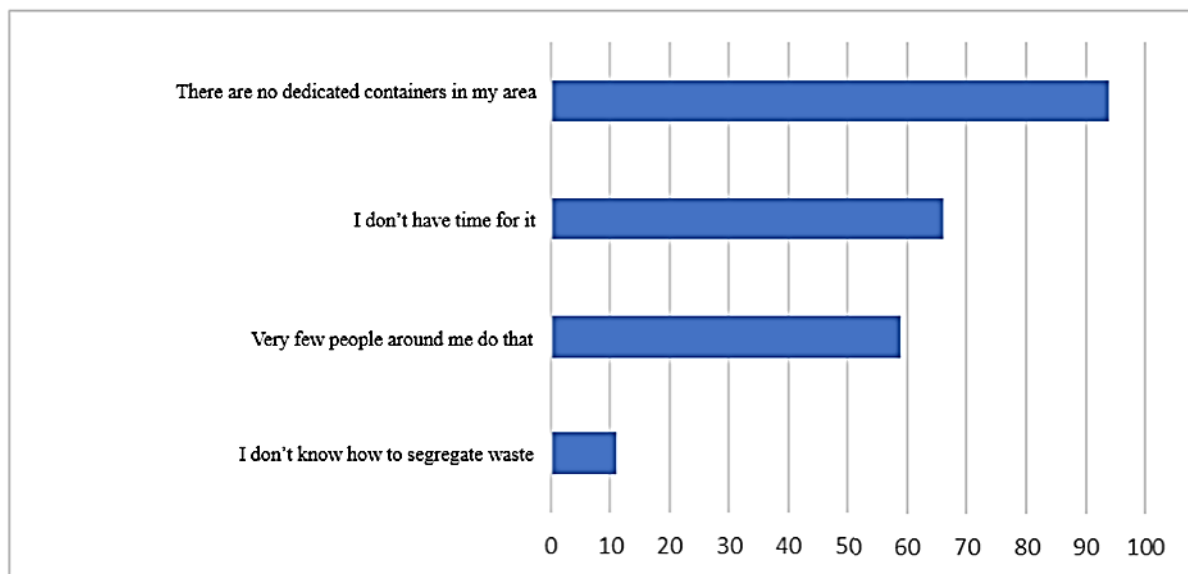


Figure 3. Declared factors affecting the decision not to segregate waste by young consumers.

Source: own study based on conducted research.

An important argument in favour of waste segregation is, obviously, environmental protection. Sorting waste and the subsequent recovery of various raw materials from it is an effective method to prevent the gradual overflow of landfills. Recycling also allows us to significantly reduce the consumption of various types of natural resources. Waste segregation is not only to protect the natural environment, but also a way to save money. The waste we produce every day is an excellent source of so-called secondary raw materials, i.e. those that can be reused. Packaging made of metal, glass, cardboard, plastics – all can be processed and obtain measurable economic and environmental profits.

5. Conclusion

Waste management is an important element of the contemporary environmental policy of each country. Poland, as a member of the European Union, is obliged not only to introduce its own waste management regulations, but also to comply with and implement community regulations, which are designed to ensure the balanced development of the natural economy. The multiplicity of changes, new obligations, imprecision in the law may cause problems in the proper implementation of the new requirements, and thus may have a negative impact on our environment. Moreover, the complexity of regulations may result in behaviour consisting in circumventing new obligations imposed by law. Therefore, it seems important for the state to rationally approach the issue of waste management and regulate these issues in such a way that they can be easily implemented and performed by the entities obliged to do so. The survey conducted among young consumers primarily pointed to the shortcomings of knowledge on

waste segregation. Despite the fact that the vast majority declare that waste is collected selectively in their homes, they are unable to correctly indicate what type of waste should be thrown into the appropriate bins. Therefore, it is recommended that in each school, both primary and secondary, there are containers for selective waste collection, along with a description and instructions on what kind of waste should be placed in them. Undoubtedly, this will increase the ecological awareness of children and teach pro-ecological behaviour. Furthermore, direct participation of children in waste segregation campaigns is also necessary to consolidate this primarily practical skill. Interestingly, there is also no progression with age in the knowledge of the analysed groups of children. This is a dangerous phenomenon demonstrating that changing requirements are not communicated or properly recorded and skills in this area are not extended. This requires the right approach in the process of educating this generation.

It is worth emphasizing that the problem of sustainable consumption among children and adults in terms of waste management cannot be solved at the national level alone, due to, among others, has cultural differences, financial possibilities of individual countries, different approaches to the organization of the education system and environmental protection. This is extremely important now, when the issue of waste migration is becoming one of the most important problems in the implementation of sustainable development principles to global economic practice. Undoubtedly, this issue requires and will require in-depth research and international cooperation in this field in the future.

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EMPLOYEES' JOB SATISFACTION AND ITS IMPACT ON MANAGEMENT PROCESSES AT THE KOMAG INSTITUTE OF MINING TECHNOLOGY

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Purpose: The article contains an analysis of inquiry results concerning the KOMAG employees' job satisfaction and its impact on management processes. As in recent years a management style and paradigm were mainly oriented onto improving the employees' motivation and commitment, it is important to highlight the significance of job satisfaction. Satisfied employees go beyond their formal duties, required by job description, and they are ready to put in an extra effort to achieve organizational goals. Based on available literature and on the results of conducted inquiry, the Authors concentrated their research work on human resources management in the aspect of motivation, leadership and organizational culture as well as their impact on job satisfaction and employees performance. The paper is ended with conclusions which can be treated as a form of guidelines for managers responsible for investments in building values and a maintenance of all the efficient activities oriented onto management processes of human resources.

Design/methodology/approach: The main objective of the undertaken research work includes a presentation of the KOMAG employees' job satisfaction survey, enabling to improve human resources management processes. A realization of research-and-cognitive objectives enabled to obtain knowledge concerning an important aspect of management activities. The main methods used for the research are as follows:

- an analysis of publications,
- a case-study method,
- a heuristic method,
- a method of diagnostic investigation (questionnaires).

The subject scope of the paper embraces human resources management, in particular in the aspect of employees' job satisfaction.

Findings: The findings show an urgent need of introducing management measures oriented onto an improvement of the KOMAG employees' level of job satisfaction, in particular in the area of appreciation needs. An introduction of the holocation system should be taken into consideration as it rejects a traditional model of a company and makes self-organizing collective bodies active and creative. It is worth highlighting that an encouragement of employees to undertake activities of innovative character and an appreciation of their achievements are equally important as risk assessment and budget management in projects.

Originality/value: An approach to the management process of human resources seems to be new due to highlighting the job satisfaction aspect. Some recommendation and guidelines, based on survey results, are also a sort of novelty as they emphasize the aspect of appreciation needs. A suggestion of implementing holocracy processes at the KOMAG Institute of Mining Technology confirms this new approach to managing human resources in an efficient manner.

Keywords: job satisfaction, management processes, motivation, institute, human resources, career paths, career perspectives.

Category of the paper: Case study.

1. Introduction

The KOMAG Institute of Mining Technology is a state-owned research organization which started its business activity more than seventy years ago. It has always been a sort of a bridge between science and industry, specializing in a commercialization of research results. Its scientists and researchers are the most valuable assets, so their job satisfaction is one of the strategic aspects of human resources management processes at the Institute.

The subject-matter of the article covers the results of surveys on job satisfaction of the KOMAG employees, enabling to improve human resources management processes and procedures. These results reflect the employees' most important needs and expectations in terms of job satisfaction. It should be highlighted that an approach to a scientific problem as well as research objectives and methods are based on an analysis of the Polish and foreign multi-disciplinary literature in the domain of participative decisions, motivation, leadership, organizational culture and also on the promotion of innovative, creative behaviour from the career perspective. In the subject-matter under consideration, some implications of Maslov's hierarchy of needs play a significant role and they should be taken into consideration while analyzing different aspects and criteria of employees' job satisfaction.

A holistic approach to the issue of job satisfaction is crucial. Some factors, affecting the relationship between leadership and job satisfaction, are described in detail in the following chapters of this article, where special attention is paid to a human resource management perspective and innovation – based human resource management influence on employees' satisfaction and performance. Self-evaluative and self-efficacy mechanisms, governing the motivational effects of goal systems and differences between personal and organizational value systems, are also taken into consideration. It should be highlighted that an encouragement of employees to undertake activities and an appreciation of their achievements are extremely important as regards efficient, effective and goal-oriented human resources management systems.

However, apart from traditional management models, which are widely used nowadays, a holocracy, rejecting typical procedures and processes, is suggested to be implemented in research institutions, where the employees of intellectual character constitute most valuable and important assets.

2. Analysis of the literature

In the last few years a new management style and paradigm were mainly oriented onto improving the employees' motivation, commitment and satisfaction through participatory management practices and more democratic organizational structures. According to the test results obtained by the Authors of (Balawajder, 1994), participative decisions positively influence job satisfaction directly and indirectly by means of employees' perception of trust.

It is worth highlighting the fact that quite often employees go beyond their formal duties, required by job description (Đorđević et al., 2021), and they are ready to put in an extra effort to achieve organizational goals. The Authors have based their conclusions on the analysis of 244 respondents from Serbia, stating that there is a positive relationship between respondents' job satisfaction and organizational citizenship behaviour.

Analyzing the available literature on the subject of effect of motivation, leadership and organizational culture on satisfaction and employees' performance, the Authors (Paais, Pattiruhu, 2020) concentrated their research work on human resources management. The test sample consisted by 155 employees and the results of data analysis showed that work motivation and organizational culture had a positive and significant effect on performance, but did not significantly influence employees' job satisfaction. While leadership seemed to have a substantial impact on employees' job satisfaction, it did not affect performance. An analysis of the issues related to employees' professional satisfaction and its impact on management processes requires some information about differential association theory (Johnson, 2020) which emphasizes how patterns of behaviour are learned through a process of interaction with different types of individuals with varying ideas about the acceptability of a particular course of action. The results of 61 in-depth interviews, conducted with commercial and noncommercial scientists at four universities in the United States, show that socialization to commercialism is an interactive learning process in which scientists learn definitions that are favourable to commercial career trajectories.

The promotion of innovative behaviour from the career perspective (Zhu et al., 2022) is analyzed from the point of view of job satisfaction, based on responses from a sample of 4007 scientific workers in China. The need for achievement serves as a moderator between career satisfaction and innovative behaviour. The influence of personal management systems on job crafting behaviours via motivation was tested using survey data gathered in Italy (Berdicchia, 2022). A development and validation of a scale to measure knowledge-sharing

motives at work are discussed in (Fischer, 2022). An understanding of the employee performance facilitates and understanding of job satisfaction, training and leadership connection (Rusli et al., 2020). A new perspective of the motivation-performance link and the influence of satisfying each basic human needs, described by Maslow's hierarchy of needs and on employees' professional performance is described in (Ştefan et al., 2020). It is interesting to find out if higher professional satisfaction translates into more ethical attitudes regarding work-related dilemmas (Małkowska et al., 2021). It should be borne in mind that professional, ethical issues are an integral part of decision-making processes at critical moments. Insights, related to ethical concerns when collecting and assessing evidence within decision making processes, are developed (de Graaf, 2019; Fobel, 2019). Survey data from 63 private sector organizations in Iran enable to analyze an implementation of human resource management practices (Nazarian et al., 2021). In Peru most organizations are actively competing to survive in troubled markets, especially today when the effects of COVID-19 caused a collapse of most businesses. Some of the essential tools for organizational success in the long and short terms continue to be motivation and job satisfaction (Moran, Corzo, 2021). There is a direct and positive relationship between the employee perception of development and intent to stay at the company and that job satisfaction mediates this relationship (Kasdorf, Kayaalp, 2022). In the literature there is some guidance to analyze the relationship between employee - oriented corporate social responsibility actions and employee retention in a business context (Boutmaghzoute, Moustaghfir, 2021). The development and application of innovation - driven human resources in the Nigerian aviation context encourage satisfaction with assigned task roles, leading to employee performance (Małkowska et al., 2021). A communication system of a bidirectional character plays an important role in management processes (Balawajder, 1994), which is shown in Fig. 1.

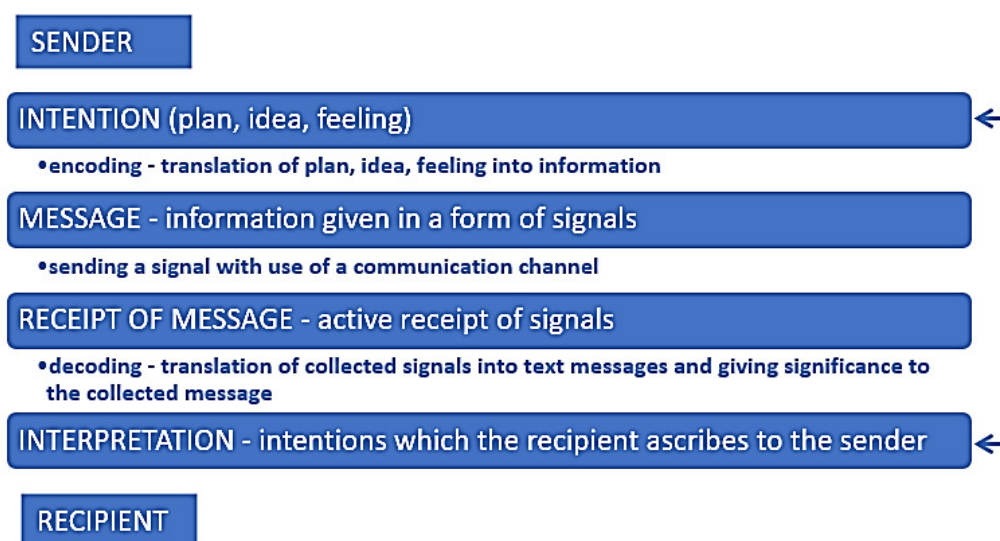


Figure 1. Communication scheme according to K. Balawajder (1994).

While drawing conclusions on social behaviour, it is important to take into consideration its role in an assessment of professional life quality and satisfaction. A good principle, concerning a control of employees' behaviour, includes an aim for a social justice. An interaction among employees can be broken if they do not get an expected satisfaction. It should be borne in mind that management of employees, oriented onto shaping abilities of creative thinking, which is particularly important in the case of research organizations, should be efficient irrespective of the situation (Grzesiuk et al., 1997).

A determination of institutional objectives and an information feedback from the employees have a strong impact on the level of motivation, what can be seen in Fig. 2.

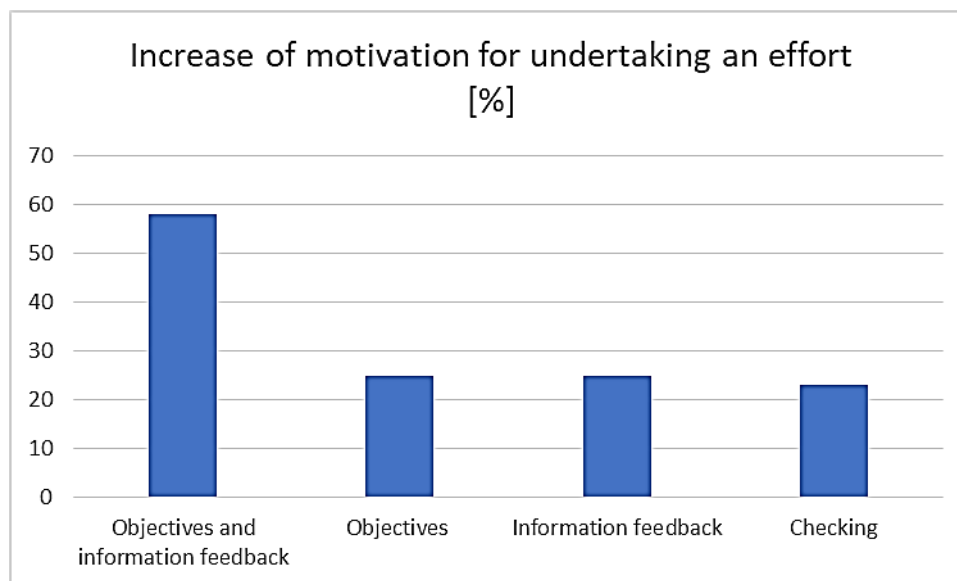


Figure 2. Increase of motivation for undertaking an effort (Bandura, Cervone, 1983).

3. Research objectives and methods

The main objective of the undertaken research work, described in this article, is a presentation of the KOMAG employees' job satisfaction survey, enabling to improve human resources management processes. A realization of research-and-cognitive objectives enabled to obtain knowledge concerning an important aspect of management activities. A utilitarian character of recommendations should be highlighted. The subject-matter of the article is limited to a research institute, but the Authors plan to conduct research at their industrial partners' as soon as possible.

The KOMAG scope of activity covers machinery and equipment for underground exploitation and mechanical preparation of minerals. The research-and-development projects are oriented onto anthropotechnical systems, smart mechatronic systems, interactive shaping of work environment, clean coal technologies ensuring ecological safety, just transition of

post-mining areas according to the recommendations of the European Green Deal strategy as well as a production of green energy, its storage and management. The reclamation of post-mining areas and the restoration of the post- industrial sites require a close collaboration among scientists, researchers, politicians, businessmen, representatives of local and regional authorities and of mining plants. A role of scientists and researchers in the just transition of post-mining areas should be highlighted. The KOMAG Institute of Mining Technology is an example of a successful transformation into the Institute of Green Transition 2030.

The research methods, used by the Authors, are as follows:

- an analysis of publications being a deepened literature studies on the subject-matter of job satisfaction and its impact on management processes; the literature analysis included Polish and foreign publications,
- a case-study method limited to a preparation of questionnaires for testing the KOMAG employees' job satisfaction level and to an analysis of the survey results,
- a heuristic method, enabling to detect new facts and relationships among them, was used for a rationalization of the selected solutions assuming the assessment criteria, searching for similarities and contradictions,
- a method of a diagnostic investigation (questionnaires) consisting in a preparation of questions as regards testing of the KOMAG employees' job satisfaction level; they form a consistent, logical set of items to be used for solving research problems, avoiding suggestions of responses and answers.

It should be borne in mind that the management processes at the KOMAG Institute include a motivating remuneration system of rewards and bonuses. These systems encourages employees to achieve the objectives of the Institute as well as their personal objectives. In Fig. 3 an accordance of institutional values with personal values is shown. According to the presented figures institutional values vary between 14.87 and 6.26 (high) and 4.90 and 6.12 (low) whereas personal values vary from 4.90 to 14.87 (high) and 6.12 to 6.26 (low).

Institutional values	High	14.87	6.26
	Low	4.90	6.12
		High	Low
		Personal values	

Figure 3. Accordance of institutional values with personal values (Posner, Schmidt, 1993).

As it has already been presented in the former chapter, the main objective of the undertaken research work, described in this article, is a presentation of the KOMAG employees' job satisfaction survey results.

4. Analysis of the KOMAG employees' satisfaction

In the case of research and scientific institute such as the KOMAG Institute of Mining Technology the most valuable assets include the intellectual capital. Even the best testing infrastructure or software will be useless without skilled creative personnel. There is no doubt that the KOMAG staff makes the assets useful due to their research and development projects. The human potential becomes a real challenge for the managing staff of research institutions, taking into consideration their limitations in the scope of requirement possibilities in comparison with universities and remuneration systems which in most cases cannot compete with industrial enterprises. Within the research project of improving management process at KOMAG, tests of employees' professional satisfaction were carried out based on the Maslow's Pyramid. A Model described among others in the "Motivation and personality" (katowice.eu/edukacja, 2023). The essence of this model consists in grouping human needs on five levels: psychological security, affiliation and love, appreciation and self-realization. The two first ones are regarded to be the basic needs of lower rank which condition a transfer to satisfying needs of higher ranks.

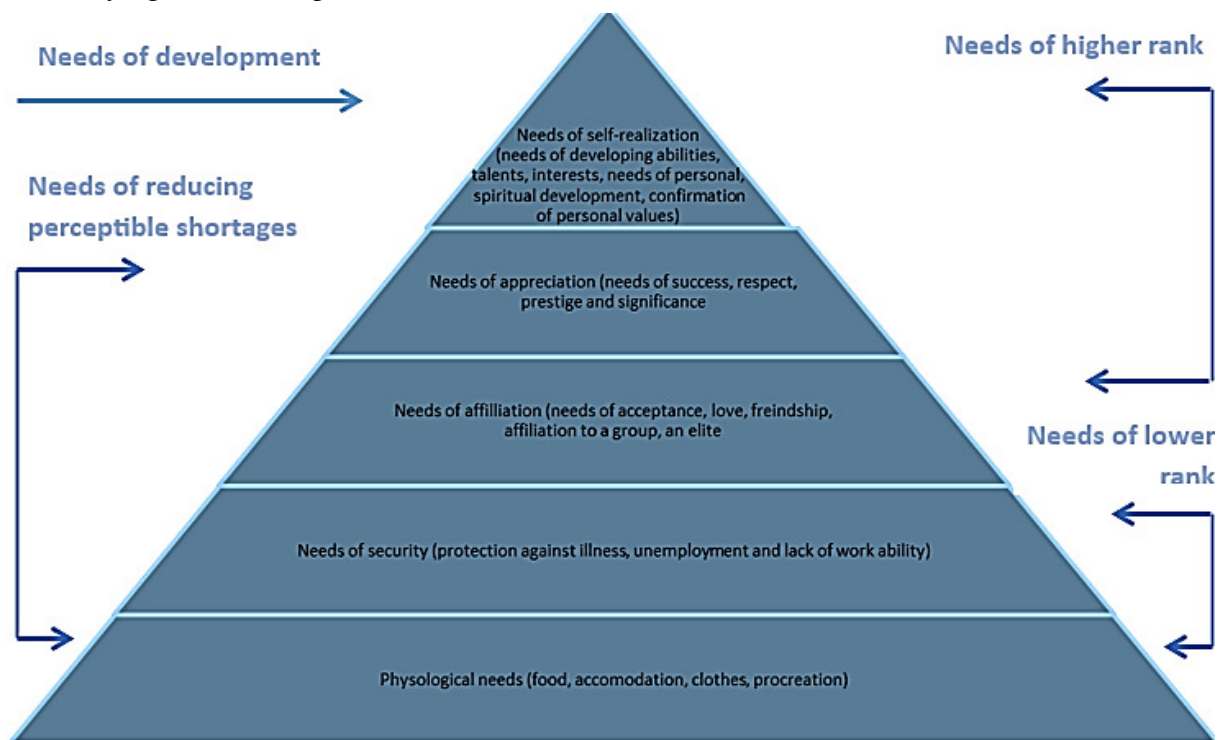


Figure 4. Pyramid of needs according to Abraham Maslow (katowice.eu/edukacja, 2023).

An employer's role is oriented onto a satisfaction of employees' needs if the efficiency of employees' work, due to an improvement of the satisfaction level, is to be achieved.

An important objective includes a reduction of costs required for getting and implementing new workers. The above mentioned activities are oriented onto strengthening the employer's position on the market which enables to maintain the best employees and to

attract most valuable new ones. In the case of the KOMAG Institute there is also a danger of losing specialists of very high qualifications in the mining branch of industry because there are fewer and fewer students who want to study mining at technical universities. Another issue concerns a reduced number of orders from the mining industry, as according to the European Green Deal coal should be replaced by renewable energy sources in the energy mix. A job satisfaction of employees seems to be a real challenge considering the circumstances described above. The questionnaire, enabling to test the KOMAG employees' level of satisfaction contained 36 questions. Seven questions were related to each level of A. Maslow's Pyramid of Needs and an additional question was on the plans of working for KOMAG in future. Besides, there were four questions of specification. The reaction of employees to a request of fulfilling the questionnaire was very positive. Altogether 111 employees presented their views. Allocating one point to opinions of firmly and negative character to assess a job satisfaction and five points to opinions firmly positive in the case of psychological, security, affiliation and self-realization needs an average assessment was very close and it varied between 3.47 and 3.70.

An assessment of appreciation differs significantly as it is on the level 2.85, i.e. slightly below the neutral level (Fig. 5).

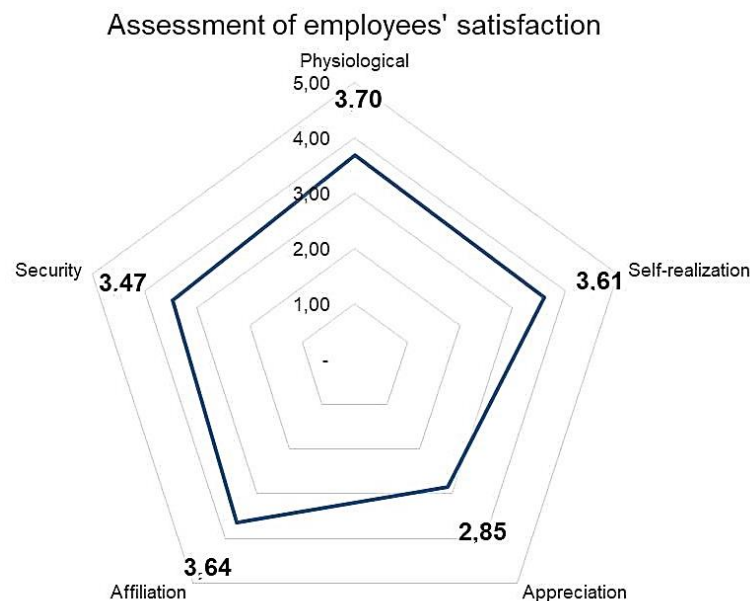


Figure 5. Assessment of employees' satisfaction – results of tests conducted at KOMAG in 2022.

The survey results reflect the KOMAG employees major needs and expectations as far as their job satisfaction is concerned. At present different management measures are taken into consideration to improve the situation.

5. Detailed results of employees' job satisfaction tests

The Figures 6-14 present the survey results in a graphical form.

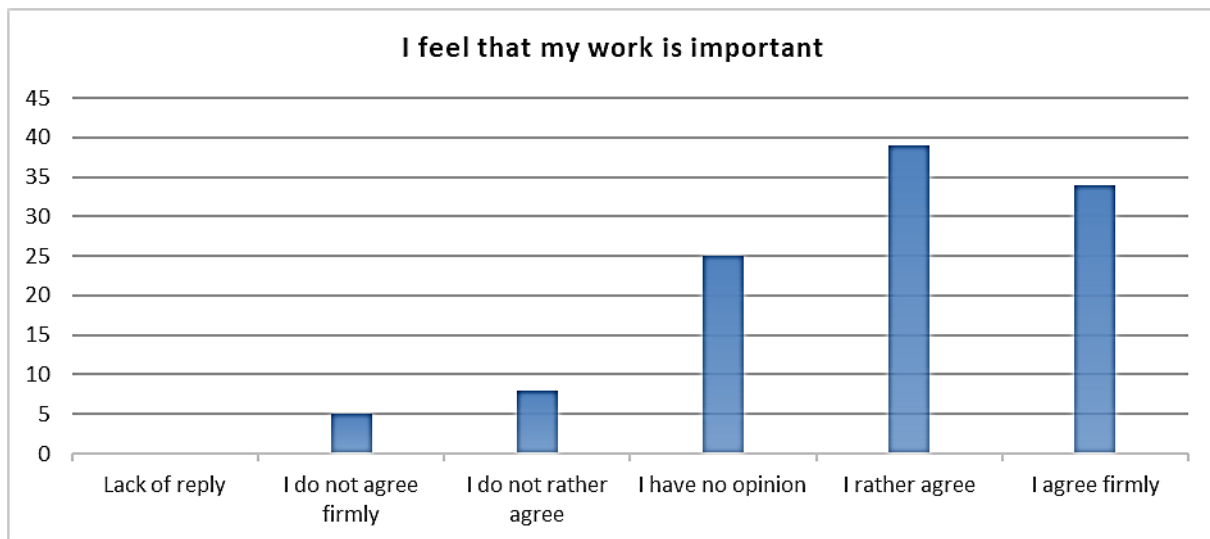


Figure 6. I feel that my work is important – test results.

It should be highlighted that 73 respondents gave positive responses and 13 of them disagreed. It should be investigated why such a big number of employees - 25 did not want to present their opinion at all.

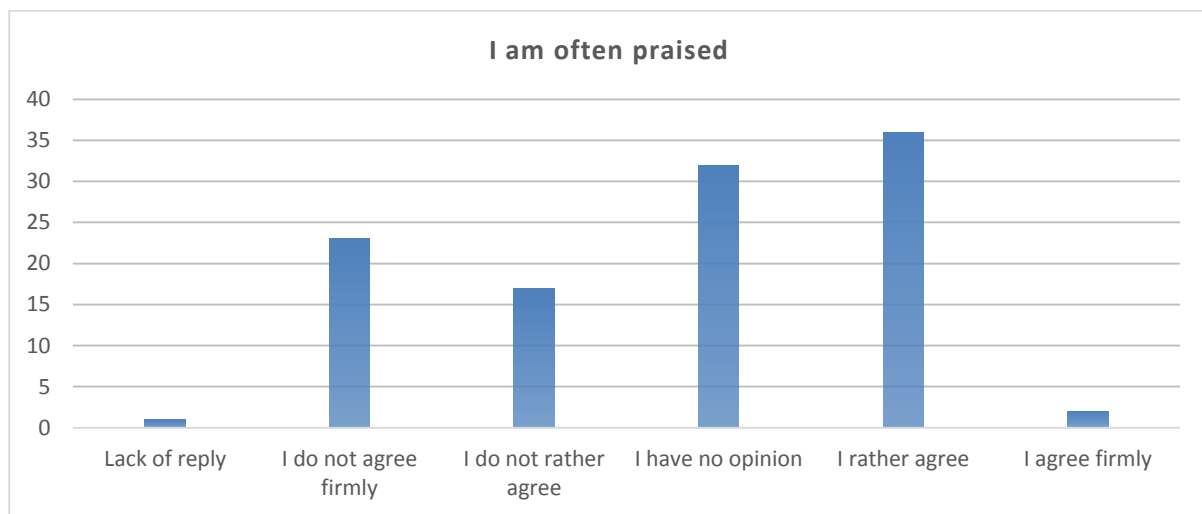


Figure 7. I am often praised – test result.

It is worth presenting the fact that only 36 employees rather agreed giving a positive opinion whereas 72 disagreed or had no opinion, which reflects a negative comment.

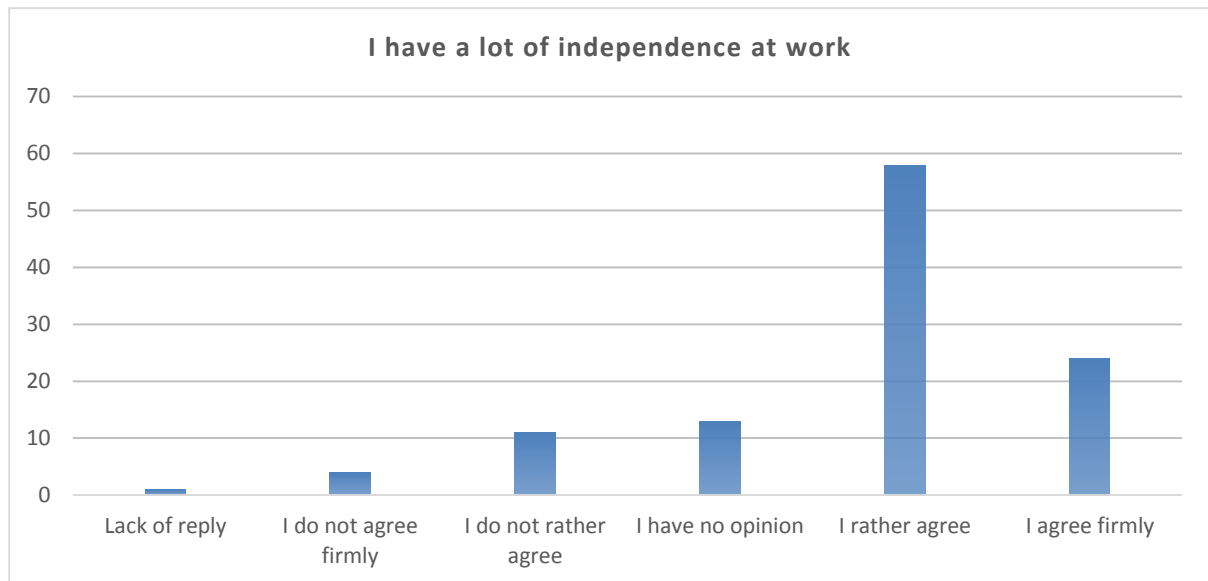


Figure 8. I have a lot of independence at work – test results.

In this case the majority of respondents - 81 employees expressed positive opinions which confirmed the fact that creative researchers, oriented onto a generation of innovative ideas at KOMAG, appreciated their independence.

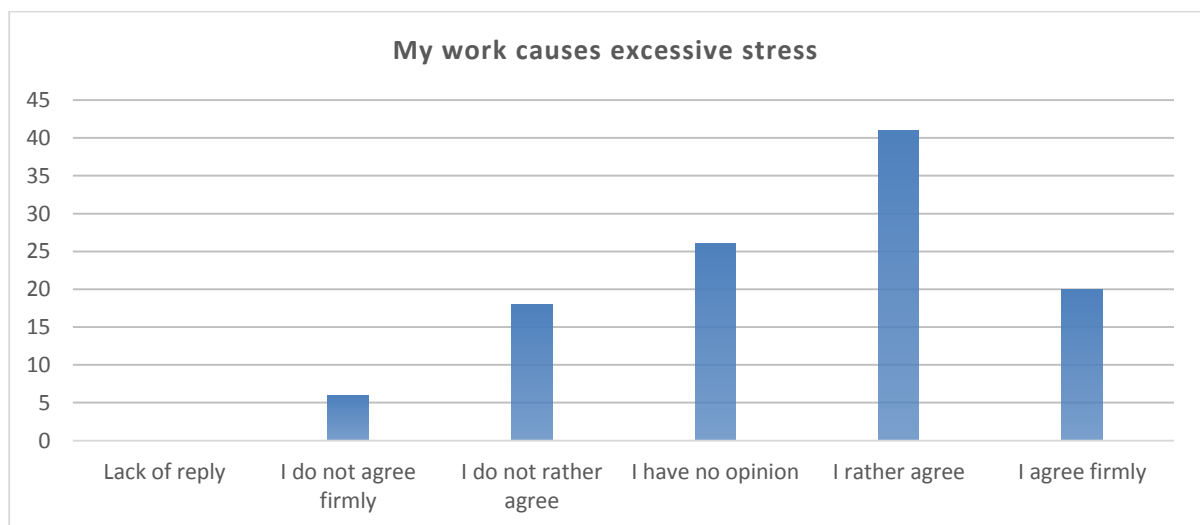


Figure 9. My work causes excessive stress – test results.

The majority of respondents - 60 persons have confirmed the fact that their work causes excessive stress, however 24 persons expressed their negative views in this case.

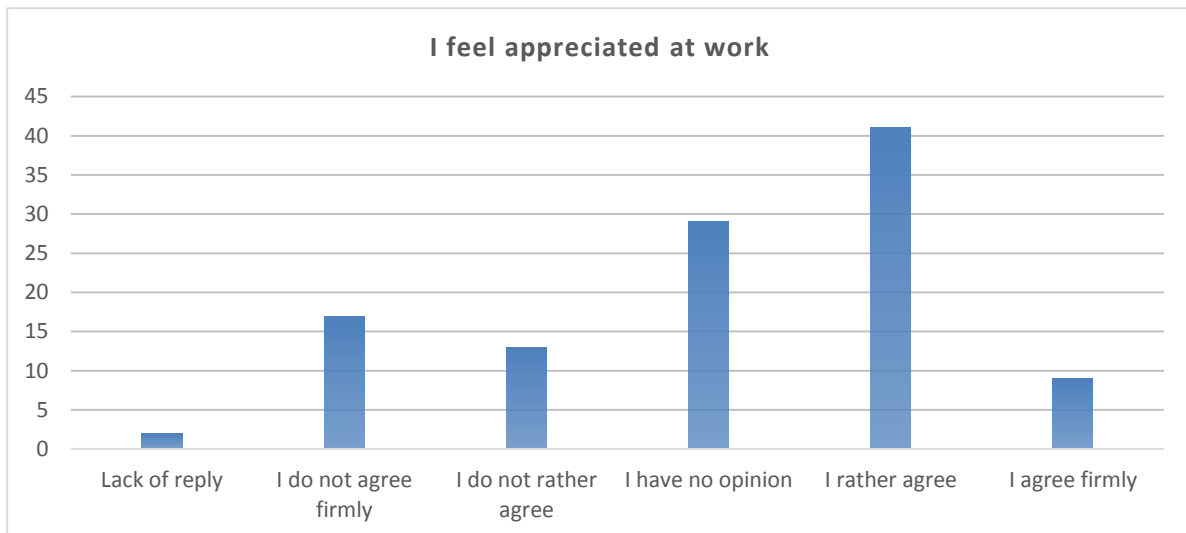


Figure 10. I feel appreciated at work – test results.

From the conducted test it can be concluded that 50 persons feel appreciated at work, but it is surprising that 31 employees did not give any opinion at all, so the Authors think that they should be included into the group of employees who are not appreciated and their number in total reaches 61 persons.

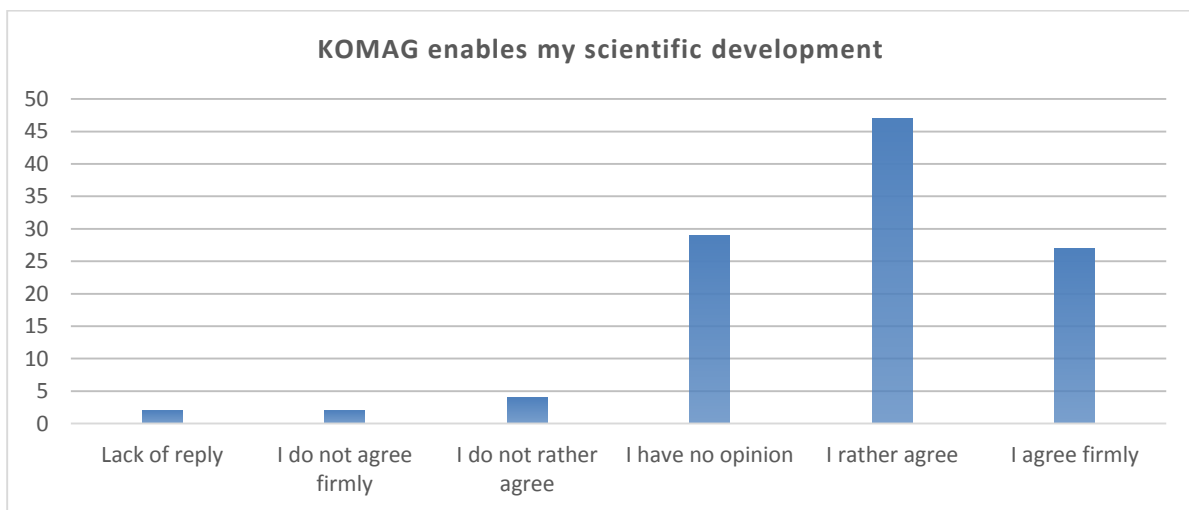


Figure 11. KOMAG enables my scientific development – test results.

The opinion on this item seems to be really important in the case of a research institute such as KOMAG, so it is worth highlighting that 74 persons have confirmed the fact that KOMAG enables a development of scientific careers and only 6 persons disagreed with that.

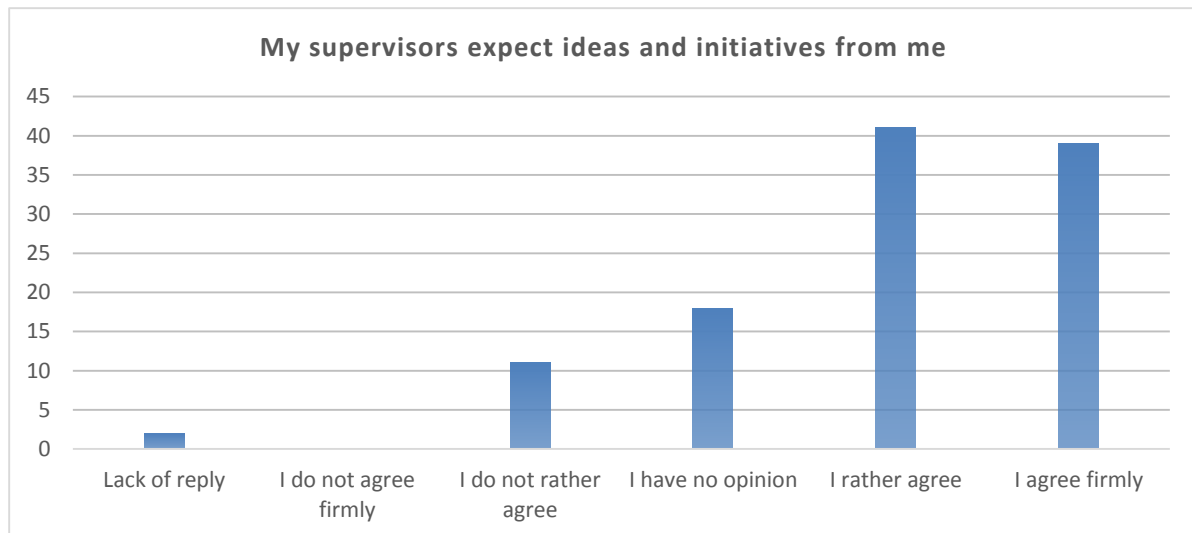


Figure 12. My supervisors expect ideas and initiatives from me – test results.

In this case 80 persons gave a positive reply and only 11 employees responded in a negative way.

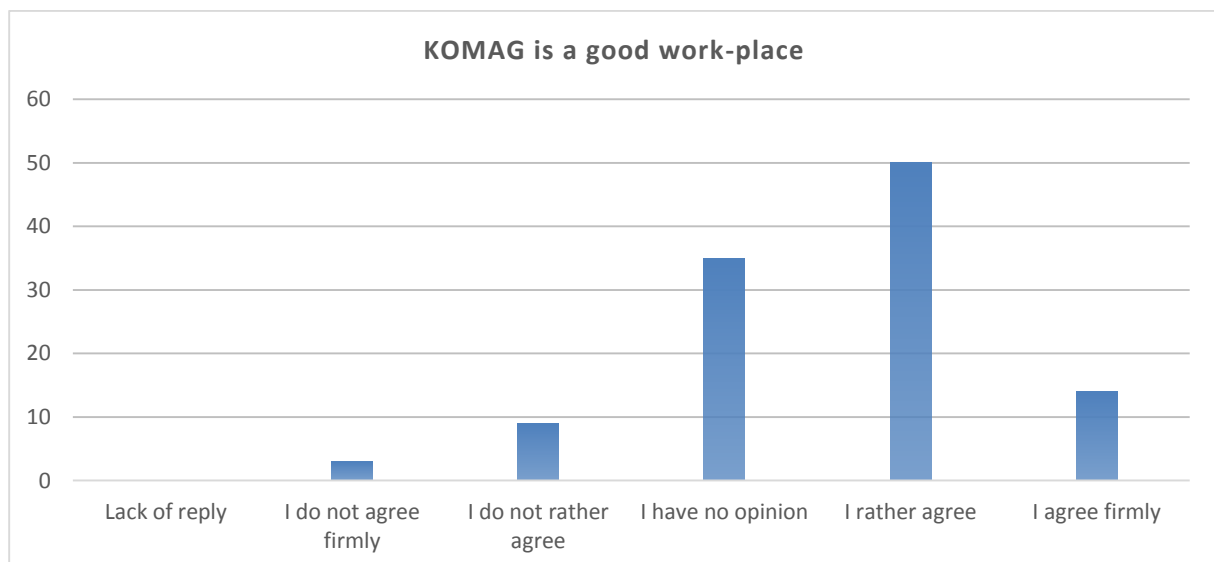


Figure 13. KOMAG is a good work-place – test results.

It is important to highlight the fact that 62 persons have positive opinions, i.e. I agree firmly and I rather agree, and in the case of the Item: “My work is interesting and gives me a lot of satisfaction” 81 persons gave positive opinions, as it is shown in Fig. 13.

Taking into consideration the questionnaire results presented above, it is surprising to find out that only 36 employees would recommend an employment at KOMAG to relatives or friends as it is presented in Fig. 14.

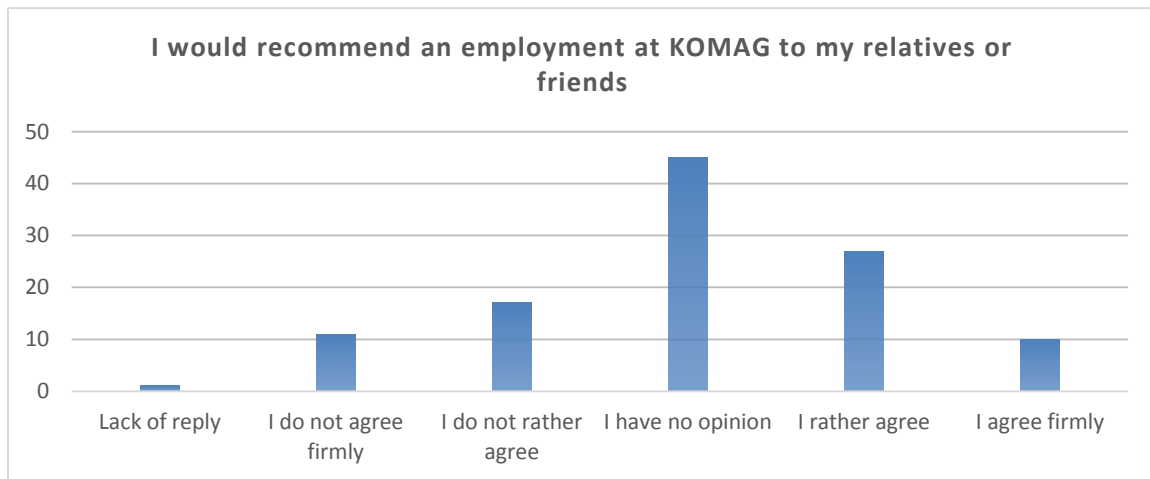


Figure 14. I would recommend an employment at KOMAG to my relatives or friends – test results.

Summing up the test results, it should be mentioned that it lacked responses in the case of many items which is rather difficult to explain because a participation in the questionnaire survey was anonymous. In some cases it lacked replies of 49 respondents, although all the items were formulated in a clear, undoubtful way. It may be interesting from the scientific point of view to analyze the respondents' age groups (Fig. 15), their work-places at KOMAG (Fig. 16), and their positions (Fig. 17) as well as their employment periods (Fig. 18).

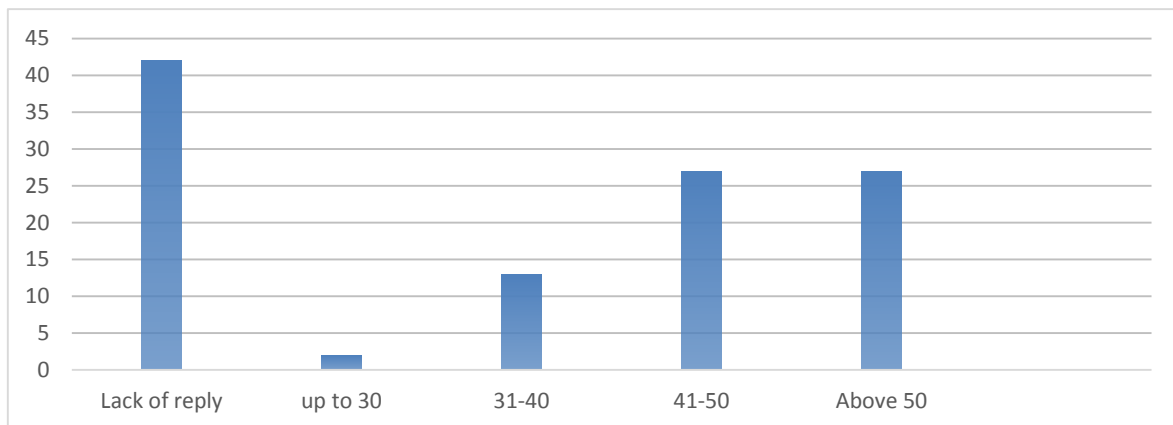


Figure 15. Analysis of the respondents' age groups.

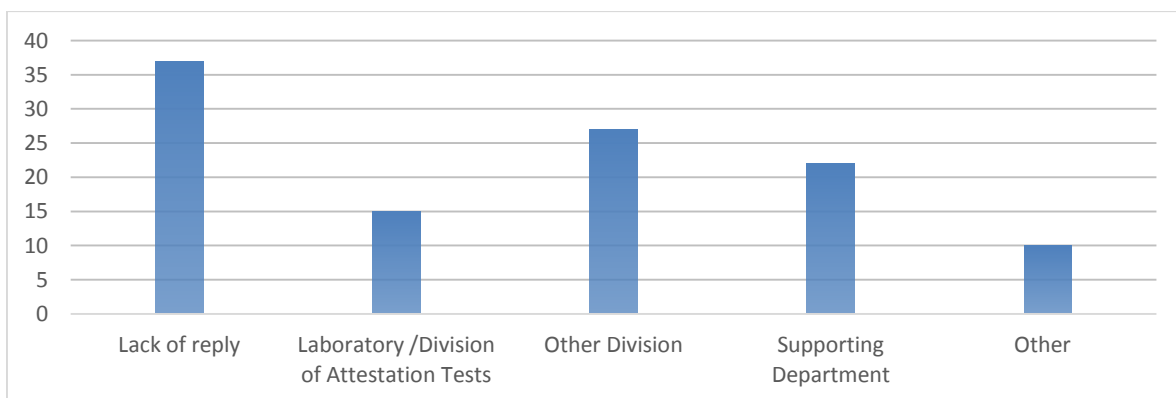


Figure 16. Analysis of employees' work-places at KOMAG.

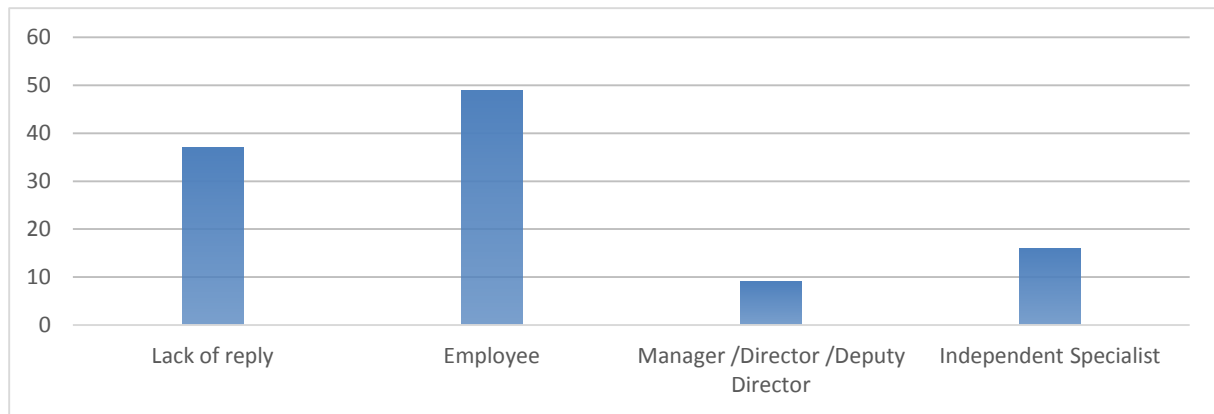


Figure 17. Analysis of employees' positions at KOMAG.

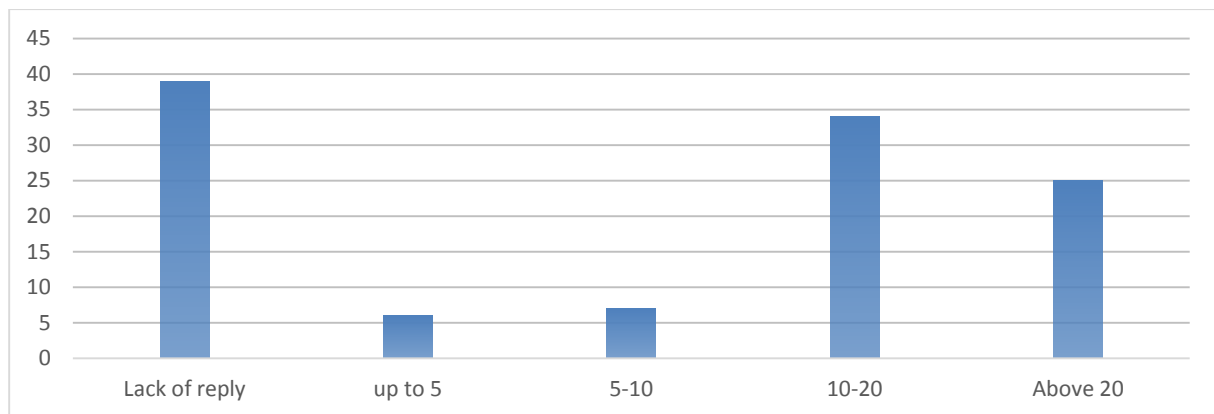


Figure 18. Analysis of KOMAG workers' employment periods.

An analysis of the respondents' age groups shows that it lacked responses from 41 of them, there were 28 persons in the age group: 41-50 years old and the same number in the age group above 50 years old. Only one person was younger than 30 and 12 employees were in the age group 31-40 years old.

As regards the work-places at KOMAG, it lacked responses from 36 employees, 15 persons represented laboratories and Division of Attestation Tests, 26 - another division, 21 - supporting department and 10 of them - other divisions and departments.

Analyzing the positions, it is easy to see that it lacked 39 replies, 49 respondents were classified as employees, 9 - as managers, director, deputy director and 18 - as independent specialists.

An analysis of the employment period showed that it lacked 39 replies, 32 persons have been employed for the period 10-20 years, 22 - for more than 20 years, 8 - for the period 5-10 years and 3- for the period up to 5 years.

The test results reflect an urgent need of improving the appreciation area. At the KOMAG Institute of Mining Technology, where intellectual work results are generated, the main and most valuable assets are its employees who require investments in the chain of values to maintain the economic efficiency of the organization and to guarantee a correct management of human resources.

6. Conclusions

The obtained results show a necessity of introducing management measures oriented onto an improvement of the KOMAG employees' level of job satisfaction, in particular in the area of appreciation needs. It is worth following the example of IT companies which make ordinary project team members active and creative in the result of decentralizing decision processes and introducing holocracy processes, at the beginning of the XXI century. Holocracy is a system which rejects a traditional model of a company. It eliminates bosses, managers and workers forming a flat structure, created by a jointly responsible collective body. This model becomes more and more popular, especially in the IT sector. In this case the management determines only general directions of activity, whereas self-organizing collective bodies present their initiatives. An encouragement of employees to undertake activities and an appreciation of their achievements are equally important as risk assessment and budget management in projects. It should be highlighted that in the case of each scientific and research institution, it is indispensable to take care of creating, maintaining and developing the potential which is based on:

- developed and gathered knowledge (know-how, test results, publications, technical documentations),
- intellectual assets (independent scientists and researchers, young scientific personnel, qualified technical personnel),
- state-of-the-art testing infrastructure,
- possibilities of getting financial means for covering costs of research-and-development projects,
- network of collaboration,
- market position and renown,
- organizational efficiency.

Undoubtedly the sphere of appreciation needs should be improved at the KOMAG Institute of Mining Technology first of all. The employees of intellectual character are the most important assets and they require an investment in building values and a maintenance of all the efficient activities oriented onto management processes of human resources.

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EXPERTS' PERCEPTIONS OF THE ORGANISATION'S STAKEHOLDERS – SEMANTIC FIELD ANALYSIS

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Purpose: The purpose of this article is to identify experts' perception of stakeholders.

Design/methodology/approach: The research methodology involved conducting focus group interviews in a remote format. The obtained material was transcribed and interpreted through the prism of semantic field analysis.

Findings: The approach used made it possible to depict perceptions of stakeholders among the research participants.

Research limitations/implications: The article contains a preliminary study. In the future it is planned to conduct additional quantitative and qualitative research also at international level.

Practical implications: The conclusions proposed as an outcome of this research can have an impact on the formulation of a strategy aiming at managing relations with the organisation's stakeholders.

Social implications: The article demonstrates the opinions of experts representing a variety of organisations and sectors.

Originality/value: For the purpose of the research, a purpose-built methodology was developed to obtain the answers to the research questions. On-line interviews were conducted in line with the authors' research design.

Keywords: stakeholder theory, qualitative research, semantic field analysis, expert interviews, co-management

Category of the paper: The article presents the results of the authors' own research.

1. Introduction

Stakeholder theory sits within the key research areas in the social sciences (Nartney et al., 2023). The theory focuses on aspects related to organisational activities determining the direction which an organisation is taking (Bonnafeous-Boucher, Rendtorff, 2016; Moroz et al., 2021). The concept also addresses the expectations of stakeholders, with whom relationships are built at various levels. Taking into account the perspective of stakeholders in the process of creating an organisation's strategy indicates that its activities are carried out in a socially responsible manner, as well as the decisions made lead to balance the interests of various social groups. In business management, stakeholder theory encourages the involvement of external stakeholders already at the stage of creating and consolidating strategic activities (Kaplan, Norton, 1992). A problem that emerges straightaway is the diversity of expectations of stakeholders representing different sectors and social groups. Heterogeneity and hierarchical nature of the actors can hinder the relationship between stakeholders. However, if these relationships are properly managed, harmonized, and aligned with common needs, shared added value is produced. The issues outlined above indicate that the stakeholders and their involvement in organisations is complex but important and worth being investigated from the point of view of the social sciences.

The purpose of the article is to identify experts' perceptions of stakeholders and their involvement in organisations' activities. The research methodology involved conducting on-line focus group interviews. The obtained material was transcribed and interpreted through the prism of semantic field analysis. The approach used made it possible to understand how stakeholders and their involvement are perceived by research participants representing various organisations and sectors.

2. Experts participating in the qualitative research

Nowadays, expert knowledge is of high value in many areas of socioeconomic environments (Cukras-Stelągowska, 2021). This knowledge can be obtained through qualitative research and leads to describe reality as it is in order to understand socioeconomic changes. A list of reasons justifying the use of the indicated approach can include (Czernek, 2015):

- building a new theory when the theory explaining a phenomenon does not exist or is insufficiently developed,
- capturing the life experiences of the subjects of the study in their natural environment, including the interpretation of these experiences,

- illustration of some abstract idea deduced from the theory,
- examination of narratives, discourse or other unusual phenomena.

Qualitative research can be conducted through interviews, which are divided into individual and group interviews (Maison, 2022). Their objective is to obtain respondents' statements of facts, which are subjective in nature, but nevertheless referring to experiences and individual observations. The literature points out that the interview interaction „is characterized by a kind of dynamics based on the constant interpretation and establishment of meanings between the researcher and the respondent, the questioner and the respondent” (Geisler, 2013, p. 45).

For the purpose of this research the term „expert” is synonymous with a research participant. It can be considered that the group of experts is made up of people with strong professional experience as a result of duties they have carried out at work for many years (Manczak, Gruszka, 2021). Most often, these individuals are in leadership positions. Expert interviews are a type of meeting between researchers and a group of people who represent a relatively small population under study (Döringer, 2021). Those interviews take form of non-standardised interviews, which in market research are mostly known as in-depth interviews, while in academic sociology they are referred to as free-form targeted interviews (Stempień, Rostocki, 2013). It is worth mentioning that the use of this type of approach „makes it possible to learn the internal viewpoint of a community from the perspective of its leaders” (Cukras-Stelągowska, 2021, p. 117). The discussion above indicates the rationale for undertaking qualitative research with the participation of representatives coming from the economic environment. By inviting the market actors to take part in the research the scientific community showcase an attitude of openness towards changing economic environment and aspire to understand the phenomena occurring in the socio-economic landscape.

Undoubtedly, this approach gives an opportunity to further investigation of problems under discussion and may also lead to identify new and meaningful issues that fall within the thematic scope of the analyses conducted (Hackley, 2019).

Previously prepared interview scenario sets the way interviews with the participation of experts are conducted. They follow carefully designed research methodology and set out general research orientation. In order to expand the discussion, in-depth questions are most often prepared in advance that allows the researchers to obtain detailed primary data (Thomas, 2006). Often, the course of an interview is heavily determined by the level of experts' responsiveness to the interview questions and their interest in items and issues taken up by the other participants in the meeting.

3. Purpose and the research method used

The purpose of the research was to identify how stakeholders are perceived by participants taking part in the focus group interviews. The participants consisted of people who have worked as managers in various organisations. The interviewees can be considered as experts having strong professional experience and a good understanding of operations carried out by their organisations. In order to identify the most appropriate variables describing the social phenomena in organisations it is recommended to get close to the nature of the activities performed by individuals in their environments (Glińska-Neweś, Escher, 2018).

The research was conducted in series between February and March 2022. Six virtual meetings were held in which all together 23 participants took part (four participants took part in each out of five meetings, three participants took part in one meeting)¹ (Table 1).

Table 1.

Profile of the respondents participating in the study

Lp.	Function	Organisation type
1.	chairman (R ₁)	a housing association
2.	Department manager (R ₂)	a museum
3.	chairman (R ₃)	a company operating in the transport and logistics sector
4.	chairman (R ₄)	a municipal company operating in the area of transport
5.	manager (R ₅)	a bank
6.	manager (R ₆)	a plant operating in the field of metallurgy
7.	board member (R ₇)	a railroad sleeper plant
8.	chairman (R ₈)	an airport
9.	deputy director (R ₉)	an education institution
10.	chairman (R ₁₀)	a company operating in the area of industrial automatics
11.	deputy director (R ₁₁)	a television station
12.	chairman (R ₁₂)	a shared services centre
13.	CEO (R ₁₃)	a food industry company
14.	co-owner (R ₁₄)	an accounting office
15.	deputy chairman (R ₁₅)	a company operating in the area of accounting, consulting and audits
16.	chairman (R ₁₆)	a company operating in the area of automation
17.	project co-ordinator (R ₁₇)	a company operating in the area of electronics and electricity
18.	chairman (R ₁₈)	a company performing activities in the area of design, production, assembly of components and equipment for the power industry
19.	manager (R ₁₉)	a training company
20.	manager (R ₂₀)	a business consultancy
21.	manager (R ₂₁)	a company operating in the field of energy
22.	CEO (R ₂₂)	an IT company
23.	owner (R ₂₃)	a construction and maintenance company

Source: own study.

Analysing the profile of the respondents and the entities they represented, it can be concluded that the interviewees represented the strategic areas of the economy. Importantly, most of the experts hold senior managerial positions such as chairman or CEO.

¹ The respondents were marked with the letter R with the addition of another ordinal number in the subscript.

In order to facilitate the discussion, the following in-depth questions were prepared:

- who do you consider as stakeholders of the organisation you represent?
- why did you indicate the named individuals or stakeholder groups?
- what resources do your identified stakeholders have that are important to your organisation?

The interpretation of the answers to the above questions was proposed as a result of the semantic field analysis carried out post interviews. It should be noted that this type of analysis is applicable to research papers representing management and quality sciences (Szymańska, 2022). The research led to recognise how reality was created by respondents in the process of assigning meanings to selected categories of concepts (Warmińska, Urbaniak, 2017). In the primary material, respondents' statements related to the term stakeholder, stakeholder groups and stakeholder resources were identified. This procedure made it possible to conduct an analysis of the semantic field. This analysis is derived from the theory of the semantic field, which is based on the assumption that „language is a system consisting of elements - words, interconnected by a network of semantic relations, building specific categories (groups, maps) of meaning” (Pacek, 2015, p. 22). This method „provides an opportunity for researchers and initiators of change to communicate it in a non-invasive way, tailored to practitioners' perceptions of social reality – that is, those actors in social life on whom the existence (or not) of social change will ultimately depend” (Dudkiewicz, 2015, pp. 160-161). In order to realise the research objectives, it was considered necessary to assign the coded statements to categories in relation to their function².

The purpose of the semantic analysis was to reconstruct the experts' thinking on the term „stakeholder”. The researchers attempted to outline the perception of stakeholders by the interview participants. For this purpose, the following networks of meanings were identified (Warmińska, Urbaniak, 2017):

- equivalents (synonyms; what is the subject/term identified with?),
- descriptions (what is the subject/term like? what are its characteristics?),
- associations (what is the subject/term associated with? what is it associated with? what accompanies it?),
- oppositions (what is the subject/term opposed to? what is its opposite?),
- a description of the subject's activities (what does it do? what effects does it have?),
- a description of actions towards the subject (what actions can be taken towards him?).

In the course of the research, networks of meanings related to the term „stakeholder” were identified and confronted with the literature on the studied subject. Analysis of the semantic field of the term „stakeholder” made it possible to outline the positions of experts on the issues covered by the study.

² The research was guided by an open-ended approach within the framework of the adopted convention.

4. Results obtained

The following research areas were adopted: criteria for listing a stakeholder group, reasons for identifying stakeholders and stakeholder groups, and resources held by stakeholders. These areas formed the integral axes of the research and set the research framework. The answers obtained during the interviews allowed the researchers to build answers to the research questions which are closely based on the professional experience of the interviewees and derive from the activities carried out by the organisations they represented (Gruszka, Manczak, 2022). During the interviews the experts gave free statements and presented spontaneous opinions, taking into account other thoughts that only emerged during the meeting (Denzin, Lincoln, 2017). Moreover, the research participants were able to experience situations in which all individuals discussed dynamically the subject of the research, and notify how group dynamics processes support or inhibit discussion during the course of a given meeting. The added value of the completed interviews was not only presenting respondents' thoughts and developing them, but confronting them with the point of view of other interviewees (Worek, 2001).

4.1. Equivalents

At the beginning of the analysis and with the view to understand the meaning of the term „stakeholder” the equivalents were identified. The literature indicates that the elements of the semantic field are closely linked to what, for the interlocutors, is the equivalent of the concept under analysis (Warمیńska, Urbaniak, 2017). The experts offered a plethora of terms that according to them equvalence the „stakeholder” term (Table 2). Some of the equivalents refer to the Freeman's stakeholder classification (1984). Importantly, this category of meaning, i.e. „equivalents” was the most abundant.

Table 2.
Equivalents identified

Categories	Examples
Equivalents	<i>firms (R₄, R₅, R₁₃), suppliers (R₁, R₃, R₄, R₆, R₁₂, R₁₅, R₁₆, R₁₇, R₁₈), owners (R₆), state (R₂₂), national authorities (R₁), government (R₃, R₁₄, R₁₅, R₂₁), ministry (R₉), local authorities (R₁), municipalities (R₄, R₆), board of directors (R₃, R₁₇, R₁₈, R₁₉, R₂₂), co-owners (R₁₈), actioners (R₃, R₅), shareholders (R₇, R₁₀, R₁₇), market regulators (R₁₀, R₁₁, R₁₂), European institutions (R₁₁), investors (R₁₅, R₁₆), visitors (R₂), tourists (R₂, R₄), employees (R₃, R₄, R₅, R₆, R₇, R₈, R₉, R₁₀, R₁₂, R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, R₂₀, R₂₂), clients (R₃, R₅, R₆, R₇, R₁₂, R₁₄, R₁₆, R₁₇, R₂₀, R₂₂), certifying authorities (R₁₈), environmental institutions (R₂₁), industry associations (R₂₃), recipients (R₁₀, R₁₅), passengers (R₈), media (R₁₇), universities (R₆, R₇, R₁₂), competitors (R₆, R₁₁, R₂₁), financial creditors (R₃), scientific institutions (R₁₇), banks (R₁₇, R₁₈, R₁₉), social organisations (R₁₂), environmental organisations (R₂₃), institutions (R₁₃), financial institutions (R₃), neighbourhood (R₁), cultural organisations (R₁, R₃), cultural and educational organisations (R₁), NGOs (R₂, R₂₁), intermediaries (R₃), seniors' organisations (R₁), central authorities and services (national and municipal police) (R₁), sovereign (R₁₀, R₁₁), spectators (R₁₁), parents (R₉), schools (R₂), pupils/students (R₉), children with disabilities (R₃), controlling institutions (R₁₇), local community (R₄, R₅, R₇), municipality (R₂)</i>

Source: own study.

Respondents' answers take into account the different stakeholder groups distinguished by Freeman (1984). These stakeholders include internal stakeholders such as *employees, owners, management, co-owners* or *shareholders*. External stakeholders include such entities as *suppliers, customers, state, national authorities, government, ministry, local authorities, municipality, market regulators* and *European institutions*. According to respondents, external stakeholders also include *competitors, financial creditors, banks* or *media*. *University and scientific institutions* also appeared among the responses. A stakeholder group frequently mentioned by respondents was the local community and environmental organisations: *community organisations, environmental organisations, cultural institutions, cultural and educational institutions, senior organisations, children with disabilities, local community, neighbourhood, and environmental institutions*. Respondents' comments coincided with the assumptions of the five-dimensional innovation system which characterises economies funded on the knowledge economy concept (Carayannis, Campbell, 2011). The model distinguishes helices that work together and allow an exchange of knowledge and resources in order to create a sustainable system in which organisations from various sectors form networks that help develop and thrive. This contributes to the overall economic growth and enables the smooth functioning of all entities in a system. The components of the model are three helices (the triple helix) represented by the private sector, the public sector, universities and other R&D organisations, all of which have an impact on increasing the stock of knowledge, number of innovations and commercial applications. Those helices also enter into a balanced relationship with the social and natural environments (Leydesdorff, Smith, 2021). The networks built as a result of the collaboration between the helices are fundamentals of modern and democratic economies which function in a smart and sustainable manner, including fostering social inclusion.

4.2. Descriptions

Examples of descriptions were analysed through the prism of emotions (emotional emphasis) (Dudkiewicz, 2015). A simplified approach was used, which assumes the division of the expressed views into positive, negative, ambivalent and neutral (Warمیńska, Urbaniak, 2017). As a result of the analysis carried out, it was found that among the offered descriptions of the term „stakeholder” there was a predominance of those with a positive tinge, which demonstrated what the subject under study was like (Table 3). The examples of the answers were as follows: *stakeholders determine the development strategy of each organisation, make key decisions, fund day-to-day operations, are able to help fund large scale projects, implement and execute projects, take care of customer relations, or outline the idea we use*. The descriptions with a positive tinge include: *has intellectual resources from the R&D area*. According to one interviewee, *stakeholders allow us to develop. We use their laboratories, their knowledge base ... we make available our products to them, our staff and current topics as research topics for students*. The views expressed by the respondents help build

an interpretation how the stakeholders are perceived by the interviewed parties. The research indicates that one of the most important characteristics of the stakeholders is the R&D activity and their knowledge base (Growiec et al., 2022). Moreover, the responses demonstrate that the knowledge exchange between stakeholders and organisations is two-way, the stakeholders share their knowledge and the infrastructure with the organisations but also the organisations make available their knowledge and resources to their stakeholders.

Table 3.
Descriptions identified

Category	Examples
Descriptions	<i>stakeholders have different opinions and voices (R₈), determine the development strategy of each organisation (R₁₅), outline the idea we use (R₁₃), outline the direction (R₁₇), make key decisions (R₁₇), fund day-to-day operations (R₁₇), are able to fund large scale projects (R₁₀), control (R₁₇, R₁₈), assess the operations (R₁₇), have intellectual resources in the R&D (R₂₁), implement and execute projects (R₁₇), take care of customer relations (R₁₇), take care of relations with the suppliers (R₁₇), regulate taxes (R₁₄), a group of teachers must be committed, creative, open to developing themselves, open to treat students we have individually (R₉), allow us to develop. We use their laboratories, their knowledge base..... we make available our products to them, our staff and current topics as research topics for students (R₁₇)</i>

Source: own study.

One of the respondents, a school representative provided the following statement: *a group of teachers must be committed, creative, open to developing themselves, open to treat students we have individually*. One expert also stated that „stakeholders have different opinions and voices”. The way the stakeholders were described correspond with the literature indicating the involvement of employees (internal stakeholders) into organisations which is vital for organisational success (Sobocka-Szczapa, 2022).

4.3. Associations

The associations with the term „stakeholder” point to the activities taking place by the organisations represented by the interviewees (Table 4). Among others the respondents provided information on activities carried out by stakeholders which are related to *environmental protection*. Furthermore, they indicated *support for people with disabilities* which can be understood as one of the activities within the corporate social responsibility. There were also views which referred to knowledge and organisational learning: *deepen the knowledge, continuous learning or too a number of resources in the form of, first of all, knowledge and way of doing things, which also expands our way of doing things and our knowledge, and with each customer we learn different things*. The interviewees acknowledged stakeholders’ engagement in activities enhancing development of the organisations: *stakeholders give opportunities for expansion into external markets*.

Tabel 4.
Associations identified

Category	Examples
Associations	<i>environmental protection (R₁₃), environment (R₅), we run various projects with us (R₁₃), support for people with disabilities (R₁₄), loyalty (R₁₄), deepen the knowledge (R₁₄), a number of resources in the form of, first of all, knowledge and way of doing things, which also expands our way of doing things and our knowledge, and with each customer we learn different things (R₂₂), opportunities for expansion into external markets (R₁₇), feedback but also constructive criticism and positive feedback (R₂), verify if the school meets its obligations (R₉), fund operations of the company, pay our salaries, pay for possible development (R₁₀), It is better to cooperate with us, despite the fact that they bear some costs (R₁₁), impose obligations on us that we must fulfil (R₁₂), organisational culture, a brand that allows us to grow (R₁₅), healthy competition (R₁₅), strong cooperation, which involves the development of common standards (R₂₁), we try to discuss, have the opportunity to influence and discuss, to participate in the legislative process (R₂₃), getting employees at every level of management is becoming more and more difficult, and it's getting harder to see the future in a positive way (R₇)</i>

Source: own study.

The respondents viewed the presence of stakeholders and their participation in ongoing projects through the prism of organisational relationships: *loyalty, healthy competition, impose obligations on us that we must fulfil*. The associations illustrated various aspects related to the process of creating this kind of relationship. Importantly, the costs of cooperation were also pointed out *it is better to cooperate with us, despite the fact that they bear some costs*. According to the respondents, the stakeholders *fund operations of the company, pay our salaries, pay for possible development* or *run various projects with us*. One of the experts highlighted the aspect of the organisational culture and bigger brand value as a result of the relationships built with the stakeholders: *organisational culture, a brand that allows us to grow*. The school representative noted that parents as stakeholders *verify whether the school is fulfilling its obligations*.

An important observation offered by a respondent was related to setting common standards and influencing the decision making and legislative processes: *strong cooperation, which involves the development of common standards, we try to discuss, have the opportunity to influence and discuss, to participate in the legislative process*. One of the interviewees highlighted a common challenge: *getting employees at every level of management is becoming more and more difficult, and it's getting harder to see the future in a positive way*. It indicates that regardless the type of organisation the common issues arise and by developing effective networks it is easier for managers to overcome difficulties of this type. The associations also referred to concepts such as sustainable development (Mensah, 2019), organisational learning (Lenart-Gansiniec, 2019), continuous learning (Olejnik, 2022), corporate social responsibility (Zboroń, 2022) or even organisational relations (Sachpazidu et al., 2022).

4.4. Oppositions

The oppositions represent views of the respondents related to what the term 'stakeholder' is opposed to. Based on the analysis of the primary data, several expert statements were identified that fall within the conceptual scope of this semantic category (Table 5). One of the

experts provided an observation associated with decisions that can be made by the state understood here as a stakeholder they design *policies that will exclude the organisations on the market*. This statement related to the state interventionism, and how the state stakeholder can be perceived by the organisations (Noviello, 2021).

Table 5.
Oppositions identified

Category	Examples
Oppositions	<i>policies that will exclude the organisations on the market (R₁₄), It's not necessarily organisations linked to culture or leisure (R₂), If their interests were not satisfied, then ... I would not be able to meet the shareholders' expectations (R₃), the resources they have facilitate or hinder the company's operations (R₂₁)</i>

Source: own study.

One of the views *If their interests were not satisfied, then ... I would not be able to meet the shareholders' expectations* proves that the effectiveness of an organisation is evaluated from the perspective of stakeholders' expectations, which should be taken into account already at the stage of creating and consolidating strategic actions (Kaplan, Norton, 1992). One of the views offered within the oppositions indicated that *organisations related to culture or leisure* should not be called a stakeholder.

4.5. Description of the subject's activities

To identify activities of the subject the following questions should be answered: what does it do? what effects does it have? (Table 6). One of the respondents recognised the role media (as a stakeholder) play: *the media educate our customers. There was also an opinion indicating employees' involvement in an organisation. It can be interpreted as the organisational empowerment „employees have an impact on the quality of production”*. According to one of the experts, stakeholders *also helps us grow*. In addition, the description of activities indicated relationships between the stakeholders that enhanced knowledge sharing and companies efficiency and effectiveness: *increase the efficiency, mutual learning (with the client), build a system for development and efficiency or share knowledge*.

Table 6.
Identified activities of the subject

Category	Examples
Description of the subject's activities	<i>the media educate our customers (R₁₇), also help us grow (R₁₇), give access to funds and ensure liquidity (R₁₈), increase the efficiency, mutual learning (with the client) (R₂₂), build a system for development and efficiency (R₂₂), share knowledge (R₁), employees have an impact on the quality of production (R₆), IT companies, thanks to which ...we reduce the number of employees by implementing ... computer programs that are compatible with our needs, which in many cases save on labor costs (R₄), Often our customers provide us with their technology and give us a new idea (R₁₈)</i>

Source: own study.

The experts acknowledged that some stakeholders offered solutions which helped build competitive advantage in the market: *IT companies, thanks to which ...we reduce the number of employees by implementing ... computer programs that are compatible with our needs, which in many cases save on labor costs.* Other interviewees added that the stakeholders *give access to funds and ensure liquidity, increase the efficiency, mutual learning (with the client), build a system for development and efficiency.* There was also an observation offered by one of the respondents that the stakeholders played an important role in the innovation process by sharing technological knowledge and providing ideas: *often our customers provide us with their technology and give us a new idea.*

The listed examples of activities run by stakeholders fit with the concept of organisational empowerment (Rothman et al., 2019). Furthermore, the analysis allowed the researchers to identify stakeholders' activities which refer to process management (Bartkowiak, Grabowska, 2019), co-management (Carlsson, Berkes, 2005) or creation of a competitive advantage. (Švárová, Vrchota, 2014). The interviewees identified specific situations that illustrated the importance and potential of their stakeholders for their organisations.

4.6. Description of actions towards the subject

The description of actions towards the subject illustrates the actions undertaken by the organisations towards the stakeholders (Table 7). The following activities were mentioned *we identify the needs, mutual trust or strong cooperation which means the development of common standards.* The answers indicate that there is a healthy competition (co-opetition) between the organisation and their stakeholders which may have a positive impact on both parties (Klimas, Radomska, 2022). One of the respondents pointed out to aspects related to Corporate Social Responsibility as an important driver in relations between the organisation and its stakeholders *it is key to us that our business partners act according to general CSR principles* (Zboroń, 2022).

The experts referred to activities related to human resources management (Matwiejczuk, 2022). They listed the actions undertaken towards the internal stakeholders i.e. employees: *fair recruitment or we conduct employee satisfaction surveys.* Volunteering was also mentioned *we engage in employee volunteering or a project ... around support for higher education sector, through scholarship programmes* (Dylus, 2022).

Table 7.
Identified actions towards the subject

Category	Examples
Actions towards the subject	<i>fair recruitment (R₂₀), we identify the needs, mutual trust (R₂₀), strong cooperation which means the development of common standards (R₂₁), it is key to us that our business partners act according to general CSR principles (R₅), we conduct employee satisfaction surveys (R₅), we engage in employee volunteering or a project ... around support for higher education sector, through scholarship programmes (R₅), we introduced cards made 85% from the recycled plastic (R₅), Activation of the local community in terms of the usefulness in the labour market (R₄), we engage a lot in discussions which aim at mitigating the consequences of disrupted supply chains (R₁₀)</i>

Source: own study.

One of the respondents paid attention to actions taken towards the local community with the view to support the development of the labour market: *Activation of the local community in terms of the usefulness in the labour market*. Furthermore, the interviewees carry out discussions with the stakeholders to overcome challenges present in the current business reality *we engage a lot in discussions which aim at mitigating the consequences of disrupted supply chains* (Kotzab et al., 2023).

5. Conclusions

In conclusion, it can be said that the respondents offered a variety of observations that exemplify the perception of their stakeholders. The following conclusions emerge:

- the experts have a good understanding of their organisation's stakeholders and consciously interact with them;
- the identified stakeholder groups represent a variety of subjects (including industry, government, science, social environment);
- only one respondent included environmental organisations among his organization's stakeholders; it can be assumed that those included in the environmental stakeholder group are the least represented of all the stakeholders listed;
- trade unions were not identified as stakeholders of any organisation during the interviews.

All the elements of the five-dimensional innovation system model were mentioned by the respondents and those elements fit with the components indicated in the quintuple helix where each of the elements interact with each other to exchange knowledge and resources. The system built in such way has an impact on the socio-economic development of the regions and countries. The respondents' statements also prove that they are aware of the interdependencies that exist between their organisations and their stakeholders.

The reasons why the experts identified specific stakeholders included the resources they possessed which were key for the operation of the organisations in question. The strategic resources included among others knowledge, feedback, constructive criticism, financial resources and technologies. It was observed that the investigated companies acquired knowledge, funding, access to technology or innovation from the stakeholders as a result of networks they belong to and cooperate within. Furthermore, the organisations co-create products with the stakeholders for a mutual benefit. By cooperating they create synergies that foster the creation of shared added value. Thus, unique solutions can be created by the involved parties and this has an impact on product, process or even social innovations. Such external partnerships foster the creation and implementation of new ideas and lead to the creation of new business models which open up new opportunities and strengthen the organisation's

competitive position. However, those business models require new management mechanisms in order to be properly operated and managed.

In the expert opinions, the business openness allows the parties to grow and learn from each other which is one of the main characteristics of the knowledge-based organisations. According to them the organisations strive to meet stakeholders' expectations which can be consistent and complementary but at the same time contradictory (Dabrowska, Ferreira de Faria, 2020). The diversity of expectations can therefore generate a diverse impact on the cooperation undertaken. Therefore, it is key to manage the cooperation with the stakeholders from a very beginning by setting common goals while planning strategies and building performance measurement systems.

Taking into account the above observations and in order to ensure effective cooperation with the stakeholders, the development of an appropriate management framework and mechanisms for exchanging resources seems not only necessary, but even essential. Thus, the concept of the co-management is becoming more and more important in the current economic contexts, especially for organisations which want to demonstrate more than only a financial success. Those organisations want to meet various stakeholders' expectations to demonstrate a wider impact they generate on the society and the environment. By doing this, the organisations contribute to building the modern knowledge economy.

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RESILIENT CHAINS AND CHAIN SHORTENING – TRADE EXCHANGE PERSPECTIVE

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Purpose: One of the fundamental ways to strengthen supply chains is by shortening them. This can be reflected in the degree of utilization of chains for exports and imports. This is crucial for efficient supply chain management as it enables simpler and faster logistics operations. However, on the other hand, comparative advantages, resource localization, and cost considerations may lead management decisions to refrain from significant supply chain shortening on a larger scale. Additionally, the increasing level of digitalization in the logistics industry, which supports supply chains, also contributes to this perspective.

The purpose of this study is, therefore, to examine the extent to which recent crisis situations have influenced the exchange of exports and imports, categorized by short, medium, and long supply chains. The Polish economy has been chosen as a reference for this analysis.

Design/methodology/approach: Statistical methods based on time-series analysis were employed in this research.

Findings: Despite the crises, supply chains have not been shortened. It can be observed that in the long term, as well as in the post-pandemic period, there has been a shift in the structure of supply chains towards longer chains, particularly noticeable in import dynamics. The reason why supply chain shortening for the purpose of enhancing resilience is not evident in the data, despite many declarative statements about this approach in empirical research, has been indicated.

Research limitations/implications: The formulated arguments in favor of supply chain lengthening should be confirmed through research in various economies.

Practical implications: The importance of this article lies in providing management decision-making suggestions, particularly regarding supply sources.

Social implications: The establishment of shorter supply chains is crucial for environmental sustainability and meeting customer needs.

Originality/value: Research in this field is often conducted in an aggregated form, without differentiating between various supply chain lengths. In this article, we have taken these factors into account.

Keywords: supply chain management, international trade, pandemic, reshoring, resilience.

Category of the paper: research paper.

1. Introduction

The construction of resilient chains is a relatively new area of research, as evident in the literature review conducted by Kamalahmadi and Parast (2016).

Existing empirical models have highlighted various approaches to building resilient chains (Maryniak, Bulhakova, Lewoniewski, 2021; Shishodia et al., 2023). Based on an extensive review of the literature, we have developed an original classification system comprising five fundamental groups of activities (see Fig. 1).

Given the disruptions caused by the pandemic, as well as war-related events, the vulnerability of long-distance supply chains and the importance of immunizing them through appropriate supply strategies and shortening existing chains have become particularly crucial (Shivajee, Singh, Rastogi, 2023).



Figure 1. Elements of strengthening supply chains.

Source: Own work based on the review of proposed models concerning resistant supply chains.

On one hand, there is a suggestion that companies should decrease their geographical coverage and make their supply chains less globalized. This approach promotes shorter or local supply chains, which enable better inventory control and bring suppliers closer to the buyer. On the other hand, it is emphasized that the nationalization or regionalization of supply chains can increase the risk of disruption. Such a strategy may limit companies' ability to optimize supplier diversification and minimize risk (Anukoonwattaka, Mikic, 2020). These differing views present a dichotomy in supply chain strategies.

It is widely believed that the post-pandemic world will witness a fundamental shift towards greater risk aversion, nationalism, and protectionism. There are discussions about a "legitimacy crisis" of the post-war neoliberal economic order (Abdelal, 2020). However, it is also argued that globalization will continue to be necessary and beneficial. Historical evidence suggests that

supply chains quickly adapt and relocate, leading to cost reductions in production (Contractor, 2022). Furthermore, several arguments support the continuation of globalization in the post-pandemic era, emphasizing the justification of global value chains (GVCs) (see Fig. 2).

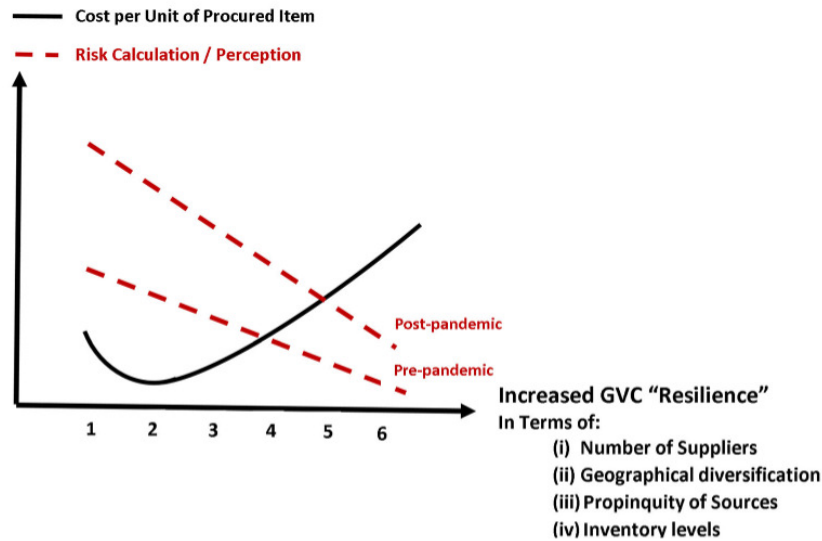


Figure 2. Profitability of reconfiguration of value chains in the perspective of their resilience.

Source: Contractor, 2022, p. 159.

Thus, one needs to analyze the redundancy in the form of multiple suppliers and increasing inventory levels, as well as the geographic diversification and proximity to sources of supply, in the context of potential risks, raw material and component prices, and final product prices.

The division of labor, economies of scale, the low absorptive capacity of domestic markets, and the advantages of locating operations in less developed countries contribute to the increase in exports, imports, and the internationalization of supply chains.

However, research has confirmed that trading partners with lower risk and the ability to quickly recover import volumes have less vulnerable supply chains, while individual countries have varying levels of vulnerability in their logistics and transport systems (Jomthanachai et al., 2022). In globally distributed supply and production networks, the mode of delivery to the production plant differs in terms of transportation costs, tariffs, and stoppages (Sardesai, Klingebiel, 2023). This aspect became particularly evident during the recent war-related crisis, marked by a significant rise in fuel prices and the introduction of EU directives and "Fit for 55" packages.

Studies have shown a significant negative impact of the financial crisis and COVID-19 on international trade (Bricongne et al., 2021; Hayakawa, Mukunoki, 2021). However, it should be emphasized that these effects were considerably mitigated within a relatively short period of time. Additionally, the strong impact of COVID-19 on international trade has highlighted the need for increased industrial production in the US and EU countries to enhance self-sufficiency and independence (Coquidé et al., 2022). It has also been noted that since the war in Ukraine, the so-called global geopolitical risk index has significantly increased, reaching levels not seen since the beginning of the Iraq war in March 2003 (Caldara, Iacoviello, 2022). However,

the willingness to leave high-risk zones largely depends on factors such as the cost of relocating supply chain links, the size of operations, labor costs, insurance costs, capital intensity of the business, legal possibilities, and choice of political blocs. Moreover, an international company with a high level of imports from a foreign economy may have less incentive to change sources of supply after a geopolitical shock (Ruta, 2022). Recently, attention has also been paid to various transport-related indicators that indicate a slowdown in the negative effects associated with oil and diesel prices, both globally and in Europe (Polska Organizacja Przemysłu i Handlu Naftowego, 2023).

All these contradictions imply that slogans advocating for chain shortening to enhance resilience are not straightforward and unambiguous.

Therefore, in this study, we adopted a macroeconomic perspective that reflects the management decisions made at the enterprise level, aiming to answer the question of whether the recent crises have significantly influenced international trade in terms of the length of supply chains.

The international exchange of goods between Poland and other countries has been chosen as the focal point of this investigation.

2. Shortening supply chains from the point of view of international trade – research methodology

Among the various strategies and initiatives aimed at shortening supply chains to enhance resilience (Fig. 3), while also considering the potential risks associated with complex supply chains, several approaches have been identified in the literature. These approaches are highlighted by researchers such as Amighini et al. (2023), BCI (2023), Deppermann et al. (2018), Hertz (2001), Kamakura (2022), Lee (2022), and The White House (2021).

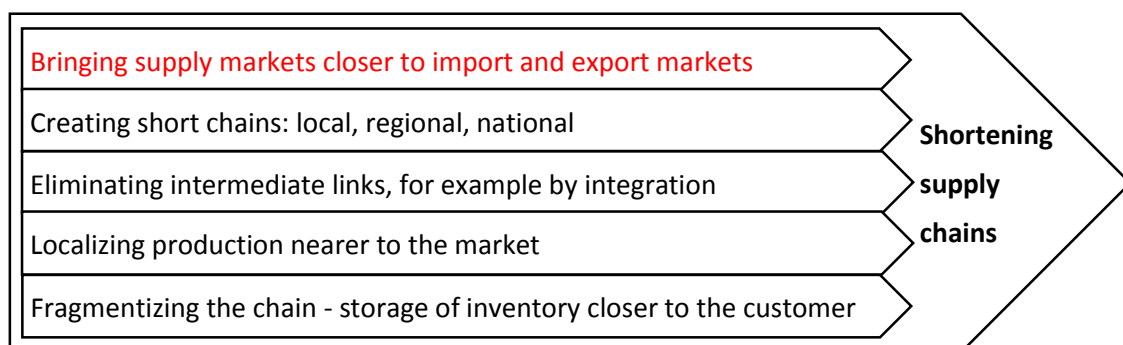


Figure 3. Shortening input and output supply chains.

Source: own work.

This study focuses on the first dimension, specifically international trade. Previous studies have predominantly concentrated on aggregated results related to various macroeconomic indicators such as GDP, inflation, or unemployment. In this study, we adopt a perspective that examines the structural and dynamic differences in the context of the length of supply chains.

The primary objective of the empirical analyses was to investigate the extent to which recent crisis situations have influenced changes in export and import patterns within short, medium, and long supply chains. To achieve this main goal, we have established the following specific objectives:

- determine the level of dynamics in Polish trade in terms of value, quantity, and structure,
- estimate the monthly dynamics of changes in trade,
- identify the directions of trade development in structural terms, categorized into short, medium, and long chains.

Based on preliminary studies, it is assumed that supply chains tend to lengthen when there is an increase in trade flows over longer distances, leading to destinations in import and export directions remaining largely the same. The division of supply chains into different lengths is based on a geographical, arbitrary distance from Poland. Short chains encompass Poland's trade with neighboring countries, excluding Russia due to its vast territory. Medium chains involve exports and imports within Europe, while the remaining countries are considered part of the long chains.

For our research, we utilized time series data obtained from the statistical office's international trade databases. Although the time series method is used to study supply chains, it is not widely popular. For instance, searching for "supply chain" yields 142,280 thousand articles, but when combined with "time series," the search narrows down to 765 articles, with only a few percent being relevant to the given topic.

Among the most frequently cited works, some employ time series to study demand (Fattah et al., 2018; Willemain, Smart, Schwarz, 2004; Aviv, 2002; Nguyen et al., 2021; Gilbert, 2005). Another thematic strand, which is also frequently cited, explores the environmental impact of supply chain activities and aspects of corporate social responsibility (Acquaye et al., 2017; Norris, 2006).

Furthermore, time series analysis is used to test the resilience of flows and analyze foreign trade. For example, it is employed to forecast the demand for critical raw materials in terms of ensuring smooth flows (Polat, Yücesan, Gül, 2023), and to assess the impact of imports and exports on economic development (Du et al., 2019).

3. Results of the study

Figures 4 and 5 present graphs illustrating the value of Polish imports and exports of goods expressed in euros for three types of supply chains. The short chains represent imports (exports) from (to) all neighboring countries of Poland, excluding Russia. The medium chains encompass all other European countries, excluding Russia. The long chains include all non-European countries. The graphs reveal a consistent upward trend in international exchange on both sides.

The data also exhibit two notable features. Firstly, there is a decrease in exchange at the onset of the COVID-19 pandemic, beginning in 2020. This decline is observable in both exports and imports, across all chain lengths. Secondly, a significant change in trend is visible after 2020. To confirm this change, we conducted Chow tests for structural shifts. The baseline model assumes a linear trend in the series:

$$y_t = \alpha + \beta t + \varepsilon_t \quad (1)$$

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$$y_t = \alpha + \beta t + \varepsilon_t \quad (2)$$

To assess structural changes, we assumed that both the slope and intercept (representing the level and trend) had altered following the outbreak of the COVID-19 pandemic in March 2020. Table 1 presents the regression results, including estimated coefficients and their standard deviations, the regression's value, and the outcomes of Chow's test (test statistics and p-values).

As depicted, the trend for all supply chains (both in exports and imports, across all chain lengths) was positive. The coefficients represent the average monthly changes in the analyzed variables. For instance, the highest increase was observed in exports to neighboring countries (export-short). On average, the value of these exports has been growing by 49.767 million euros per month. The export to non-European countries (export-long) exhibited the slowest growth rate, but still experienced a consistent increase, with an average monthly change of 13.391 million euros.

We conducted a Chow's test to investigate the hypothesis that the onset of the COVID-19 pandemic caused a shift in the series' trend. We employed the following segmented model to evaluate if it better captured the data:

$$y_t = \begin{cases} \alpha_1 + \beta_1 t + \varepsilon_t, & \text{for observations before the change} \\ \alpha_2 + \beta_2 t + \varepsilon_t, & \text{for observations after the change} \end{cases} \quad (3)$$

The null hypothesis in the test assumes no structural break (i.e., and), indicating no change in the trend. The results of Chow's test indicate that there was indeed a structural change in the trends of all the analyzed chains, as all p-values were below 0.05.

Table 1.

Time trends and the results of the Chow's tests for values of export/import

Series	α (sd)	β (sd)	R^2	Chow's test: F-statistics (p-value)
Export – short	-591.300 (249.642)	49.767 (1.572)	0.8645	134.149 (0.000)
Export – medium	239.819 (269.928)	49.534 (1.700)	0.8439	90.250 (0.000)
Export – long	-243.045 (63.4209)	13.391 (0.399)	0.8774	101.013 (0.000)
Import – short	675.834 (222.203)	36.713 (1.399)	0.8142	89.5002 (0.000)
Import – medium	651.516 (235.342)	38.967 (1.482)	0.8149	113.368 (0.000)
Import – long	-1947.21 (237.287)	34.360 (1.494)	0.7710	294.645 (0.000)

Source: Own calculations.

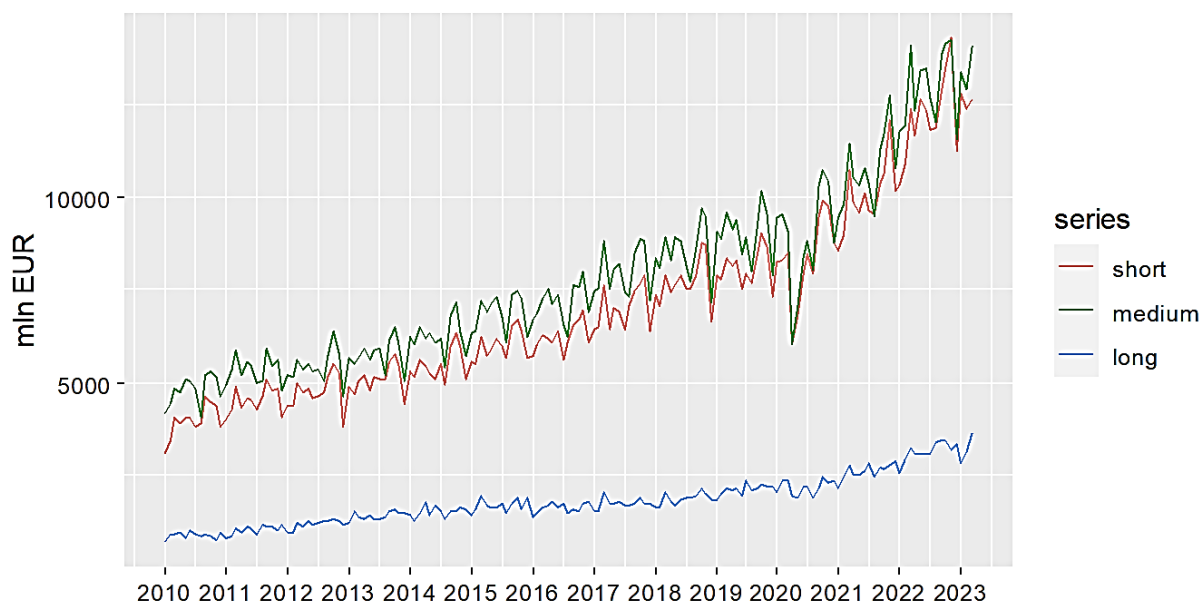


Figure 4. Export from Poland (in mln €).

Source: Polish Statistical Office.

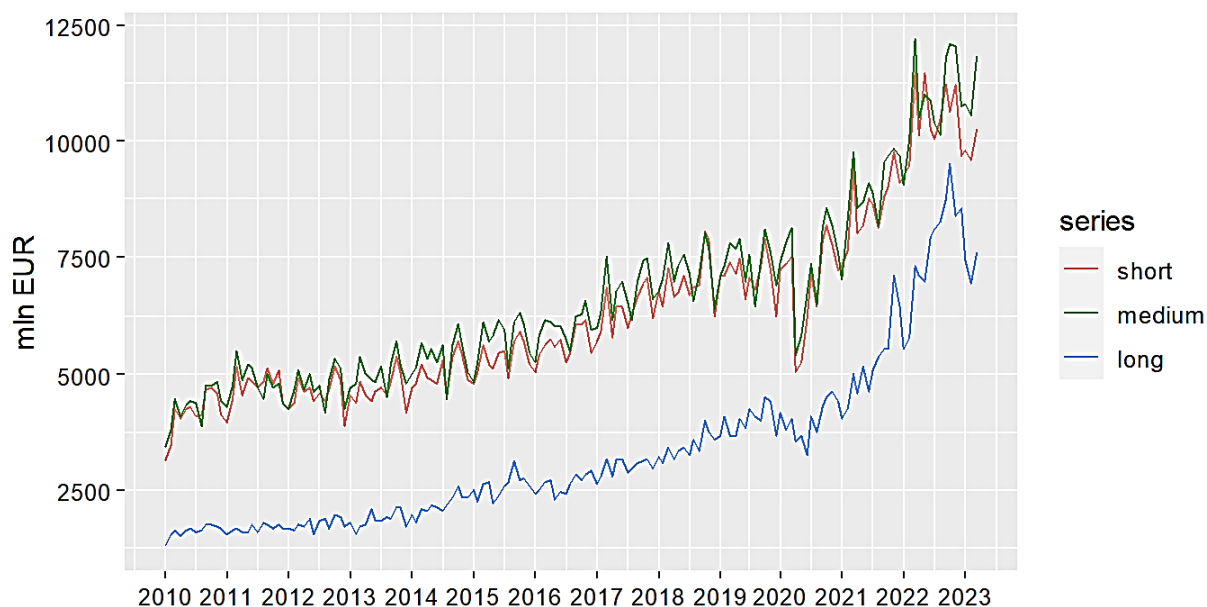


Figure 5. Import to Poland (in mln €).

Source: Polish Statistical Office.

Figures 6 and 7 depict graphs illustrating the value of Polish imports and exports of goods expressed in thousand tons (kt). The overall trend shows an increase, although not as significant as in the series expressed in euros. To examine the presence of structural changes, we estimated the trend line and conducted Chow's test for structural shifts, assuming that the change occurred following the onset of the COVID-19 pandemic in March 2020.

As shown in the table, both exports and imports have increased across all lengths of supply chains. The import from the rest of the world (long supply chains, excluding European countries) experienced the most rapid growth, with an average monthly increase of 15.569 kt. On the other hand, the smallest increase was observed in exports to long distances, with the tonnage of this export rising by an average of 3.807 kt per month.

The results of Chow's test indicate a structural change in the trend of imports and exports for long and medium distances. However, there was no significant change in the trend of exports and imports for short distances.

Table 2.

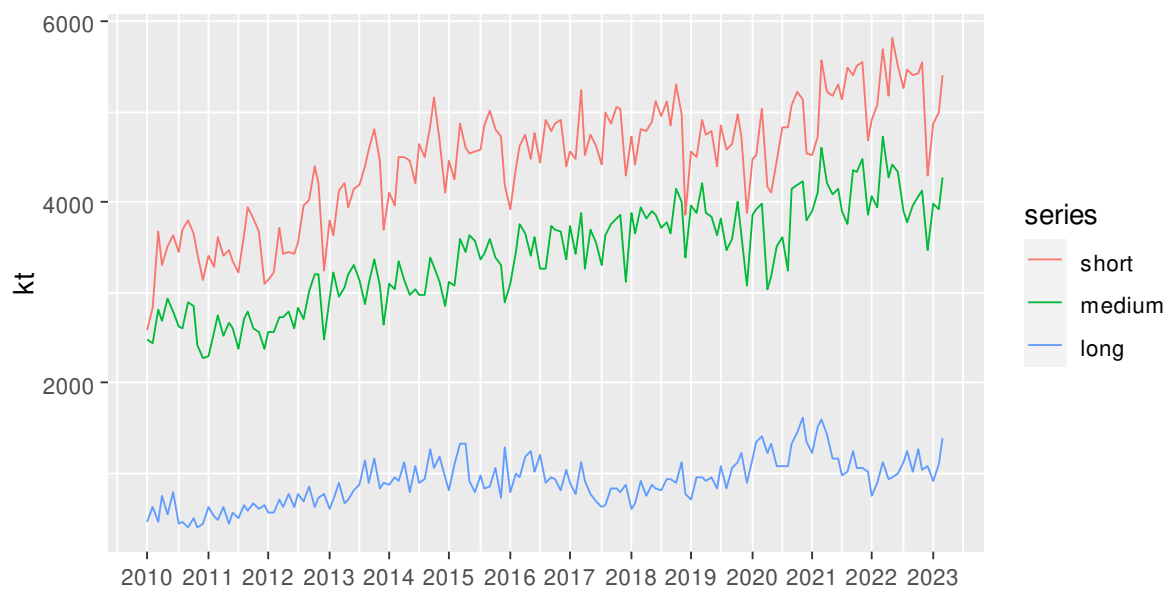
Time trends and the results of the Chow's tests for tonnage of export/import

Series	α (sd)	β (sd)	R^2	Chow's test: F-statistics (p-val)
Export – short	2641.624 (105.341)	11.919 (0.663)	0.673	3.045 (0.050)
Export – medium	1775.503 (74.2067)	10.742 (0.467)	0.771	3.203 (0.043)
Export – long	334.606 (52.849)	3.807 (0.333)	0.454	9.562 (0.000)

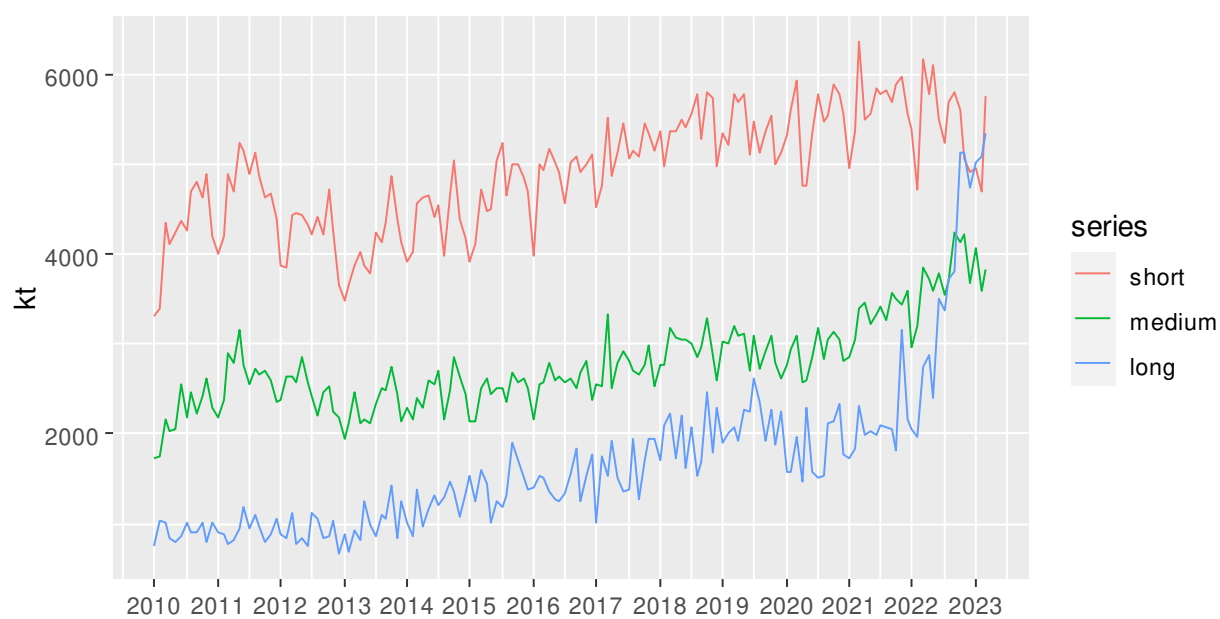
Cont. table 2.

Import – short	3336.776 (115.143)	10.465 (0.725)	0.570	3.018 (0.052)
Import – medium	1496.465 (82.120)	8.407 (0.517)	0.627	37.516 (0.000)
Import – long	-688.251 (156.687)	15.569 (0.987)	0.613	97.503 (0.000)

Source: Own calculations.

**Figure 6.** Export from Poland (tonnage, kilotons).

Source: Polish Statistical Office.

**Figure 7.** Import to Poland (tonnage, kilotons).

Source: Polish Statistical Office.

It is particularly interesting to note the changes in import over long distances. After the onset of the COVID-19 pandemic, there was a decrease in this type of import. However, starting from 2022, there was a rapid increase. Figure 8 displays the graph of import from Russia, and by comparing it with Figures 4 and 5, we can deduce that the rise in import over long distances was influenced by the war in Ukraine. Following the outbreak of the conflict, goods that were previously imported from Russia were substituted with imports from non-European countries. The decrease in the import from Russia was mainly caused by the decline of supplies of mineral fuels (natural gas and crude oil). Figure 8 depicts the dynamics of overall import from Russia and import of mineral fuels.

Our claim is that there were two structural breaks in the trend of long-distance import. The first break was associated with the impact of COVID-19, which resulted in a reduction in import levels. The second break occurred due to the war in Ukraine and led to an increase in the import trend. To test this hypothesis, we have estimated the following model:

$$import_t = \alpha + \beta_1 t + \beta_2 covid + \beta_3 war \cdot t + \varepsilon_t \quad (4)$$

The variables ‘covid’ and ‘war’ are dummy variables that take the value of 0 before March 2020 and February 2022, respectively, and 1 after these dates. The parameter β_1 represents the change in the level of import after the beginning of the pandemic, while β_2 represents the changes in the trend (slope) after the outbreak of the war in Ukraine. Table 3 presents the estimation results, indicating that all the explanatory variables are statistically significant. The coefficient of determination (R-squared) for this regression is [the actual value is missing from the provided text].

To examine whether the assumed structural breaks in the regression equation hold, we conduct a test of linear restrictions. The null hypothesis is as follows:

$$H_0: \beta_2 = \beta_3 = 0 \quad (5)$$

(i.e., there was no structural change either in the level of import or in the trend). The test statistic for this hypothesis was $F(2, 155) = 84.442$, with a p-value lower than 0.01%. This indicates that we must reject the null hypothesis, suggesting that there were indeed structural changes.

According to the results presented in Table 3, the onset of the COVID-19 pandemic caused a decrease in long-distance imports by 220.253 kt. The outbreak of the war led to a structural change in the trend of this import. Prior to the war, it had been increasing on average by 11.863 kt per month. However, after the outbreak of the war, the rate of change increased by over 50% to 19.584 kt per month.

Table 3.
Regression for long-distance import (from non-European countries)

Variable	Parameter	t-value	p-value
<i>const</i>	223.935	1.593	0.113
<i>t</i>	11.863	11.650	0.000
<i>covid</i>	230.253	1.973	0.050
<i>war · t</i>	7.721	12.741	0.000

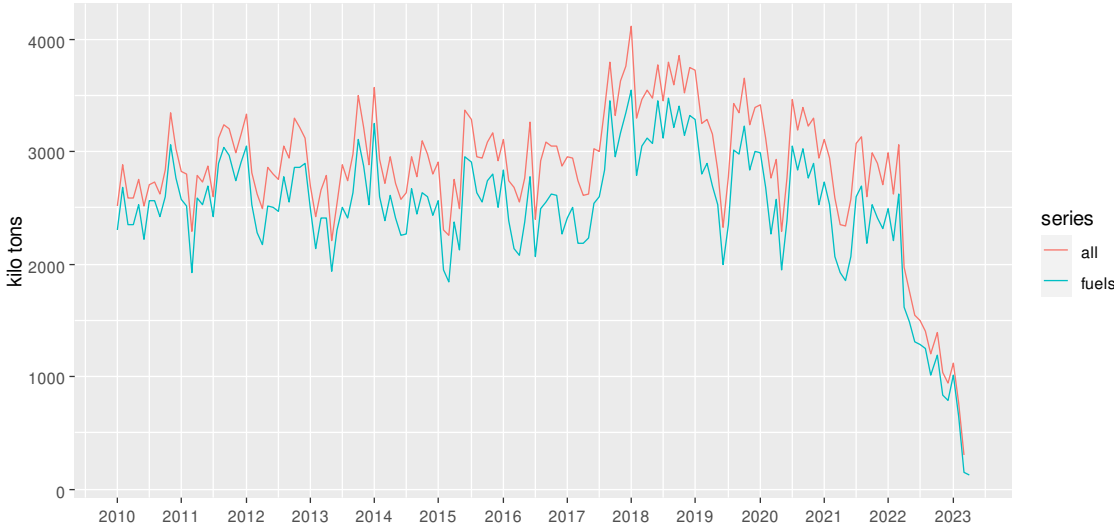


Figure 8. Volume of import from Russia – all import and import of mineral fuels (tonnage, kilotons).
Source: Polish Statistical Office.

From the perspective of the main objective of this study, which is to investigate changes in the potential shortening of supply chains, the aspects discussed are especially evident when considering the structural approach, particularly in terms of the tonnage of exports and imports (refer to Figures 9 and 10).

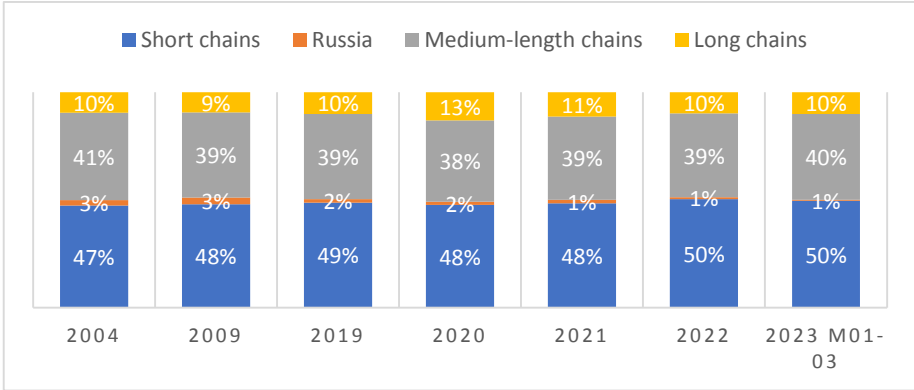


Figure 9. Volume of export from Poland (in tonnage).
Source: Polish Statistical Office.

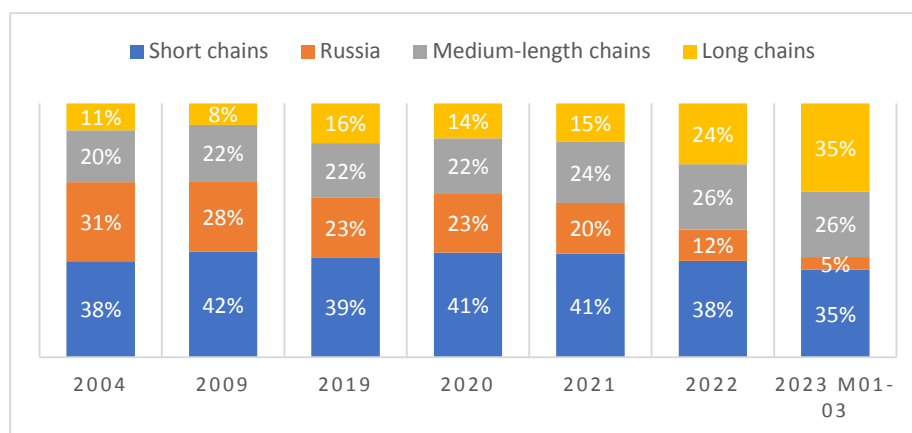


Figure 10. Volume of import to Poland (in tons of transport).

Source: Polish Statistical Office.

Based on the results obtained, it can be concluded that there has not been reduction in the length of supply chains, both in the long-term and in the post-pandemic period. Additionally, there has been an increase in the proportion of long chains in imports. In the last year of the analyzed observations, this could be attributed to the search for alternative sources of raw materials that lack close substitutes. However, it is important to note that this trend also occurred in the previous period.

Between the years 2004 and 2023 (1st quarter), noticeable growth in the export direction (measured in kilograms) is observed for India, Nigeria, and Saudi Arabia. The United States and China have been significant exporters in the realm of long supply chains for years. Within medium supply chains, Poland primarily exports to the Netherlands, France, and the United Kingdom, with the last two countries consistently ranking in the top five since the beginning of the analyzed period. Regarding short supply chains, Germany (currently with over 50% share) and the Czech Republic have dominated since 2004. Notably, Ukraine's share has significantly increased due to geopolitical changes.

The largest importers (measured in kilograms) are Egypt, Colombia, and China, with China being consistently at the forefront since the start of the research period. Norway and the Netherlands have been dominant within medium supply chains for years. As for short supply chains (involving neighboring countries to Poland), goods are predominantly imported from Germany, Ukraine, and the Czech Republic.

4. Conclusions

The disruptions in supply chains, especially those caused by the COVID-19 pandemic and the Russian war with Ukraine, along with other factors such as maritime piracy, Chinese blockades in 2022, and climate changes, have highlighted their vulnerability due to countries'

dependence on import and export ties, particularly those at a great geographical distance. Consequently, research reports emphasize aspects of international flows, such as reliance on suppliers and value creation in subsequent links of the supply chain (Ambroziak et al., 2023; Amighini et al., 2023).

The most common method of strengthening supply chains is to increase inventory levels and then diversify suppliers. However, relatively few companies have completely abandoned Chinese suppliers (EBRD, 2022), and this applies to Poland as well. Research conducted by the European Bank for Reconstruction and Development indicates that Poland's participation in global supply chains is increasing. There is a growth in global production linked to the supply chain as a percentage of total production and an increase in the sophistication of exports. This shift results in Poland moving up the value chain.

Studies show that some countries have chosen to shorten their supply chains due to the impact of COVID-19 and the war in Ukraine. However, such a trend has not been observed in Poland (Ambroziak, 2023). On the contrary, the structure of supply chains indicates a growing burden of goods on long routes both in the long-term perspective and in the post-pandemic period. This trend is also observed in other economies. Despite researchers indicating firms' readiness for production relocation and providing numerous examples of such actions, the chances of supply chain shortening becoming the leading strategy for mitigating risks created by the pandemic or the war in Ukraine are limited (Ambroziak et al., 2023).

While shortening supply chains could reduce the risk of disruptions, rising transportation costs are another important consideration. These costs include increasing CO₂ emissions fees, higher fuel costs (despite a decline in 2023 with a forecasted slight increase in the second half of the year), rising wages for drivers, and increased insurance costs for goods on longer routes. However, this factor weakens the observed economic slowdown process in Poland since mid-2023. It implies a lower purchasing power and, consequently, a demand for inexpensive products manufactured in distant countries with lower wages and less stringent regulations.

Additionally, the obtained results can be explained by the following factors:

1. The process of production relocation is time-consuming and involves significant investments, which may delay the visible effects of supply chain shortening on a larger scale.
2. The increasing volume of e-commerce orders from China and other countries in the region, accelerated by the pandemic, despite the growth dynamics of this industry in Poland in mid-2023, contributes to the continued lengthening of supply chains.
3. During the pandemic, customers shifted their expenditures from unavailable services to goods, generating trade in products, many of which originated from distant corners of the world.
4. Many raw materials are only available in distant countries, leading to substitutions of Russian raw materials, which are more closely associated with reshoring than nearshoring.

5. Participation in global supply chains for the purpose of specialization based on comparative advantages aligns with trade theory and is considered an optimal approach.
6. Supply chain shortening likely applies primarily to selected critical raw materials and components and occurs through the localization of critical inventory closer to the final recipient, which requires confirmation in future research.
7. Supply chain transparency is increasing through digitization.

Furthermore, Poland is an attractive location for the consolidation and deconsolidation of imported and exported goods from distant countries. Despite the pandemic and war crises, the warehousing market has remained in good condition. Poland is also one of the main beneficiaries of changes in global production chains after the pandemic, ranking fourth globally and first among European firms in terms of preferred production relocation locations (PKO Bank Polski, 2022). Consequently, it is assumed that unlocking supply chains and prior foreign investments will lead to continued export growth, even in an unfavorable environment. However, a decline in import-dependent inventories and changes in consumption patterns may negatively impact imports (PKO Bank Polski, 2023). Presently, there are significant planned investments related to the relocation of semiconductor production to European countries, including Poland. Therefore, potential suppliers for the Original Equipment Manufacturer (OEM) sector will generate additional imports and boost export results to shorter distances.

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CRAFTSMANSHIP AS A DEVELOPMENT POTENTIAL OF THE REGION - A CASE STUDY OF CRAFTSMEN FROM OPOLE SILESIA (POLAND)

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Purpose: The aim of the article is to present craftsmanship as a development potential of the region, including a regional tourist product that influences the attractiveness of the Opole Voivodeship.

Design/methodology/approach: A case study of craftsmen from Opole Silesia specializing in the production of handicrafts was presented, with whom in-depth qualitative interviews were conducted in April 2023.

Findings: The research results present craftsmanship as a regional product that can make a significant contribution to the cultural heritage of the region and constitute a significant development potential that is not yet fully utilized.

Originality/value: The article attempts to demonstrate the significance of craftsmanship in the Opole Voivodeship in terms of its impact on regional development.

Keywords: crafts, Opole Silesia, regional development, development potential, economic culture, cultural economy.

Category of the paper: Research paper.

1. Introduction

One characteristic of craftsmanship is, among others, small-scale production, a local character, and the harmonization of industrial-driven economic development. Craftsmanship is also considered as an essential complementary element to industry, influencing economic growth (Cegielski, Milich, 2017). Man-made attractions in tourism include cultural, historical,

and artistic elements (Lew, 1987). Craftsmanship is sometimes treated as a tourist product and a component of cultural tourism, where culture is the subject of exchange. The exchange process is related to the tourist's experiences and the economic effects obtained by producers of products and services for tourists (Zmyślony, 2009). Tourism is an economic phenomenon linked, among other things, to employment, income generation, and money transfer (Nieżgoda, 2009). Furthermore, research conducted by T.J. Moagi, C. Ivanovic, and M.C. Adinolfi indicates that craft suppliers from areas not typically associated with tourist attractions still attempt to benefit from the tourism value chain (Moagi et al., 2021).

Craftsmanship plays an important role in the economy of the region. The focus of tourists is often on folklore and artistic craftsmanship (Kosmaczewska, 2011), although local industrial heritage may also be considered among the attracting elements (Cudny et al., 2022). The attractiveness of a particular place is linked to plans for meeting specific tourist needs. It reflects feelings, beliefs, and attitudes associated with those needs (Ćorluka et al., 2021). In undertaking a tourist journey, the experiential process and the needs that cultural tourism aims to satisfy are of great importance (Nieżgoda, 2013).

The connection between tourism and craftsmanship is also evident in the implementation of projects aimed not only at preserving traditions and increasing the attractiveness of traditional crafts but also at enhancing tourist traffic. Similarly, the creation of thematic tourist routes, such as culinary trails or honey trails (e.g., the Podkarpacki Honey Trail), aims to enhance the regional offer and link it with other economic entities and collaborating institutions, as well as promote sustainable cultural tourism (Krupa, Młynar, 2016). Examples of such projects include:

- Life Composed of Tradition (Regional Development Agency in Bielsko-Biała),
- Craftsmanship Trail (funded by the National Centre for Culture and the Marshal's Office of the Małopolska Region),
- Traditional Crafts Trail of Podkarpacie (Museum of Folk Culture in Kolbuszowa with financial support from the Minister of Culture and National Heritage),
- Historical Recipes Trail (Interreg Poland-Slovakia Program, partners: Podkarpacka Regional Tourism Organization and Slovakian Carpathian Euroregion Slovensko-Sever),
- Wallachian Culture Trail on the Polish-Ukrainian Borderland (Cross-Border Cooperation Program Poland-Belarus-Ukraine 2014-2020, partners: Association for the Development and Promotion of Podkarpacie 'Pro Carpathia' and Association of Self-Governments 'Euroregion Carpathians-Ukraine'),
- On the Way of Culture and Craftsmanship - Sakiiai-Budry (Interreg Lithuania-Poland Cooperation Program 2014-2020, partners: Zanavykai Museum and Budry Municipality),

- Centers of Ancient Crafts on the Via Fabrilis Trail (Cross-Border Cooperation Program 2014-2020 Interreg V-A Czech Republic-Poland, project partners: City Municipality of Bolesławiec, City Municipality of Kłodzko, and Město Jaroměř).

As part of the Life Composed of Tradition project, the Crafts of the Borderland application was created, allowing not only to explore the craftsmanship of the Polish-Czech borderland but also to use of a map showing the tourist trail. In the application, users can search for crafts located nearby, artisan workshops, objects along the local crafts trail, information about crafts in Polish and Czech lands, as well as the tourist attractions and cultural heritage of the region (Medway, 2018).

The Craftsmanship Trail project is aimed at tourists interested in discovering forgotten occupations on the map of Małopolska (Foundation From Culture, n.d.). The Traditional Crafts Trail of Podkarpacie project focuses on documenting, preserving, and promoting traditional craftsmanship, its creators, cultural heritage, and the Podkarpacie region. The project partners note that traditional crafts and their creators are often located outside the main tourist routes, which is why a tourist-cultural trail with six tourist routes was developed as part of the project (Migut-Ciuba, n.d.).

Another project, the Historical Recipes Trail, is associated with a trail passing through the Podkarpackie Voivodeship and northern Slovakia. It marks places related to the artisanal production of regional products (Wilk, 2018). The Wallachian Culture Trail on the Polish-Ukrainian border is connected, among others, with the development of an integrated tourist product and the protection and promotion of the cultural and historical heritage of the borderland, including craftsmanship (PL-BY-UA 2014-2020, n.d.).

The On the Way of Culture and Craftsmanship - Sakiai-Budry project focuses on increasing the sustainable use of cultural and natural heritage in tourism in the transboundary area of Sakiai-Budry (Bulletin..., 2021). The main goal of the Centers of Ancient Crafts on the Via Fabrilis Trail project is to highlight the region's craftsmanship tradition and utilize its potential for developing thematic tourism throughout the transboundary area (Bulletin..., 2019).

Craftsmanship can be a tourist attraction of the region, a tourist product that responds to the 'yearning for bygone years', an idealized and mythologized yearning associated with a sense of lost continuity between the past and the present (Wieszaczewska, 2015; Nieroba et al., 2010). Therefore, the focus of this text is on craftsmanship treated as a tourist attraction. The aim of the article is to present the craftsmanship of the Opole Voivodeship in the context of its attractiveness and potential contribution to regional development.

2. Material and Methods

The article presents the results of a qualitative study conducted among craftsmen operating in the Opole Voivodeship. From April 17th to 28th, 2023, eleven individual, open, in-depth, and structured interviews were conducted using a questionnaire consisting of 16 questions. These questions were divided into three groups. The first group focused on understanding the craftsmen's opinions regarding consumer interest in craftsmanship and the directions for the development of craft products. The second group aimed to characterize the main recipients of local craft products and identify differences in preferences between domestic and foreign recipients. The third group was related to the possibilities of supporting the sale of regional craft products, including activities carried out by units representing local and regional authorities. The study assumed that craftsmanship, treated as a regional tourist product, influences regional development.

Analyzing the relatively few published materials on contemporary craftsmanship, statements have been encountered indicating that accessing craftsmanship is not a straightforward matter, partly due to craftsmen being the least represented group on the Internet (Wielkopolska Izba Rzemieślnicza w Poznaniu, n.d.). Furthermore, contemporary craftsmanship undergoes numerous dynamic transformations, making it difficult to confine it within strict definitions and rigid categories. Craftsmanship is also associated with 'bodily knowledge', knowledge acquired outside institutional frameworks of vocational education and guild structures (Malesińska, 2022). Craftsmen represent different disciplines and have varying levels of education. In Poland, compared to countries like Germany, there are no absolute requirements for validating craft skills (Jóźwiak, 2011). This contributes to the difficulty of creating a comprehensive list of individuals who identify themselves as craftsmen—professional craft creators actively engaged in the craft sector. Due to the complex nature of compiling such a list, which is not merely a roster of members affiliated with specific organizations or individuals with confirmed skills (completed formal education), the following contact path was planned when reaching out to craftsmen:

- Visiting events or fairs organized in the region where craftsmen from the Opole Voivodeship conduct workshops showcasing local craftsmanship techniques or exhibit their products.
- Contacting craftsmen who are actively involved in research and networking during scientific conferences, such as the International Scientific Conference on Crafts (CILRAID) organized by the Faculty of Economics and Management at Opole University of Technology.

- Searching the resources of the Internet to find craftsmen who have their own websites or profiles on social media, as well as websites of craft groups and associations.
- Reaching out to creators through e-commerce platforms that offer the sale of craft products.

The first access path, which involved participating in the craft workshops held at the Museum of the Opole Village [Muzeum Wsi Opolskiej], proved to be particularly useful in conducting the interviews. Craftsmen met at the workshops recommended contacting others, using the snowball sampling method, which is a non-random sampling technique applied when researchers have difficulties reaching respondents (Central Statistical Office, n.d.).

Six interviews were conducted in direct contact at the location of the craftsmen's workshops, while the remaining five were conducted via phone conversations, as preferred by the respondents. The interviewed craftsmen represented the following crafts: blacksmithing, leatherworking, artistic ceramics, hand-painted porcelain decoration, gingerbread making, crochet, handmade sewing of bags, backpacks, and similar accessories, and embroidery. The respondents had the choice of anonymous interviews or allowing their personal information to be mentioned in the text. Three respondents opted for anonymous interviews. For the purposes of this study and for uniformity, the respondents were assigned numbers from 1 to 11. These numbers were given in the order in which the interviews were conducted. The answers were transcribed by the researcher and then presented in the article in the form used by the craftsmen. It included the following elements: selection and arrangement of the data, breakdown of the responses to each of the research questions (respondents often answered questions from other thematic sections within one of the themes), interpretation of the data, and indication of the conclusions within each section. As part of the data obtained, a qualitative content analysis was conducted. Nine craftsmen sustain themselves through their represented craft (by offering goods and/or services) or supplement their retirement income, while two are no longer exclusively engaged in craftsmanship but pursue it more as a hobby than a source of income.

3. Results

3.1. Craftmanship as a support for demand side

When asked whether there is an increasing interest in local craft products, the majority of respondents indicated that they have noticed a positive trend both in the short and long term. 'Yes, definitely. It seems to me that many people are now buying and moving away from cheap Chinese products. I have been sewing for two years, and in my opinion, this trend has

been present for the past 5 years', said respondent 1. 'There is a significant growth, more interest than 20 years ago. You can see this growth', stated respondent 3.

According to the craftsmen, workshops showcasing craft art have also become very popular in recent years, especially among young people. There are usually more eager participants than available spots in the workshops. The motivation to participate in craft workshops is primarily driven by:

- Stress relief,
- Trying something new and unique. 'Only craftsmen cultivate this craft', mentioned respondent 6,
- Personal development of their own interests,
- Exchange of experiences,
- Learning about history,
- Engaging in hands-on manual creation. '(...) the opportunity for manual work', mentioned respondent 2,
- The trend of returning to certain traditions. 'In the past, this knowledge was passed down from mother to daughter, from grandmother to granddaughter, but it has been abandoned, and now the new generations are learning everything from scratch in workshops', explained respondent 10,
- Unexpected encounters with craftsmen. 'Sometimes it's people who come across a project and one of the points is a visit to the forge, but it doesn't always stem from their own need', described respondent 5.

Just as craft workshops were described by the creators as highly successful, craftwork and products made by craftsmen were associated with two contrasting opinions. Some craftsmen used terms like *in demand (...), you can notice the high number of products sold during events...* (respondent 9). The second group believed that craftwork is declining. *Craftwork (...) is neither promoted nor subsidized by the government. Last year, 220,000 small craft businesses went bankrupt. There is no help available, let alone considering the current economic hardship. Customers come, inquire about the price, thank us, and go to IKEA or Jysk for something cheaper. Our products are being sold but with difficulty. No one has control over it. Artistic crafts are at the bottom. Almost nothing is currently popular, maybe carpentry, windows, doors, not even furniture is popular* (respondent 7).

The modern consumer who chooses artisanal products is primarily interested in their practical application - items that are *not necessarily decorative (...), that I can use in everyday life* (respondent 1), and the desire to own unique and exceptional products, handmade in small series or made to individual order – *In manual work, no two pieces are the same. The creator does not reproduce previous art, there are no two identical items* (respondent 11). Despite this, consumers prefer their subsequent purchases to possess the same characteristics – *(...) repeatability, if they purchase a certain item, the next batch should have the same shape*

and colors. We move away from the artistic aspect and embrace a more artisanal approach (respondent 6). However, not all craftsmen currently produce products intended for practical use, so their products are aimed at people with special needs – (...) *the things I create are 80% based on my own design, and the client must have a certain spiritual need. I don't create first necessity projects; one can live without them* (respondent 5).

In addition, natural products made from recycled materials are also chosen. Craftsmen notice that traditional craftsmanship is embracing modernity, combining it with what is defined as traditional. Craftsmanship is heading towards ethno-design. *This can be dangerous for the tradition of craftsmanship because we are moving with the times. In 1996, Cepelia collapsed. Craftsmanship was an export commodity, and it can happen again. It's worth preserving tradition, on the one hand, we want tradition, but we consider it too cumbersome'* (respondent 8). *'I had contact with England and Ireland. Craftsmanship is valued differently there. They don't have it; there are no schools or workshops. Foreign delegations that come to Poland envy us for cherishing and safeguarding our tradition* (respondent 7).

Recipients of regional craftsmanship can be divided into several groups. The first typology proposed by the respondents distinguishes buyers as local residents and those from outside the area/region, primarily tourists. *In my town, many people buy and support me because I'm from here. They come here. It was supposed to be challenging in a small town, but many people come back and make purchases. My products are most commonly acquired by residents from the immediate vicinity, the local market* (respondent 1). The second division includes Polish and foreign recipients. The third division highlights primarily men and women, as well as children, young people, and adults. *There may be a minimal difference in age groups; porcelain connoisseurs are usually the older age group (...). Opolskie Dziouchy (regional craftswomen) have ethno-design aimed at younger people. It involves transferring a traditional pattern fragment to other products. However, it is not chosen by veterans and connoisseurs. The younger generation likes it when only a fragment is present; it is much 'lighter.' In the past, the entire surface had to be painted, but that is popular among the older generation* (respondent 9). For example, connoisseurs prefer Opole porcelain not only signed by the craftsman but also marked with a date.

In summary, the most common characteristics of recipients of Opole Silesia craftsmanship include groups such as Poles, local/regional population, women and children regardless of age.

Within the second typology, artisans observe that there is no specific rule or pattern distinguishing the preferences of Polish and foreign customers. *There are no rules whether it's a Pole, a German, or a Ukrainian, it depends on the need for a particular item. If someone cares about the aesthetics of their interior, they seek coherence and buy a detail that fits with something else they already have* (respondent 5). *Hitting the taste and aesthetics is important* (respondent 8). There are also collectors referred to as 'enthusiasts, collectors' (respondent 7). In addition to individual customers, craftsmanship is also acquired by institutions. *Entities*

that resell it, galleries, gift shops, especially in tourist cities such as Kołobrzeg, Kraków, Kazimierz Dolny, or Białystok. They find us online, some during major fairs. They come and look for creators who can fulfill orders (respondent 6). Other larger orders come from universities or government offices that plan foreign visits or expect guests and want to promote regional products. Young Poles living in Sweden and the UK, who have taken over sales points and want to sell Polish handicrafts abroad. *One lady in Ulm bought a tenement and opened an art gallery, and there is a legend about sparrows, and she buys many of my sparrows, which are sold there as their tourist product* (respondent 6).

The respondents were asked which countries their works/products are sold to, and they mentioned: England, the Netherlands, the USA, Canada, China, Germany, the Czech Republic, Italy, Sweden, and Norway. *I have many friends in the Netherlands, my acquaintances, my friends, they order products and take them with them. Many people from my surroundings have moved to the Netherlands and England, they come during the pre-Christmas period and buy for themselves and their loved ones* (respondent 1). *There were also individual customers planning to travel with Opole handicrafts to Africa, Brazil, Hong Kong, Iran, or the Hawaiian Islands. The peak of Polish handicraft sales (among foreigners) occurred in the 1960s and 1970s. Cepelia had a lot of foreign orders* (respondent 11).

Foreign recipients are attracted to Opole craftsmanship not only for its aesthetic value but also for the price of the handicraft, which *is a very significant factor that encourages and often determines the purchase. It discourages customers in Poland, but it attracts foreign recipients. Tourists are often willing to spend more on a product than local customers* (respondent 2). Both Polish and foreign recipients pay great attention to the quality of craftsmanship and the quality of materials, *whether the product comes from organic cultivation, how it tastes, how many active ingredients it contains, whether it is made using traditional methods* (respondent 4). Sometimes, the phrase ‘handcrafted product’ itself is an enticing factor – *People from abroad are more fascinated by the fact that it is a handmade, artisanal product* (respondent 8).

3.2. Craftmanship as support for the supply side

The surveyed craftsmen were eager to discuss the importance of external support, particularly related to:

- **Organizing fairs and markets:** *I think there should be more fairs and markets to reach customers. Not everyone can visit a specific workshop or store. It can be difficult to access craftsmanship at times* (respondent 1); *In our region, there are attractive markets and fairs of all kinds. It is challenging for every craftsman to open their own shop because online sales can be impossible, especially for the older generation. However, there are always many people at fairs and markets who will find something for themselves. Thousands of people attend these events* (respondent 9).

- Increasing awareness of regional traditions: *Among the local population, it is necessary to increase awareness of traditions in the region. An excellent foreign example is Bavaria, where people walk around the city in traditional costumes. It is challenging for us to find out how such costumes looked. When it comes to Poland, promoting local traditions is crucial* (respondent 2).
- Establishing a regional craft museum: *The best solution would be to create a craft museum! A strictly craft-oriented museum* (respondent 7).
- Educating future generations: *Education is crucial, starting from a young age, from childhood. I see it in my grandchildren; some are interested, and others are not. It depends a lot on the values transmitted at home* (respondent 3); *Creators must promote and showcase their work, organizing workshops on a broader scale* (respondent 10).
- Conducting marketing campaigns: *Promote through advertisements in newspapers, television, and participate in thematic events* (respondent 4); *Online promotion works very well...* (respondent 6).
- Introducing new legal solutions: *There must be new legislation regarding craftsmanship. New aspects should be associated with greater interest from the government to recognize this significant job market* (respondent 7); *In Poland, running a business is already expensive from the start. If there's a creator who also works an 8-hour job and creates handmade items, wanting to have their own booth, they would have to bear the cost and hire an accountant for help with tax returns, which could cost 700 PLN just to enter, not to mention the space to work and taxes. These are enormous expenses* (respondent 2); *Lower taxes* (respondent 3).

The discussion about the possibility of registering trademarks took two directions. One line of argumentation was primarily related to the cost aspect of such actions: *Everything is associated with costs, so obtaining a patent that can be easily invalidated because another company slightly changes the shape or color, and you can't accuse them of copying...* (respondent 6); *A trademark must be registered and patented, and it's not easy. Registration is possible, but patenting is costly. It costs around 2,000 PLN for two years. Most craftsmen cannot afford it... It can't be that one craftsman patents something that is produced in the entire region; it should be the region (Marshal) who patents it, for example, kroszonka¹ or hand-decorated porcelain* (respondent 7).

The last discussed topic was the design pattern, and it was described as difficult and complicated to provide a definitive answer: *This is a tough topic, not the design pattern itself. In most cases, these things are listed on the national cultural heritage list, accessible to everyone. Folk creators cannot copyright their painting patterns on porcelain or kroszonka. By copyrighting something, you cannot pass it on to future generations. Each person has their*

¹ Easter egg.

own developed style, but formal trademark registration does not allow for that. However, everyone can develop their own brand. Otherwise, it will disappear at some point if we continue to operate this way (respondent 10).

In particular, the first aspect was related to the involvement of local/regional authorities in promoting or supporting the sale of regional craftsmanship products: *Yes, by organizing fairs, markets (respondent 1); All kinds of entertainment events are good occasions to present local products or services. In the municipality where I live, cooperative fairs are organized every year, where companies showcase their local services and products (respondent 4); For example, cooperation with the city council and the regional office, representing them at various events in the country and abroad. It requires years of work and establishing contacts (respondent 5).*

In connection with local/regional authorities, the promotion aspect highlighted by craftsmen also involved using regional craftsmanship products to promote the region beyond its borders, including outside Poland, and during visits by people from 'outside' the region: *Of course, they do that. When they go anywhere, they visit partner cities or new institutions with which they want to collaborate (respondent 6).* Promoting the region through craftsmanship products was also discussed in the context of the need to develop 'promotional packages'. Municipalities could create such 'promotional packages', for example: *Each region has its own costume, a type of embroidery. There's wickerwork, and it could be a small basket made of wicker with herbal tea in a sachet and something embroidered. A local gadget with the municipality's logo magnet (respondent 10).*

The current situation and support from the authorities are appreciated by artisans: *The municipality has done a lot for me by commissioning the creation of huge kroszonka and making giant cups, with the largest one standing in the center of Gogolin. They promote my work and its elements abroad. I attribute a significant role to both our municipality and the county (...) (respondent 11).* Municipalities provide places for selling regional craftsmanship products: *Yes, they do that, but I don't have specific examples from the Opole Voivodeship. In Lower Silesia, the Chamber of Crafts proposed offering free exhibition spaces to creators like me. They created such places to promote these units and make the city more attractive. There are costs involved, which often eliminate creators like me at the start. The costs can be as high as 15,000 PLN, and craftsmen often don't have goods worth that amount. During Christmas, 5-10 cottages were made available for the entire duration of the fairs, free of charge for 7 days. Only a deposit was required to ensure the cottage wouldn't be damaged, and despite that, there are artisans who don't want to take advantage of it because it's cold or they think no one will buy, etc. (respondent 6).* Furthermore, *there are designated marketplaces in every municipality. I think a craftsman would like to set up during various events, and there are no issues with that. Christmas markets, Palm Sunday markets, Easter markets. Older people are accustomed to receiving personal invitations to such events, but unfortunately, that's changing. If there's an event, they need to apply for it. We make*

posters for Easter, asking who wants to exhibit, but older people don't respond to such things. Younger generations use Facebook, websites, and other social media, but older people still need personalized paper invitations (respondent 10).

Regarding the question about the possibility of selling their own products under the patronage of a specific institution/organization, among the seven craftsmen, there were negative responses with various arguments: *Not yet, for now, I want to sell on my own, and it's going well so far* (respondent 1); *Not me, I can't keep up with production* (respondent 3); *Only under my own name, higher-level institutions increase prices without informing the craftsman* (respondent 7); *No, due to previous experiences* (respondent 9). Other individuals either already sell their products that way: *That's mainly how it happens. Some people mention and provide my information, while others claim it's their work because they fear competition. When selling my work, I have to consider that wholesalers also buy it, produce it, and sell it to other florists. Small products, ceramic elements that will be used in floral arrangements* (respondent 6). Some are already working on such solutions: *We have been considering having a showcase with products at the House of Culture for some time now, but it's a process to get residents and tourists used to the idea* (respondent 10). Others are considering the possibility: (...) *I think if an organization provided conditions that greatly facilitate such activities, I could consider it. Having my own brand but within an association. I would like to work under my logo and not mold myself under someone else's logo* (respondent 2).

3.3. The impact on regional development

All surveyed craftsmen recognize the opportunity in regional products as a tool for promoting the region in Poland and beyond its borders: *Definitely, for example, the association I belong to is going to our twin city in Germany to promote the city with my products* (respondent 2); *Of course, one of our local products is already available for purchase in Krakow* (respondent 4); *Of course, yes. If the government uses porcelain, they can certainly use artisanal porcelain decorated by craftsmen. Municipalities prepare gifts and presents, and they could use artisanal products instead of just flowers* (respondent 7); *Of course, it's essential. It has always been that way. In the 1970s, international delegations always took folk artists for shows to introduce the culture of the country they were visiting. They traveled a lot. I wonder why it doesn't happen now* (respondent 8); *Of course, yes. Not everyone may recognize me, but they recognize the choice - Opole!!! They didn't know the language, but they said Opole has come again, Opole is here! Opole products. Opole porcelain is very suitable and is often chosen by regional/city authorities* (respondent 9).

The respondents also proposed their suggestions for products that could promote the Opole region, including:

- Keychain cases and shopping bags,
- Ceramics and jewelry,
- Clothing items,
- Products adorned with patterns,
- Food products, including honey,
- Miniature coats of arms,
- Stained glass,
- Herbal medicine and herbalism,
- Wicker products.

In addition to specific products, there is also a recognized need for the creation of craft tourism routes, such as a wicker route along the Oder River or others centered around regionally characteristic products, including: (...) *kroszonka, honey, and I would really like traditional embroidery, wickerwork, herbalism, and herbal medicine to be included...* (respondent 10).

In summary, craftsmanship is perceived by the craftsmen themselves as a field that quickly adapts to economic realities. They expressed the opinion that craftsmen will find their place in the current trends. Attention was particularly drawn to issues related to the higher quality of artisanal products compared to mass production. It seems natural that demand for certain products/services diminishes while new demand emerges. The perception of artisanal products and their social function is also changing. Coexistence with cheap mass production means that craftsmanship now more often occupies the niche of original and unique products. Furthermore, social transformations mean that many people are seeking activities based on manual labor, natural materials, and close interaction with the community. In this regard, craftsmanship offers appropriate opportunities such as workshops, demonstrations, and education to promote traditions in a given region. It should also be noted that craftsmen are custodians of cultural heritage and contribute to local identity. These functions are primarily recognized and supported by institutions and public bodies involved in the field of crafts (museums, centers, fairs, exhibitions, etc.), and thanks to their efforts, craftsmanship creatively transposes traditional values, enriching contemporary communities.

4. Discussion

The topic of the ‘return’ to craftsmanship, the ‘craft renaissance’, the ‘new craftsmanship’, or the impending ‘second wave’ is a new but increasingly discussed subject in

the media and literature of the field (Property Design, 2022; Museum of Warsaw's Praga, 2019; Herman, 2019; Nowe rzemiosło, 2019; Polich, 2022; Sadowy, Brodowicz, 2021; Basuki et al., 2022; Mazur-Włodarczyk, Drosik, 2019; 2022). The recent changes in the craft landscape include identity transformations (changes in craftsmen's identification with regard to the traditions of dual education, manual labor, the use of specific tools and machines, the nature of craft work, and the socio-economic and cultural mission of craftsmanship). Additionally, effective communication tools of the 'new craftsman' are being utilized, including marketing skills, such as storytelling (Malesińska, 2022, pp. 14, 16).

On the other hand, craftsmanship plays a crucial role in preserving cultural heritage, representing the culmination of a master's expertise and artistic expression. It encompasses the transfer of knowledge, skills, and craft culture to the succeeding generation of artisans. The education and training in craftsmanship rely heavily on the trust between the master and their apprentices, as well as the master's dedication to the craft. Young individuals benefit greatly from the master's commitment, as it allows them to acquire the necessary qualifications and expertise in their chosen craft (Bielawska, 2016).

Moreover, craft is not only a means of creating objects, but it also encompasses a unique mindset characterized by collaboration, inclusivity, and adaptability to the evolving natural world. In the context of shifting away from the prevailing 'take, make, and waste' production model towards a more circular approach, craft becomes indispensable (Crafts Council, 2023). Traditional knowledge and practices hold significant importance in discussions surrounding the planet and the urgent issue of climate change.

Craftsmanship can be a regional potential that contributes to the development of a particular area. According to Klasik (2013, p. 45), regional development policy encompasses four thematic areas that consider the region as:

- a territory that possesses its natural and cultural heritage,
- a community that has human and social capital, including complex capital, which refers to creative and entrepreneurial capital,
- a network of institutions, connections, and flows,
- a structure of activities composed of industries with varying levels of technological advancement and creative industries stemming from knowledge, research, creativity, and culture. Transitioning from the classical approach to specialization, understood as engaging in selected industries, to smart specialization, understood as the process of effectively and efficiently utilizing the region's endogenous potential, requires the creation of networks and connections among various entities, both from the public and private sectors, operating in the region (Badanie potencjałów..., 2014). As emphasized by Klasik (2013, p. 48), the areas of smart specialization in Polish regions will become increasingly linked to the creative economy, including culture and heritage.

Table 1 shows the sectors and potentials of crafts, and the observed multiplier effects and inspirations in economic activity.

Table 1.
Craftsmanship as a stimulator of regional development

<p style="text-align: center;">Sectors and potentials of the crafts industry. Crafts directly generating economic activity.</p>	<p style="text-align: center;">Observed multiplier effects and inspirations (in economic activity). Indirect impact of craftsmanship.</p>
<p>Cultural tourism</p> <ul style="list-style-type: none"> • Traveling and visiting places to discover heritage, such as cultural routes, historic sites, galleries and museums, open-air museums (skansens), park and garden areas, archaeological sites, battlefields, and industrial heritage. • Staying in hotels located in historic buildings, and visiting traditional gastronomy venues. • Activities of tour guides and tourist guides. • Activities related to tourist information services. 	<p>Tourism</p>
<p>Creative cultural heritage industry</p> <ul style="list-style-type: none"> • Publishing activities (museum catalogs, posters, heritage institution informational materials). • Music industry (folklore groups, traditional or local music). • Photography (archaeological photos, panoramas, pictures of historic sites). • IT (databases, e-museums, museum websites, geoportals, digitization of heritage resources). • Organization of fairs. • Intellectual property industry: revenues generated from the sale and use of recipes, patents, traditional and regional names. • Craftsmanship is often associated with the production of unique and original products that serve as a hallmark of the region. 	<p>Creative industries</p>
<p>Traditional crafts</p> <ul style="list-style-type: none"> • Activities of traditional professions (cooper, shoemaker, blacksmith, baker, etc.). • Traditional textile products. • Leather production. • Handicraft. • Basketry. 	<p>Small and micro-enterprises encompassing traditional crafts</p>
<p>Popularization, information, and education of craftsmanship, craft conferences</p> <ul style="list-style-type: none"> • Educational activities: lessons, museum workshops, craft and heritage days, teaching traditional professions. • Craftsmanship can be a tool for learning about local history, culture, and traditions. • Artistic education. • Entertainment activities based on heritage: historical reenactments, festivals, fairs. • Activities of government entities, private organizations, and associations aimed at popularizing craftsmanship. • Craft as a learning organization. Passing down knowledge from generation to generation. 	<p>Education. Craft as a learning organization</p>
<p>Art and Antiques Market</p> <ul style="list-style-type: none"> • Buying and selling of craft products in the market. • Activities of private entities (collectors, investors) and public institutions (museums, galleries). • Gaining foreign investors. 	<p>Commerce or Trade</p>
<p>Craft Heritage Protection Industry</p> <ul style="list-style-type: none"> • Activities of institutions involved in supporting craftsmanship. • Craftsmanship can help build regional identity and contribute to the preservation of cultural heritage. • Conferences, exhibitions. • Maintenance of regional traditions. 	<p>Culture. Craftsmanship perceived through the prism of cultural heritage</p>

Cont. table 1.

Promotion of the region on the international stage. <ul style="list-style-type: none"> • Activities of institutions involved in supporting craftsmanship. • Conferences, exhibitions. • Integrating the local community around common activities. • Collaboration in crafting and promoting local products can build a sense of community and pride in regional identity. • Contribution to increasing the attractiveness of the region for investors and tourists by promoting regional identity and culture. 	Promotion and integration
Economic development <ul style="list-style-type: none"> • Generating new jobs and increasing economic activity in a specific field. • Craft production often requires specialized knowledge and skills, which promote the development of local businesses and have a positive impact on the local economy. • Attracting tourists who want to learn about traditional production methods and purchase unique handicrafts. • Creating and promoting local products. Communities can foster a strong sense of unity and pride in their regional heritage. • Promoting regional identity and culture can also enhance the region's appeal to investors and tourists, contributing to its overall attractiveness. • Increasing the investment attractiveness of the region. • Craftsmanship as an element in regional development strategies. Craft can contribute to improving the quality of life for residents in the region. 	Economy

Source: own elaboration.

The starting point for identifying regional specializations is associated with developmental potential, which is also linked to the strengths of a given region. Developmental potential refers to a characteristic or set of characteristics that currently or potentially influence the possibilities, directions, and nature of regional development. We can understand the potential as features that currently constitute the strength and dynamism of development but also as features that require support to enable the achievement of the desired developmental state (Dziemianowicz et al., 2014, pp. 7-8). Developmental potential can be incomplete if it represents lost potential (permanently or temporarily) or dormant if it is not fully and effectively utilized. In regional development policy, it is important to focus on stimulating dormant potentials, that is, shifting from passive to active, as with appropriate interventions, they can generate satisfying multiplier effects in the near future (Węclawowicz, 2005, p. 7).

Regional potentials can be divided and grouped in various ways. According to Dziemianowicz et al. (2014), there are five groups of potentials that mutually intersect. These include:

1. Demographic-Social Potentials: They relate to the characteristics and human resources in the region, such as population size, demographic structure, education, skills, and social capital. These potentials have a significant impact on community development and the region's growth opportunities.

2. **Natural-Cultural Potentials:** They encompass unique natural resources, such as natural materials, landscapes, protected areas, as well as cultural heritage, traditions, art, and the region's culture. Utilizing these potentials can contribute to the development of tourism, creativity, and environmental conservation.
3. **Economic Potentials:** They refer to the region's ability to generate income and create employment opportunities. These include economic sectors such as industry, services, agriculture, tourism, as well as innovation and entrepreneurship. These potentials are essential for economic growth and employment in the region.
4. **Institutional Potentials:** They pertain to the institutional structure of the region, including public administration, social organizations, universities, research centers, and financial institutions. Strong institutions and cooperation among them can stimulate innovation, knowledge transfer, and regional development.
5. **Spatial Potentials:** They concern the physical and spatial characteristics of the region, such as infrastructure, transportation accessibility, environmental quality, and spatial planning. Proper spatial planning and infrastructure development can influence the competitiveness and attractiveness of the region.

The identified groups of potentials, namely demographic-social, natural-cultural, economic, institutional, and spatial, highlighted by Dziemianowicz et al. (2014), form the basis for regional development analysis and planning.

Building on the previous findings, it can be indicated that craftsmanship is a regional potential that permeates all the mentioned groups.

Craftsmanship plays an important role in regional development in several ways. Firstly, it can contribute to the region's economic development by generating new jobs and increasing economic activity in a specific field. Craftsmanship can also attract tourists who want to learn about traditional production methods and purchase unique handicrafts.

Secondly, craftsmanship can contribute to the preservation of cultural heritage and the maintenance of regional traditions. Products crafted in this way are often associated with local history and culture, and their production requires specialized knowledge and skills that are passed down from generation to generation.

Thirdly, craftsmanship can contribute to sustainable regional development by utilizing local resources and production techniques, reducing environmental impact, and increasing self-sufficiency in comparison to imported products.

Therefore, supporting craftsmanship can have a positive impact on regional development, contribute to the preservation of cultural heritage and traditions, as well as promote sustainable development.

Craftsmanship can also influence the social development of the region by integrating the local community around common activities. Collaboration in crafting and promoting local products can build a sense of community and pride in regional identity.

Moreover, craftsmanship can also provide an alternative to mass production and consumption, encouraging people to appreciate the value of handmade work, quality, and product durability. In this way, craftsmanship can bring about cultural change by reducing consumerism and promoting a more sustainable lifestyle.

It is also worth noting that craftsmanship can be used as a tool for social integration and combating social exclusion by creating job opportunities for people with disabilities, older individuals, or the unemployed.

Ultimately, the development of craftsmanship can contribute to increasing the attractiveness of the region for investors and tourists by promoting regional identity and culture. In this way, craftsmanship can be an important element in regional development strategies and contribute to improving the quality of life for residents in the region.

Additionally, craftsmanship is inseparably linked to regional identity and culture as it is based on local traditions and production techniques. For this reason, regional development perspective of craftsmanship is crucial for preserving cultural heritage and building regional identity. Craftsmanship is often associated with the production of unique and original products that serve as a hallmark of the region. Products crafted in this way are often connected to local history, culture, and landscapes, forming an integral part of the local cultural heritage. Supporting craftsmanship can contribute to the preservation of this heritage and its transmission to future generations.

Craftsmanship can also contribute to regional development by increasing employment and economic activity in the region. Craft production often requires specialized knowledge and skills, which promote the development of local businesses and have a positive impact on the local economy.

Supporting craftsmanship can also increase cultural awareness and education among residents of the region. Craftsmanship can be a tool for learning about local history, culture, and traditions. In this way, the development of craftsmanship can help build regional identity and contribute to the preservation of cultural heritage.

At the same time, the development of craftsmanship can also pose challenges for regions that need to respond to changing trends in design and the market. To meet these challenges, regional organizations and businesses must become more innovative, open to change, and willing to adopt new technologies.

In summary, craftsmanship has many positive effects on regional development, including generating new jobs, preserving cultural heritage, promoting sustainable development, social integration, cultural change, and attracting investors and tourists. Craftsmanship is an important element of local identity and can contribute to promoting the region as an attractive place to live, work, and visit.

Overall, these above-mentioned characteristics of craftsmanship contribute to the sustainable development of the region, particularly in economic, social, educational, and environmental aspects. Craftsmanship has the capacity to serve as a regional asset that plays a role in the advancement of a specific locality. As a result, it promotes long-term economic growth through synergistic effects, considering the collaboration among diverse market actors within the region (Karaś & Łukaniszyn-Domaszewska, 2022).

5. Conclusion

Some of the regional resources and capabilities are exploited but not always fully utilized in regional development. Craftsmanship is one of these endogenous resources (Gałązka, 2017). Regional products, including handicrafts, shape the image of the region where they are created and made available. They play an important role in regional development and encourage visits to the region, serving as its hallmark (KARR, 2021) and advertisement.

The article characterizes the reasons for the interest in regional craftsmanship and identifies the main target groups for crafts in the Opole Silesia region, as well as the characteristics of popular handicraft products, primarily those with practical applications, handcrafted, and characterized by high quality. The paper also highlights the direction of development for handicraft products, which are based on tradition but feature modified designs. Craftsmen surveyed perceive an increase in interest in local handicraft products, including workshops run by craftsmen. No significant differences were observed between the preferences of foreign and domestic craft recipients. Opole Silesia craftsmanship is a regional tourism product that is utilized not only within the Opole Voivodeship. Craftsmen emphasize the importance of support from local and regional authorities, particularly in terms of enabling consumers to access their workshops/products through the organization of fairs and exhibitions, disseminating information about regional traditions, education, and implementing new legal solutions. Proposed solutions aimed at the development of craftsmanship include establishing a regional craft museum, developing packages of craft products that can serve as promotional items at the local and regional level, further promoting regional crafts through educational workshops and the use of regional craft products during delegations, as well as creating craft routes within the voivodeship.

However, it should be emphasized that the conclusions are preliminary in nature, resulting, among other things, from the small number of interviews conducted and the diversity of specialized respondents recruited. This indicates the need to continue exploring the chosen topic and increase the number of interviews, ensuring a balanced representation within various craft specializations. Moreover, the study covered only one side of the market

participants - the producers of craft goods and services. Therefore, for a broader and more multi-faceted representation of the chosen topic, consideration is being given to conducting a survey of other market participants in the future, such as consumers of craft goods and local government agencies.

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THE ROLE OF THE STATE IN THE FORMATION OF MIGRATION ATTRACTIVENESS – EXAMPLE OF UKRAINE AND POLAND

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Purpose: The purpose of the article was to describe migration issues based on the example of current Polish-Ukrainian migration processes.

Design/methodology/approach: When writing a scientific article, methods of analysis and synthesis of scientific literature were used; descriptive method of the main indicators that affect the migratory attractiveness of the state; method of generalization when forming general conclusions based on research results.

Findings: In particular, on the basis of the method of analysis and the system of scientific literature, it was determined that the issue of attractiveness of states is discussed by scientists especially in terms of its individual types: investment; economic; tourist; migration. Studying migration processes, some scientists analyze the peculiarities of migration processes, identify the most popular types of migration that are characteristic of one or another country, while others focus more on the positive and negative consequences of migration.

Originality/value: The article describes the current situation of Polish-Ukrainian migration, its scale, types, and causes. The problem of migration is presented in the context of the needs and interests of the countries in question.

Keywords: migration, migration attractiveness, socio-demographic indicators, population migration.

Category of the paper: General review.

1. Introduction

Migration processes are one of the main factors that determine the directions of formation and specifics of the development of production capacities of any state. Population migration is related to economic, social, political, religious, environmental and other aspects of society. Population migration is one of the most vivid indicators of the state's development. It causes changes in the demographic situation both in the donor country and in the recipient country. It affects economic processes, the value of GDP and GNP of countries, defines the main priority industries that can be developed under certain migration conditions. At the same time, the consequences of migration can be both positive and negative, so migration processes require state management. In recent years, migration has turned from an opportunity to improve one's financial situation into an escape from harsh reality in order to preserve one's life. It became especially relevant for Ukrainians who were forced to leave their homes because of the war in the last year. That is why it is important to promptly respond to the state migration policy to the challenges that arise due to population migration.

At the same time, a potential migrant, when making a decision to change his place of permanent residence, quite often has an idea of the state as a whole, and not of individual indicators of the standard of living in it. But it is the system of indicators that forms the perception of this or that state and collectively determines the level of its migration attractiveness. At the same time, the value of the indicators depends on the efficiency of state regulation of social processes. Inefficient state regulation leads to a situation where some states become more attractive for population immigration, while others, on the contrary, have problems caused by population emigration. Therefore, it is expedient to analyze the role of the state in shaping its migration attractiveness.

2. Methods

When writing a scientific article, methods of analysis and synthesis of scientific literature were used; descriptive method of the main indicators that affect the migratory attractiveness of the state; method of generalization when forming general conclusions based on research results. In particular, on the basis of the method of analysis and the system of scientific literature, it was determined that the issue of attractiveness of states is discussed by scientists especially in terms of its individual types: investment; economic; tourist; migration. Studying migration processes, some scientists analyze the peculiarities of migration processes, identify the most popular types of migration that are characteristic of one or another country, while others focus more on the positive and negative consequences of migration.

3. Results

Today, the existence of any state, its development, socio-economic changes largely depend on the migration processes taking place in all states without exception. At acceptable levels, migration can contribute to the development of the state, the exchange of highly qualified personnel, the improvement of demographic indicators, and the growth of migration capital. However, with high rates of population migration, the situation may become critical for the country. This especially applies to emigration of the population, when young people often leave the country in search of a better life and usually do not return to their homeland.

Let us emphasize that scientists pay great attention to the study of the causes and consequences of external migration. In particular, P. Cortes investigates the impact of women's migration on the well-being of their families, relationships with children, husbands; the emergence of social orphanhood, in which parents are far from children and children are brought up by close relatives in the best case, and in the worst - "on the street". The author paid special attention to determining the effects of money income from parents on children and concluded that the more negative consequences for children will be in the absence of a mother, rather than a father (Cortes, 2023). Environmental problems are one of the equally important reasons for population migration. Environmental pollution, poor water supply, unfavorable climate, sharp changes in air temperature, air and water pollution by various emissions also cause population emigration. The same reasons are relevant for both Ukraine and Poland.

Another foreign publication notes the spread of economic and social problems, ethnic conflicts, which have increased the flow of migrants to European countries, and this is becoming a big problem and challenge for EU countries. The mass flow of refugees to European countries caused the spread of terrorism, smuggling, illegal population migration, a humanitarian crisis, and a weakening of the protection of national interests. Thus, there are more than enough reasons for migration. Speaking for Ukraine, the war in the state only intensified the process of unregulated migration, which, in turn, aggravated other problems even more. A significant part of Ukrainian migrants in the first months of the full-scale war ended up in Poland, which affected the socio-economic indicators of both states. That is why every state must respond to the realities of today and develop and implement appropriate steps to regulate migration flows. First of all, such a policy should be aimed not at smoothing the consequences of migration, but at solving the reasons for the spread of population migration.

Thus, according to the State Border Service of Ukraine, from February 24 to May 24, 2022 (in the first three months of the full-scale war in Ukraine), border guards processed more than 7.4 million people who crossed the border in both directions. Of these, more than 4.8 million people were sent to leave the country, most of them citizens of Ukraine. More than 2.2 million Ukrainians have entered Ukraine [DPS Ukraine, 2022]. According to the UN Refugee Agency, as of June 19, 2023, there are about 6 million refugees in Europe who left Ukraine due to the

war (Refugees from Ukraine recorded across Europe, 2023). Russia's large-scale war against Ukraine has a very bad effect on the demographic situation, the consequences of which are still to come.

As E. Libanova notes: "We will lose many people: due to the increase in mortality, due to the decrease in the birth rate. Many children who would have been born, they were not born in 2022 and even more so will not be born next year, 2023. And if the war drags on even longer, then in 2024. And migration will have the greatest numerical impact" (Libanova, 2022).

Due to military actions, Ukraine partially loses its migration attractiveness, primarily because of the war. The population is shrinking due to increased mortality and emigration of the usually young population. This, in turn, will affect the demographic, economic and social indicators of the state's development in the future. At the same time, some European countries, in particular Poland, Germany, France, Sweden, Great Britain, are increasing their migratory attractiveness, which is evident in the increase in the number of migrants moving to these countries (Madejski, 2023). In Poland, the number of immigrants increases annually largely due to the migration of Ukrainians.

But what is migration attractiveness and what indicators characterize it? Migration attractiveness is one of the main factors in the movement of migration flows from less developed regions and states to more developed ones. One of the ways to assess the migratory attractiveness of the state is to take into account the territorial movements of the population. According to this approach, the main indicator of the migration attractiveness of the territory is the migration load factor per 1000 people.

Determining the level of migration attractiveness of the region requires taking into account various indicators affecting it. These may include: a high concentration of well-paid jobs; (Szafraniec, 2021). A factor contributing to the development of the state and increasing its competitiveness is the development of tourism, thanks to which you can show all the positive aspects of your state (Cader, 2021). Among the factors of attractiveness of the region: cultural environment and employment opportunities; developed infrastructure; comfort of life; higher social standards; favorable environmental situation; mentality, common ideology. At the same time, the factors that make the region unattractive are the low quality of life, the lack of opportunities for career growth and obtaining a high-paying job, and a high level of crime (Vasylytsiv, 2021).

Migration flows are often characterized by dynamism and irregularity, which is due to the influence of many factors, which the author divides into three groups: socio-demographic, economic and political. In particular, socio-demographic factors reflect the level of demographic attractiveness of the region and are quite influential on a potential migrant, because they to some extent reflect the standard of living in the region.

At the same time, factors affecting the migratory attractiveness of the region can be divided into the following groups: geoeconomic (geographical position of the region, natural resource potential, ecology); economic (level of economic development of the region, infrastructure,

development of certain types of industry, level of income of the population and living wage); cultural and demographic (population density, age structure of the population, value system, social infrastructure. Table 1 presents a system of indicators that affect the level of migration attractiveness of regions.

Table 1.

Indicators characterizing the migratory attractiveness of the territory

<i>Demographic indicators</i>	<i>Social indicators</i>
Birth rate	Employment level of the population
Mortality rate	The unemployment rate of the population
The ratio of men to women	The number of students per 100,000 people
Age ratios of the population	Providing the population with doctors
The share of the urban and rural population in the total population	Number of educational institutions
Population density	
<i>Economic indicators</i>	<i>Indicators of the standard of living</i>
The level of economic activity of the population	Average salary
The level of GDP and GRP per capita	Average pension
Consumer price indices for goods and services	Salary arrears
Tariffs for housing and communal services	The amount of the subsistence minimum
Others	Average area of residential premises per citizen

It should be remembered that all countries of the world are divided into donor countries and recipient countries in terms of population migration. Migrants, choosing the country in which they want to live, focus on many different indicators, which together give an idea of how such a country develops and what a migrant can get there. Migrants are usually young people who, choosing a country, evaluate the opportunities for education, further employment, the level of wages and the level of utility costs, and opportunities for personal development. The older generation, if they decide to move, go to relatives, children, friends. The issue of employment is not a priority for them. That is why countries that want to develop should form their migration attractiveness based on the requests of migrants, in order to attract foreigners who will contribute to the development of this state.

Now almost all countries implement a policy of attracting foreign students, because this type of migration is considered the most desirable and has a number of positive consequences. Necessary conditions for educational migration are: capacity for educational activity, desire and opportunity to carry it out; availability of relevant educational institutions in the country (region); the advantage of the influence of the factors of educational migration over the desire to stay in the country (region) of residence.

A specific feature of educational migration is its least harmful nature, unlike other types of migration. The desirability of educational migration is determined by income not only for the educational sector (or a separate university), but also for the economy of the country (region) that provides educational services, as a whole. In addition, consumers of educational services are a potential workforce of appropriate qualifications. In the structure of general migration flows, educational migration is determined by the satisfaction of the social need for education

and raising the level of qualifications. At the same time, educational migration can to a certain extent correspond to the patterns of both social and economic types of migration (Kis, Mosora, Bembenek, 2020).

At the same time, scientists note a number of advantages of educational migration specifically for countries receiving foreign students. Advantages are highlighted, namely: significant financial revenues to the budget of national economies, development of the tourism industry and increased revenues from the growth of tourist flows; development of innovative and material and technical components of the educational sector, expansion of the range of educational services and accelerated integration of national institutions of higher education into the international educational and scientific space; improvement of demographic indicators due to the rejuvenation of the population structure and its quantitative increase; intellectualization of human capital and potential supply of the country's national economy with highly qualified specialists, which, in turn, accelerates scientific and technical progress and economic development of countries (Levytska, 2022). Educational migration actually became a megatrend of the 21st century. It is in the era of globalization that the issues of internationalization of higher education, improvement of educational mobility, and, as a result, an increase in the number of educational migrants traveling to another country in search of knowledge, expanding horizons, and improving the professional and social environment are becoming relevant.

The main criteria of educational migration, which determine its important role in the changes taking place in society, are the number of foreign students studying at universities in other countries. Today, Ukraine is the donor country and the leader in terms of the number of young people who go to study in various countries of the world, including Poland. A significant part of Ukrainian students, in particular in Poland, are already studying at the master's level, that is, they are getting a second higher education. It is a big risk for Ukraine that the majority of such students do not return to Ukraine after receiving the relevant higher education to put the acquired knowledge into practice.

There are many cases when young specialists with Ukrainian and Polish diplomas do not stay in Poland, but find employment in another European country. The main factors affecting the growth of the number of Ukrainian students in Polish universities are: geographical proximity; the cost of education, which in many cases is lower than in other European countries; a diploma obtained in Poland - an EU country gives greater opportunities in the European labor market; linguistic and cultural factor. In Fig. 1 shows the dynamics of the number of students from Ukraine who studied in Poland.

The number of Ukrainian students who studied in Poland

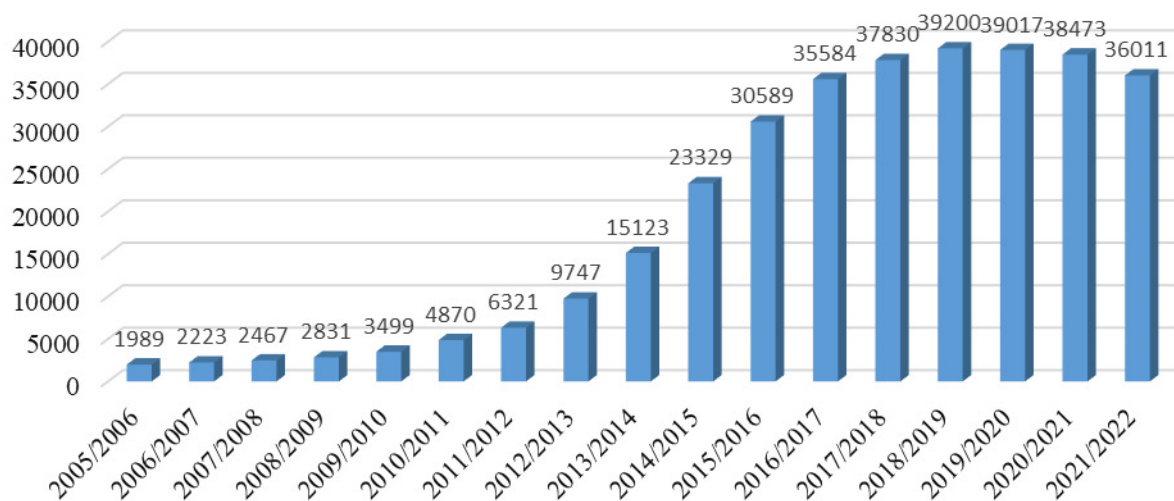


Figure 1. The number of Ukrainian students who studied in Poland in 2005-2022.

Source: Gierko, 2015; *Ukraińcy...*, 2022.

As can be seen from fig. 1 annually, the number of Ukrainian students studying in Poland increases, which is a negative phenomenon for Ukraine. It is worth noting that slightly more than 40% of Ukrainian students studying abroad study in Poland, the rest of the students choose other countries of the world, including: Austria, Germany, USA, Canada, France, Great Britain and others.

For the donor country, the positive consequences of this type of migration are: an inflow of funds in the form of remittances to the homeland, an increase in aggregate demand, national production and economic development, a potential return to the homeland of highly educated citizens with an international diploma, a decrease in the unemployment rate, a decrease in social tension; for the recipient country – immigrants contribute to investments in new enterprises and projects and innovative development of countries; the influx of foreign workers makes it possible to reduce the cost of labor, accelerate the rate of development of scientific and technical progress, increase the volume of production of GDP and national income (Petryshyn, Tolubyak, Mosora, Kis, 2021).

Despite the opinion that educational migration is evaluated as a positive phenomenon for the students' country of origin, as it involves improving the quality of education, gaining access to a wider choice of courses and disciplines, establishing social contacts and learning foreign languages, nevertheless, for Ukrainian youth, such migration becomes a way for permanent emigration, job search in the EU labor market. Unfortunately, such a process has a negative character for Ukraine, because creative, mobile, comprehensively developed young people go to study, and in most cases, after studying, they stay in those countries or go to other countries. That is why, in order to effectively regulate migration processes, Ukraine should pay attention to cooperation in educational migration, and not to unilateral, independent work in this area.

States should regulate the main indicators that shape their migration attractiveness: create conditions for education to attract as many student youth as possible; create additional areas of employment (restructuring of the economy, additional jobs, formation of new conditions for foreign investment, promotion of small business development, entrepreneurship, creation of conditions for self-employment of citizens, etc.); to provide professional orientation of the population, their training, retraining and advanced training of personnel; strengthen the territorial and professional mobility of the workforce; provide assistance in employment; provide assistance in case of labor migration; create special funds to finance regional programs.

The migration outflow together with the natural reduction of citizens increases the depopulation of the population. Therefore, it is appropriate to find ways to solve such problems, to develop a regional migration policy that will take into account the peculiarities of the subjects of the selected territorial areas. At the regional level, taking into account the features of the territory is of primary importance: geographical location, provision of labor resources, availability of natural resources, climatic conditions, features of economic development.

One of the directions of increasing migration attractiveness should be the creation of conditions for the return of citizens to their homeland, which is particularly difficult for Ukraine to do under martial law. For re-emigrants, the cessation of hostilities, shelling, political stability, the presence of democracy and a reduction in the level of corruption, the improvement of the economic situation in the state, their economic and social security, and the availability of jobs where they can fully realize themselves professionally are important for re-emigrants. E. Pienkovskii wrote about the peculiarities of the impact of labor migration on the Ukrainian economy, who emphasized that the return of the population to their historical homeland, on the one hand, contributes to the improvement of the economic situation in the state, the development of new industries, on the other hand, and it has its own characteristics, which must be regulated by state (Pienkovski, Ye, 2021).

A clear, organizationally and financially supported state policy will contribute to the return of Ukrainians, which should be aimed at providing emigrants abroad with the necessary information about employment opportunities in Ukraine or opening their own business; assistance in reintegration after their return home, which should have both an economic and a cultural and educational component; provision of professional training and retraining in order to acquire qualifications that will meet the new requirements of the labor market.

4. Discussion

The question of what countries should do to strengthen their migration attractiveness in a particular period is debatable. Certain countries of the world are quite developed and offer foreigners acceptable living conditions and, in the future, obtaining documents about their status

in the country. For such countries, the strengthening of migration attractiveness consists in the involvement of foreigners in those economic processes taking place in the state; creation of new jobs and development of new types of industry. At the same time, maintaining its own economically active population is becoming an important issue for Ukraine. Therefore, it is now relevant for Ukraine to determine those priority directions in the migration policy that will allow to stabilize the situation and better control the migration of the population, especially abroad. In this case, internal migration should not be forgotten. After all, the population migrated over the last year not because of their own well-considered decision, but because of the circumstances that developed. And, therefore, it is more difficult for such citizens to adapt to new conditions and realize themselves.

Now it becomes clear that the priority for the state migration policy is to create conditions for the preservation of the population that remained in Ukraine and the creation of conditions for the reintegration of the population that left. After all, as E. Libanova emphasizes: "There is a clear inverse-proportional relationship: the longer the war lasts, the fewer people will return. The variation in numbers is huge, so there is nothing to talk about at the moment" (Libanova, 2023). So, we must already understand that part of the migrants will not return, but what this share is at the moment is difficult to estimate.

For any country in the world, it is important to regulate migration flows so as not to turn them into uncontrollable ones. The formation of migration attractiveness for both Ukraine and Poland is an important means for the influx of migrants. And the more attractive the living conditions in the country, the greater the probability that the population of other countries will migrate to it. Due to the military actions in Ukraine and the ban on the departure of men of conscription age, the emigration of Ukrainians has partially decreased. The reduction of educational and temporary migration worsens the possibility of developing Ukraine's production capabilities. As for Poland, the country actually became a home for many Ukrainian women and children who fled the war and sought protection in other countries. It became a certain burden for the state, which is reflected in the development of the economy. Poland extended a helping hand to Ukrainians and undertook to provide assistance to such refugees, aware of the economic consequences for itself.

5. Summary

From the given material, we conclude that the state should primarily protect the rights and interests of both its own population and migrants. Scientists point to the important role of the state in regulating the issues of immigrants, creating conditions for their adaptation. However, at the same time, less attention is paid to measures aimed at reducing population emigration, which can destroy the gene pool of any country, lose national self-awareness and family values,

create such a negative phenomenon as social orphanhood, and lose a significant part of labor resources. Accordingly, the state should play an important role in forming its own migration attractiveness in order to preserve its population and promote the immigration of foreigners to itself. This is possible thanks to the improvement of the quality of life of the population in its own territory, so that it does not have the need to leave the country.

Adequate conditions for the adaptation of migrants should also be created. This is one of the most complex and problematic components of the state migration policy, which causes wide academic discussions and is embodied in the most diverse mechanisms for ensuring such adaptation. The adaptation of migrants is understood as the mutual political, cultural and socio-economic adjustment of migrants, authorities and structures of civil society in the host country, as a result of which migrants acquire a certain status and position in society. Citizens who were forced to leave the country should feel that they are remembered and waited for at home.

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ANALYSIS OF THE IMPLEMENTATION OF THE CONCEPT OF SUSTAINABLE DEVELOPMENT USING THE INDICATOR METHOD

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Purpose: The purpose of the study was to perform an analysis of the essence and importance of the idea of sustainable development and an analysis of progress in meeting one of the Sustainable Development Goals in Poland and Slovakia using a system of indicators. The progress in implementing Sustainable Development Goal 9 (industry, innovation and infrastructure) of the document "Transforming Our World: Agenda for Sustainable Development - 2030" was analyzed.

Design/methodology/approach: Achieving the purpose of the study required a structured research methodology, which included a diagnostic survey method, comparative analysis, and content analysis and desk research techniques were used as part of data collection.

Findings: The realization of the analysis of the level of fulfillment of Goal 9 of the 2030 Agenda made it possible to identify the difficulties that arise from the specifics of the adopted research method. With regard to the level of fulfillment of Goal 9, it was found that Poland and Slovakia are gradually meeting the set objectives. A critical area in relation to Slovakia's development is the aspect of inventive activity, i.e. the country's ability to use knowledge and research results to reap potential economic benefits.

Research limitations/implications: Through the implementation of the proposed methodology for analyzing data for Poland and Slovakia in relation to Sustainable Development Goal 9 (industry, innovation and infrastructure), it was found that monitoring progress in meeting the provisions of the 2030 Agenda using the indicator method is fraught with the following difficulties: the need to standardize relevant data for EU countries, lack of access or difficult access to adequate data in individual countries, generalizations and subjectivity due to the specifics of the indicator method.

Practical implications: The indicator analysis of the completed research procedure contributes to the accumulation of factual knowledge and the identification of development trends, which is the foundation for determining milestones and strategic plans for the implementation of the concept of sustainable development.

Originality/value: The analyses presented here complete the research gap regarding the diagnosis and analysis of the level of fulfillment of one of the goals of sustainable development with its assumptions by Poland and Slovakia against the background of the European Union.

Keywords: indicator measurement, sustainable development indicators, Agenda 2030, sustainable development.

Category of the paper: Research paper.

1. Introduction

Human endeavors in the economic sphere not only influence the organization of social life, but also affect the state of the environment. The ubiquitous hegemony of mankind over the natural world, combined with the irresistible need to constantly satisfy needs, results in the endangerment of nature and the emergence of an environmental crisis (Becla, Czaja, 2022). The expansiveness in terms of economic development and the fulfillment of human needs has a significant impact on the development of economic processes and transformations in the area of values (Wolniak, 2022; Lazar et al., 2022). However, the natural environment also has certain limits of endurance, and once these limits are exceeded to its destruction, which negatively affects human well-being and condition (Czerwinska, Pacana, 2022). This outlines the circle of interaction, while emphatically depicting the interdependence between: the economy, society and the natural environment.

For the formation of the idea of sustainable development from an axiological perspective, the transformations in the area of values, formed as a result of economic activity, were crucial. The core around which the transformation of values took place was the processes of industrialization proceeding along with the development of science and technology (Czerwinska et al., 2022).

The changes in values discernible in the context of the clarification of the assumptions of the idea of sustainable development progressed in a way that makes it possible to see an analogy with the successive stages of technological development. The changes in values are part of the division of societies whose characteristics have transformed from the old traditional societies (based on agriculture), through industrial, post-industrial and post-modern societies, also called information societies (Szacka, 2008). In the 1960s, when the encyclical *Mater et magistra* was published, the use of the classical Catholic methodology for social teaching was emphasized: examine - evaluate - act. The indicated method calls for identifying the historical dimension in terms of specific aspects of social life (Prüfer, 2006). Based on the presented treatment of the environmental issue and the idea of sustainable development, two historical phases of the formation of the concept of sustainable development can be distinguished: indirect - related to the effects of the industrial revolution; direct - related to events confirming the progressive degradation of the environment due to technical and scientific progress.

When listing individual phenomena indicating environmental degradation, one should not overlook the interdependence occurring between man and his natural environment. In many scientific studies, this relationship is captured in the category of a bond. This specific bond indicates the relationship between man and other entities, in relation to which man, being a rational being, occupies a superior position. Man cared for natural resources and the environment as a whole, as through its resources he was able to satisfy existential needs (Mikalauskiene, Atkociuniene, 2019). It was only the progressive economic conditions associated with increased exploitation of natural resources that contributed to an increased awareness of the interdependence between humans and nature. This has made it possible to conclude that the neglect of this coexistence will lead to negative consequences affecting the dependence of ecosystems, within which humans also function. The answer to such negative and acute circumstances is the implementation of the premises and goals flowing from the idea of sustainable development in the macro and microeconomic spheres (Pacana et al., 2020).

Based on the considerations presented, the purpose of the study was to perform an analysis of the essence and importance of the idea of sustainable development and an analysis of progress in meeting one of the Sustainable Development Goals in Poland and Slovakia using a system of indicators. The progress in the implementation of Sustainable Development Goal 9 (industry, innovation and infrastructure) of the document "Transforming Our World: Agenda for Sustainable Development - 2030" was analyzed. Progress in meeting the objectives of the selected goal was analyzed for Poland and Slovakia.

2. Sustainable Development as an idea of balance

Sustainability is a concept that owes much of its success to the creation of an opportunity to identify trade-offs between rationales occurring in the social, economic and ecological spheres. The concept is not just about simple compromise, because the environmental life-sustaining systems and the common heritage of humanity cannot be preserved in all its glory by paying attention only to simple compromise. Especially since, in essence, sustainable development means not only the constant search for harmony between its basic aspects, but also the moral, spatial, institutional aspects, in the present and intergenerational perspectives (Bieksa et al., 2022).

The guiding principles of sustainable development are not invariably fixed, but are shaped as a result of global dialogue (Ulewicz, Blaskova, 2018). In the initial stage, considerable emphasis was placed on the sphere of economic development and environmental protection (Grebski et al., 2022). After that, the concept of sustainable development was deepened and expanded attaching to its scope an ecocentric vision of nature and social development. Although

activities aimed at maintaining the level of environmental quality at the current level are in order, preventive measures and broadly understood activity in this area have a primary place in the concept presented. Restoring the value of nature that has lost value as a result of human activities is a further activity that is in line with the new paradigm of environmental protection and sustainable development (Astorga, Valdes, 2021).

Despite the openness and creative ambiguity regarding interpretation, the term sustainable development has retained a fundamental set of guiding values of the principles detailed in the Brundtland Commission's standard definition (development that meets present needs without compromising the ability of future generations to meet their needs) (Cerne, Jansson, 2019). Moreover, the terms "sustainable" and "development" themselves evoke positive associations in most people, while their association evokes virtually universal agreement on the seriousness of the values and goals to which it points. The phrase is also an important tool in various conflicting social contexts (Dagbanja, 2022).

The concept of sustainable development is defined in Polish legislation and is interpreted as social and economic development, in which the process of integrating economic, political and social activities is implemented. These activities are carried out while maintaining the balance of the natural environment and ensuring the sustainability of basic natural processes to ensure that the fundamental needs of citizens of the present and future generations are met (Environmental Protection Law, 2001). Thus, it can be said that the definition established in this form deals with the essential aspects of sustainable development. In addition, it emphasizes its basic assumptions - the need to integrate three planes: human development and development in the economic area that includes the goods of the natural environment. As indicated by (Figure 1a).

Sustainable development is a concept that focuses significantly on the quality of human life and health. Achieving the expected level in this aspect is possible through proper management of five categories of capital: natural, economic, human, social and integrating the other capitals (Adamowicz, Dresler, 2006). The disposition of all categories of capital should be done in accordance with the assumptions of ecological, economic, social, institutional and spatial order (Figure 1b).

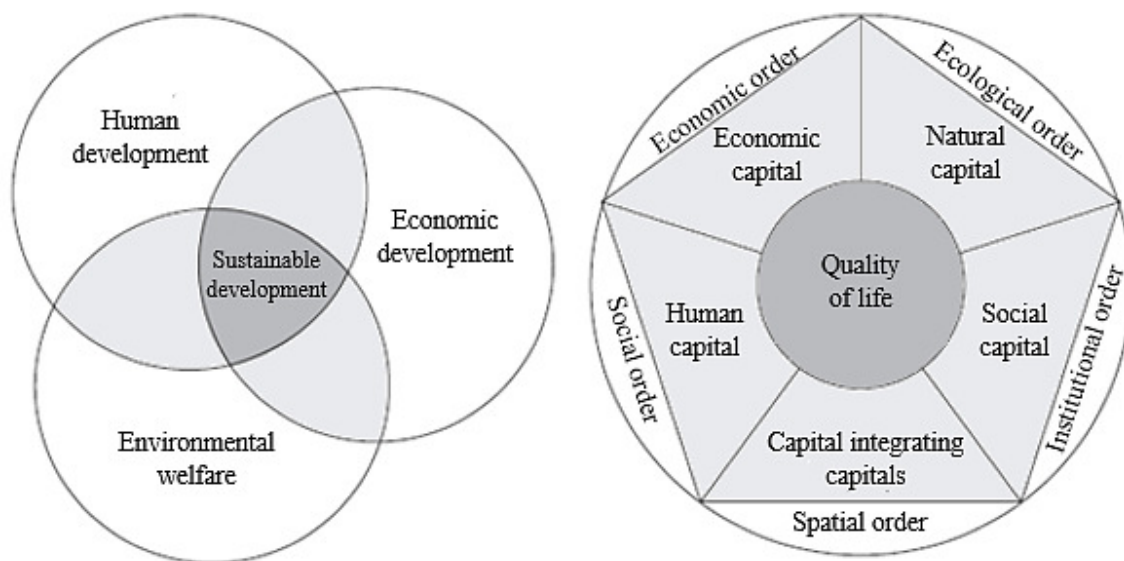


Figure 1. The idea of sustainable development a) the basic concept of sustainable development, b) sustainable development in terms of capitals and orders.

Source: own elaboration based on Adamowicz, Dresler, 2006, pp. 17-24.

A key aspect of quality in sustainable development conceived as a concept shaping the relationship between the economy, people and the environment is to attempt to capture them collectively, rather than treating them as independent issues, as has traditionally been the case (Dobrzanski, 2011). The indicated components are often included in the aspect of sustainable development as three types of capital. While their effective management is supposed to ensure well-being (Pacana et al., 2023), which is most often associated with such qualities as harmony, fulfillment, happiness, community and appreciation (Kronenberg, Bergier, 2010).

The spread of the concept of sustainability, which is now a globally accepted and even desirable solution, was linked to the development of environmental awareness (Hajduk-Stelmachowicz, 2014). Its foundation became the public perception of environmental degradation, followed by the spread of attitudes of individual involvement (perception of the risks resulting from a consumerist model of behavior) and collective involvement (civic initiatives, protest actions, promotional and informational campaigns), up to the ushering in of disapproval of behavior incompatible with the pro-environmental spirit (Olkiewicz, Wolniak, 2020; Hys, 2014).

The concept of sustainability has also become widespread in manufacturing industries. Enterprises wishing to maintain a stable position in the EU market must take care of the appropriate level of competitiveness (Pacana, Czerwinska, 2019; Olkiewicz et al., 2019). One of the fundamental conditions for mature competition has become the formulation and implementation of developmental strategies that take into account pro-environmental measures (Ulewicz et al., 2023; Staniszewska et al., 2020).

3. Research Methodology

The creation of new knowledge involves the recognition of the existing state of knowledge and the identification of findings noted in earlier studies and literature. The cognitive procedure, aimed at identifying the existing state of knowledge, is the basis for the implementation of analyses. The course of the developed research procedure consisted of six structured research steps and allowed to perform an analysis of the level of implementation of the selected objective of sustainable development of Poland and Slovakia against the background of the European Union. The first steps of the research methodology are based on the principle of continuity. The orthodox understanding of this principle allows to study the literature in layers - starting with the most recent. Each layer should include the knowledge gained in previous research. A cross-sectional characterization of the different stages of research implementation is presented in Table 1.

Table 1.

Summary of the various stages of survey implementation

No	Name	Synthetic description
1.	Clarification of the subject and purpose of the research	Establish the categories of objects for which the research will be carried out and for the cognition of reality, which involves descriptions and explanations of the phenomena and processes occurring in the reality under study
2.	Diagnostic survey	Getting to know the phenomenon specified in the purpose of the research, establishing its scope, extent, level and intensity. This activity will create a description of important processes taking place in the communities. The study uses the technique of document analysis
3.	Data evaluation	Assessing the quality of the selected data in terms of achieving the research objective
4.	Comparative analysis and interpretation of data	Analyzing the characteristics of the established subjects of the study in terms of identifying similarities and differences (dissimilarities) and making sense of the collected data
5.	Presentation of results and data visualization	Presenting the results taking into account the principles of effective communication and the standards set for scientific research; this step also involves deciding how to organize the data and identify the relevant ones to be included in the study. Data visualization plays an important role as an element that promotes understanding and remembering of the results of the analyses carried out
6.	Conclusions and future research directions	Determination of conclusions and reflections on the completed analyses and identification of the area of future scientific inquiry

Source: own elaboration.

The application of methodological rigor to the realization of the research objective set in the study leads toward the use of transparent techniques, as well as the possibility of replicating the proposed procedures.

4. Analysis of the level of fulfillment of objective 9 of the concept of sustainable development of Poland and Slovakia

The document "Transforming our world: the 2030 Agenda for Sustainable Development" adopted by the United Nations (UN) is a program of action of unprecedented scope and importance that defines a model for sustainable development in global terms. Given that the 2030 Agenda is a universal development plan for the whole world, it requires adaptation to the specifics of each country. Therefore, the role of countries in the process of implementing the goals of Agenda 2030 (SDGs) crucial (Novovic, 2022). The multidimensionality and permeability of the SDGs compels commitment and appropriate cooperation. In doing so, it is important to transfer the global goals to the national, regional, local level and make them relevant (Manero-Salvador, 2022).

The analysis included selected sustainable development indicators related to SDG 9 - Industry Innovation and Infrastructure, Agenda 2030. This goal refers to building stable infrastructure, promoting sustainable industrialization and fostering innovation.

At the core of efforts to achieve environmental goals is technological progress, including a significant impact of increasing energy and material efficiency. Without technology and innovation there can be no industrialization, and without industrialization there is no development. Hence, the study pays attention to such indicators as gross domestic expenditure on R&D by sector (Figure 2), R&D personnel by sector (Figure 3) and patent applications to the European Patent Office by applicants' / inventors' country of residence (Figure 4).

The indicator Gross Domestic Expenditures on R&D by sector measures gross domestic expenditures on research and development (GERD) as a percentage of gross domestic product (GDP). The indicator is the main measure of R&D statistics, characterizing the competitiveness and level of development of the knowledge-based economy. Figure 2 shows the values of the aforementioned indicator over the years 2000-2021 for Poland and Slovakia against the background of the European Union (EU).

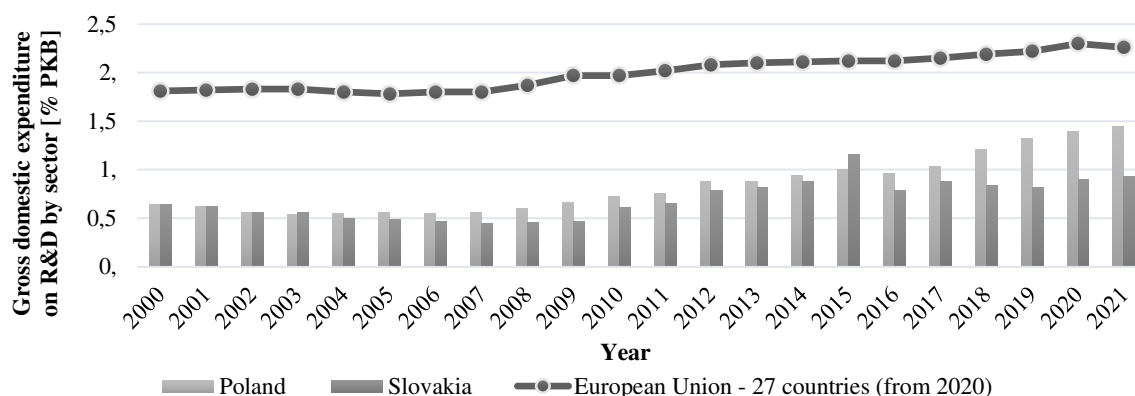


Figure 2. Dynamics of the index of gross domestic expenditure on R&D by sector for Poland and Slovakia against the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 18.07.2023.

Over the analyzed period, the values of gross domestic expenditure on R&D by sector show an upward trend. Since 2000, the value of the indicator has increased by 124.99% compared to 2021, while in Slovakia an increase of 45.31% is observed. Despite the fact that in 2000-2003 the values of the indicator for Poland and Slovakia were almost identical, in 2021 the value of the indicator for Poland is 35.41% higher than that of Slovakia. The dynamics of changes in the value of the analyzed indicator shows similar trends to those observed for the EU.

The R&D personnel by sector indicator measures the share of R&D personnel by the following institutional sectors: business enterprises (BES), government (GOV), higher education (HES), private non-profit (PNP). Figure 3 shows the values of the indicator for Poland and Slovakia against the EU from 2000 to 2021.

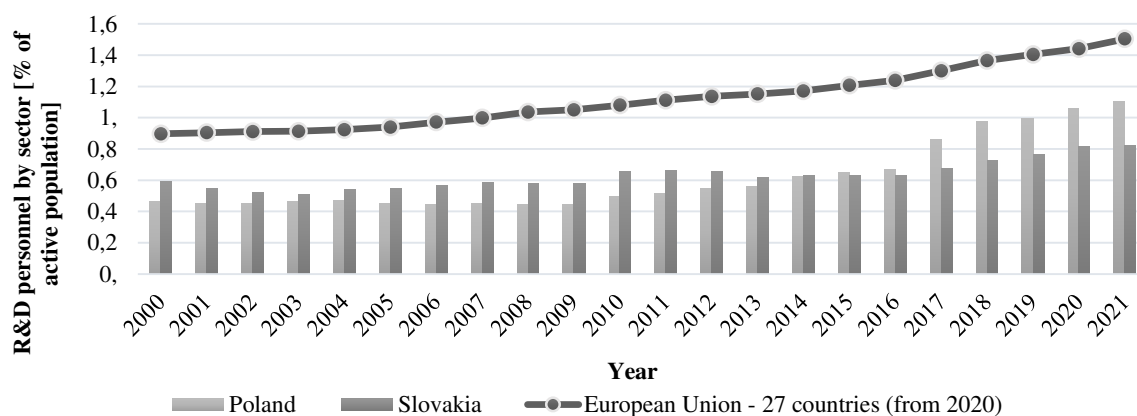


Figure 3. Dynamics of the R&D personnel by sector index for Poland and Slovakia against the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 18.07.2023.

In the first year of the analyzed period, the indicator of R&D personnel by sector in Slovakia exceeded the value achieved by Poland (20.98% higher value). This trend continued until 2014. Since 2017, Poland has seen a sizable increase in the value of the R&D personnel by sector indicator (with respect to 2016, an increase of 28.85%). This has been influenced by a significant increase in the number of R&D personnel for every one million people and by increasing public and private funding for development. This measure helped generate a 27.80% increase in the indicator over 5 years (2017-2021) (2017 - 0.8623, 2021 - 1.1021). Slovakia did not see such a marked increase between 2017 and 2021, but the country, like the EU, is on an upward trend.

Another indicator subject to analysis was patent applications to the European Patent Office by applicants' / inventors' country of residence. Figure 4 illustrates the values of the indicator for Poland and Slovakia against the EU in 2000-2022.

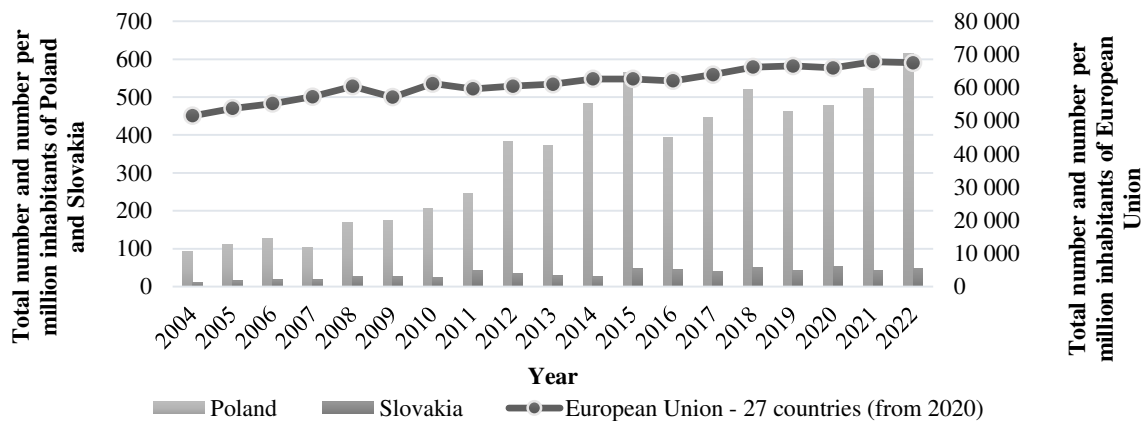


Figure 4. Dynamics of the R&D personnel by sector index for Poland and Slovakia against the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 18.07.2023.

Due to significant differences in the number of patent applications between Poland Slovakia and the EU, two vertical axes were used in the graph (left axis for Poland and Slovakia; right axis for the EU). Patent applications in Slovakia during the period under review ranged from 12 (2004) - 54 (2018), while in Poland they ranged from 93 (2000) - 615 (2022). The number of patent applications indicates the level of inventive activity and the ability of the country and its companies to use knowledge and research results and translate them into potential economic benefits. In this context, Slovakia is far from achieving the goal of sustainable development. In relation to the EU, there is an upward trend. Over the period under review, there was a 31.04% increase in patent applications, which is a satisfactory result.

Analysis of data on indicators of gross domestic expenditure on R&D by sector, R&D personnel by sector and patent applications to the European Patent Office by applicants'/ inventors' country of residence makes it possible to check whether one of the specific objectives of Goal 9 of Agenda 2030 is being met. This goal reads as follows: By 2030, research should be strengthened and the technological level of the industrial sector should be raised in all countries, especially in developing countries, including through innovation, a significant increase in the number of R&D workers for every million people, and by increasing public and private financial investment in development. Analysis of the data indicates that the stated goal has been met by Poland. Slovakia, on the other hand, should increase its level of inventive activity.

SDG 9 calls for building resilient and sustainable infrastructure and promotes inclusive and sustainable industrialization. For this reason, attention was paid to the indicator - share of buses and trains in inland passenger transport (Figure 5) and share of rail and inland waterways in inland freight transport (Figure 6).

The indicator share of buses and trains in inland passenger transport measures the share of public transport modes in total inland passenger transport work, expressed in passenger kilometers (pkm). Figure 5 illustrates the values of the indicator for Poland and Slovakia against the EU in 2000-2021.

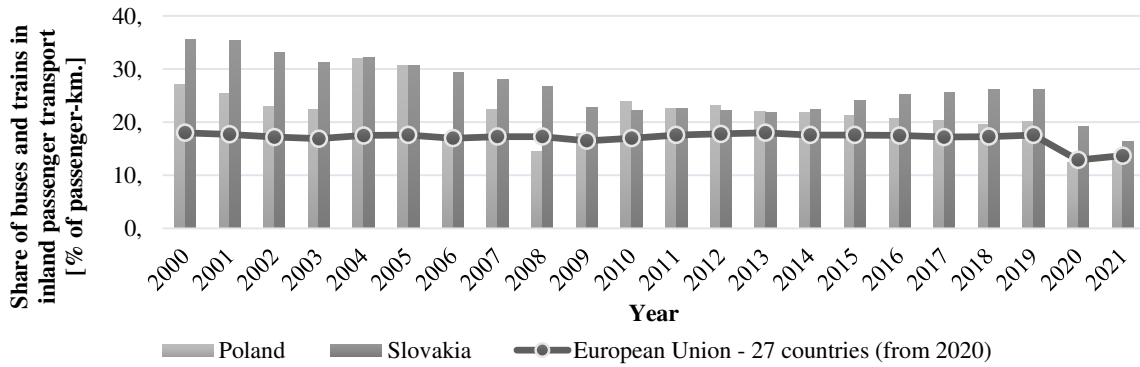


Figure 5. Dynamics of the indicator share of buses and trains in inland passenger transport for Poland and Slovakia in comparison with the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 18.07.2023.

During the period under review, the share of public transportation is decreasing in both Poland and Slovakia. A decrease in the rate of 49.63% for Poland and 54.21% for Slovakia, respectively, is observed. A similar trend, albeit milder, is taking place in the EU (a decrease of 23.88%). This may be due to the propensity to use passenger cars that has been observed in recent years in Europe.

It is worth noting that the methodology for collecting data of the indicator share of buses and trains in inland passenger transport is voluntary and not fully harmonized at the EU level. For countries without legislation on rail transport statistics, the totals include only the share of coaches, buses and trolleybuses.

The share of rail and inland waterways in inland freight transport indicator measures the share of rail and inland waterways in total inland freight transport. Data over the years 2005-2021 of the aforementioned indicator for Poland and Slovakia are presented in Figure 6.

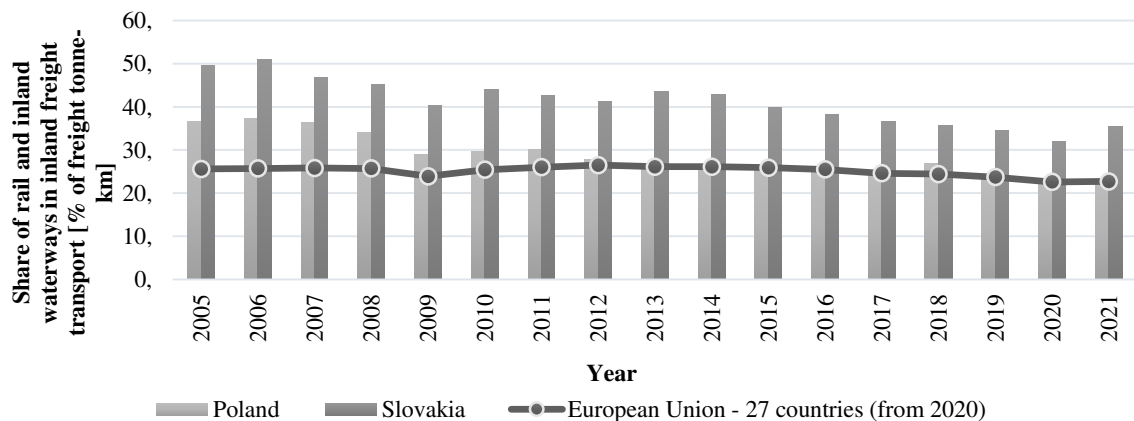


Figure 6. Dynamics of the indicator share of rail and inland waterways in inland freight transport for Poland and Slovakia against the EU.

Source: own elaboration based on: <https://ec.europa.eu/eurostat>, 18.07.2023.

In the analyzed years 2005 - 2021, the share of railroads and inland waterways in inland freight transport in Poland successively approached the indications of the EU parameter, and since 2012 has not shown significant differences. With regard to Slovakia, the level of the

mentioned indicator shows a downward trend. In the first year of the period under consideration, the value of the indicator was 25.85% higher than in Poland, and at the same time 48.28% higher than in the EU. In 2021, the indicator for Slovakia was 35.40% and was 37.85% higher than in Poland and 35.87% higher than in the EU. Which indicates that Slovakia is approaching the European level at a slow pace. However, it should be remembered that for countries that do not apply statistical rules for inland waterways, the totals include only the share of rail transportation.

Both Poland and Slovakia are striving to effectively manage available resources and achieve the goals of Agenda 2030 in line with sustainable development. These countries indicate different trends in all the areas studied, which is due to their specificities. However, it is important to remember that sustainable development and economic growth are highly dependent on investments in innovation and infrastructure. SDG 9 also seeks to increase technological progress and scientific research, which are important instruments for achieving sustainable development. Today, more than half of the world's population lives in cities, which underscores the importance of urgently promoting new and sustainable ways of living, such as public transportation, providing renewable energy and improving means of information and communication.

5. Summary and conclusions

Sustainable development is identified with intergenerational solidarity consisting in finding solutions that guarantee growth, which allow active inclusion in development processes of all social groups, while giving them the opportunity to benefit from economic growth. The purpose of the study was to perform an analysis of the essence and importance of the idea of sustainable development and an analysis of progress in meeting one of the goals of sustainable development in Poland and Slovakia using a system of indicators. The progress in implementing Sustainable Development Goal 9 (industry, innovation and infrastructure) of the document "Transforming Our World: Agenda for Sustainable Development - 2030" was analyzed.

The procedure proposed in the study for analyzing the collected data for Poland and Slovakia in relation to selected Objective 9 - industry, innovation and infrastructure was found to be fraught with the following difficulties in monitoring progress in meeting the provisions of the 2030 Agenda by means of indicator analysis:

- the need to standardize relevant data for EU countries,
- lack of access or difficult access to adequate data in individual countries,
- generalizations and subjectivity arising from the specifics of the indicator method.

With regard to the degree of fulfillment of Goal 9 and related provisions, it was found that Poland and Slovakia are gradually meeting the set objectives. A sensitive area with regard to Slovakia's development is the aspect of inventive activity, i.e. the country's ability to use knowledge and research results to reap potential economic benefits.

In spite of the identified handicaps, the need for control in the form of regular analysis of progress in the implementation of the provisions of sustainable development in the European Union countries is indisputable. Future directions of research will be related to the analysis of the level of implementation of the remaining goals of sustainable development in Poland and Slovakia and the developmental forecasts of both countries.

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VERIFICATION OF THE EFFECTIVENESS OF DISCRIMINATION MODELS FOR FORECASTING BANKRUPTCY OF ENTERPRISES

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Purpose: An attempt to evaluate the effectiveness of financial analysis tools used to assess financial health and to forecast bankruptcy.

Methodology: The study used 31 of the most popular discriminatory models for bankruptcy prediction. The effectiveness of early warning models has been evaluated on the basis of financial data of economic entities operating on the territory of the Republic of Poland. The sample of the enterprises has comprised a total of 172 entities – both bankrupt and operating in good financial condition, located in 16 provinces. The data period was 2011-2020. The companies have represented various sectors of activity. Data was obtained from the Emis.com website.

Findings: Most of the models used have been highly effective in forecasting. However, none of the methods has been 100% effective. It has also been noted that the models estimated on the basis of a sample of enterprises from only one sector, the so-called sector models allocated to the evaluation of a specific industry, have not had a significantly higher percentage of correct diagnoses than universal models. In the last analyzed period, the three most effective methods are the so-called universal models that can be used in the evaluation of companies from various industries.

Practical implications: The results of the audit can be used, among others, in the assessment of the going concern of enterprises by business managers, business analysts, investors, and above all, statutory auditors when auditing financial statements.

Originality/value: The study provides an answer to the question of which models are characterized by high prognostic effectiveness. In addition, the obtained results allow to resolve the issue of the usefulness of models created in the 1990s. The large size of the research sample allows for the generalization of the results and their wider application than has been the case in the literature on the subject so far.

Keywords: bankruptcy, financial condition, discriminatory models, early warning models.

Category of the paper: Research paper.

1. Introduction

Running a business in the conditions of the market economy involves various types of risk. The risk of bankruptcy is one of the most important risks in this regard. In the dynamic conditions of the market economy, almost every economic entity is exposed to a number of different types of risk. One of the most important risks in this respect is the risk of business bankruptcy. To quote the phrase by Joseph A. Schumpeter, economic progress is a creative destruction in which the bankruptcy of enterprises is an integral part (Schumpeter, 1982). It is a completely natural phenomenon that acts as a means of natural selection (Mączyńska, Zawadzki, 2006). From the theoretical point of view, insolvency and bankruptcy of enterprises eliminate the weakest and ineffective units, thus increasing opportunities for new and more market-prepared economic entities. On the other hand, bankruptcy processes are largely associated with numerous negative consequences. These consequences concern not only the owners and managers of the enterprise. These effects are often borne by employees, their families, or business partners of a given enterprise. From this point of view, effective and timely counteracting bankruptcy processes becomes one of the most important problems in daily business activity. Diverse types of tools, largely based on financial data, are helpful in this regard. One of the most popular tools to date are the so-called early warning models. Models using a linear discriminant function are leading in this regard.

In connection with the above, the article deals with the issue of the evaluation of early warning models, and more specifically discriminatory models that are used to evaluate the financial situation of an enterprise and to forecast its bankruptcy. The main objective of the article has been an attempt to classify discriminant models based on their prognostic effectiveness. Despite the large amount of research in the reference literature in this area, it is difficult to find studies in which verification has been conducted on a sufficiently large sample. Moreover, in research, the selection of units for the sample has very often been limited to the data from one region or one industry. Therefore, it is doubtful whether the verifications made on this basis are of adequate quality and can be applied in practice. Therefore, in this article, it has been decided to verify 31 early warning models to be able to classify individual models as broadly as possible. Additionally, the evaluation has been conducted on a sample of 172 business entities located in 16 provinces.

2. The state of research in the literature

For several decades, discriminant models have been the most popular - both in the reference literature (Aziz, Dar, 2006), and among practitioners - the results of research by B. Micherda conducted among certified auditors. They most often use, apart from traditional index analysis, discriminant models (Micherda, 2012). At this point, it is worth mentioning the most important research conducted so far.

The first notable results come from the study of P. Antonowicz, who verified 52 discriminatory models on a sample of 89 bankrupt companies from the Pomeranian Province that declared bankruptcy in 2003-2004 and 119 companies from the 2004 Gazele Biznesu (Business Gazelles) ranking (Antonowicz, 2010). A similar evaluation was also conducted by R. Balina, who assessed synthetic models on a sample of construction companies (Balina, 2012). W. Lichota based the study on the effectiveness of discriminatory models on data from 8 companies from the Podkarpackie Province that filed a petition for liquidation bankruptcy (Lichota, 2017). In turn, D. Zarzecki evaluated the effectiveness of discriminatory models on a sample of 21 companies (Zarzecki, 2003). T. Noga and K. Adamowicz evaluated early warning models based on a sample of companies from the wood industry (Noga, Adamowicz, 2021). The effectiveness of early warning models was also evaluated by S. Tomczak and E. Radosiński (Tomczak, Radosiński, 2017). Research on the effectiveness of models assessing the financial condition was also conducted by G. Gołębiowski and K. Żywno - a sample of 10 companies from the Warsaw Stock Exchange (Gołębiowski, Żywno, 2008). Also, L. Czapiewski examined 94 listed companies (48 at risk of bankruptcy and 46 with good financial condition), using early warning models (Czapiewski, 2009). J. Koralun-Bereźnicka evaluated the usefulness of early warning models on the basis of a sample of companies listed on the Warsaw Stock Exchange (Koralun-Bereźnicka, 2006). J. Wojnar assessed the effectiveness of discriminatory models on data from 50 listed companies (Wojnar, 2014). In turn, A. Kopiński and D. Porębski used early warning models to evaluate medical entities (Kopiński, Porębski, 2015). W. Lichota verified discriminatory models using a sample of 40 enterprises, of which 10 were subject to bankruptcy petitions to the court and 30 of them were characterized by a good financial condition. On the basis of the obtained results, the author evaluated the discriminant models as effective tools in assessing the financial situation of enterprises (Lichota, 2020).

Similar considerations on the possibility of using early warning models were the subject of research, among others by A. Kuciński, who assessed the usefulness of discriminatory models on the basis of companies listed on the NewConnect market (Kuciński, 2011). Other studies as part of the evaluation of the effectiveness of early warning models were conducted by G. Gołębiowski and A. Płasek, who analyzed both Polish and foreign discriminatory models (Gołębiowski, Płasek, 2018). The research on the effectiveness of early warning models,

which was carried out by J. Kitowski together with A. Pawul-Kowal and W. Lichota, concerned the assessment of the possibility of using Polish models, but also of the very popular method of E. Altman (Kitowski et al., 2022). Furthermore, it is also worth citing research related to early warning models by, among others, W. Rogowski (Rogowski, 1997), T. Korol (Korol, 2019) or B. Prusak (Prusak, 2018).

Despite the frequent use of early warning models in the reference literature and the assessment of their effectiveness based on them, many research results cannot be used. This is mainly due to the small sample size on the basis of which individual models were verified. Only a few authors used data from a sample of enterprises of more than 50 entities. Another limitation to the possibility of using multiple studies is the use of data from companies representing only one industry. The last argument that requires careful use of a particular result is the fact of using data from enterprises, the location of which in most cases is limited to only one or two provinces. In the further part of this article, the results of a study that was conducted considering the limitations mentioned above will be presented.

3. Research methods

The article assesses early warning models. For this purpose, 31 of the most popular models using the linear discriminatory function have been selected. The models selected for verification have been estimated on the basis of data from a sample of enterprises operating in Poland. This approach is consistent with most of the positions in the literature, which postulate that models estimated on the basis of the financial data of a given country should be used, or possibly foreign models can be used, but after their adaptation to the conditions of the economy of a given country (e.g. Nowak, 1997; Korol, 2010; Kitowski, 2011; Zaleska, 2012; Pitera 2014). The discriminatory models selected for the study are presented in Table 1.

Table 1.
Characteristics of early warning models used in the study

Model author	Possibilities of using the model	Function	Year of creation
E. Mączyńska	Universal	$Z = 1.5X_1 + 0.08X_2 + 10.0X_3 + 5.0X_4 + 0.3X_5 + 0.1X_6$	1994
M. Pogodzińska, S. Sojak	Universal	$Z = 0.644741X_1 + 0.912304X_2$	1995
J. Gajdka, D. Stos (Model 4)	Universal	$Z = 0.7732059 - 0.0856425X_1 + 0.0007747X_2 + 0.9220985X_3 + 0.6535995X_4 + 0.594687X_5$	1996
D. Hadasik (model 1)	Universal	$Z = -2.50761X_1 + 0.00141147X_2 - 0.00925162X_3 + 0.0233545X_4 + 2.60839$	1998
D. Hadasik (model 8)	Universal	$Z = -1.98281X_1 + 0.00118429X_2 + 0.180604_3 - 0.00847833X_4 + 1.53416X_5 + 0.0235729X_6 + 1.97095$	1998

Cont. table 1.

D. Wierzbą	Universal	$Z = 3.26X_1 + 2.16X_2 + 0.3X_3 + 0.69X_4$	2000
A. Hołda	Universal	$Z = 0.605 + 0.681X_1 - 0.0196X_2 + 0.00969X_3 + 0.000672X_4 + 0.157X_5$	2001
S. Sojak, J. Stawicki	Universal	$Z \text{ zła} = -11.6499 - 0.1144X_1 + 0.5178X_2 - 20.4475X_3 - 0.0661X_4 + 0.0663X_5 - 50.4610X_6 + 1.8358X_7$ $Z \text{ średnia} = -2.3393 - 0.0586X_1 - 3.3608X_2 + 10.7088X_3 + 0.1455X_4 - 0.066X_5 + 4.5837X_6 + 2.4329X_7$ $Z \text{ dobra} = -5.992 - 0.0153X_1 + 2.0482X_2 + 9.637X_3 + 0.1717X_4 - 0.0091X_5 - 15.78X_6 - 0.0018X_7$	2001
J. Gajdka, D. Stos (Model 5)	Universal	$Z = 0.0005X_1 + 2.0552X_2 + 1.7260X_3 + 0.1155X_4 - 0.3342$	2003
D. Appenzeller, K. Szarzec (Model 1)	Universal	$Z = 1.286X_1 - 1.305X_2 - 0.226X_3 + 3.015X_4 - 0.005X_5 - 0.009X_6 - 0.661$	2004
D. Appenzeller, K. Szarzec (Model 2)	Universal	$Z = 0.819X_1 + 2.567X_2 - 0.005X_3 + 0.0006X_4 - 0.0095X_5 - 0.556$	2004
M. Hamrol, B. Czajka, M. Piechocki	Universal	$Z = -2.368 + 3.562 X_1 + 1.588X_2 + 4.288X_3 + 6.719 X_4$	2004
B. Prusak (model 3)	Universal	$Z = -1.176 + 6.9973X_1 + 0.1191X_2 + 0.1932X_3$	2005
B. Prusak (model 4)	Universal	$Z = -0.3758 + 3.7657X_1 + 0.1049X_2 - 1.6765X_3 + 3.523X_4$	2005
E. Mączyńska, M. Zawadzki (INE PAN F)	Universal	$Z = 9.478X_1 + 3.613X_2 + 3.246X_3 + 0.455X_4 + 0.802 X_5 - 2.478$	2006
E. Mączyńska, M. Zawadzki (INE PAN G)	Universal	$Z = 9.498X_1 + 3.566X_2 + 2.903X_3 + 0.452X_4 - 1.498$	2006
M. Kasjaniuk	Enterprises from the industry sector in the Podkarpackie Voivodeship	$Z = -0.70967X_1 - 0.33346X_2 + 2.31884X_3 + 1.17084X_4 - 0.03600X_5 + 2.83332$	2006
M. Kasjaniuk	Enterprises from the industry sector from the Lubelskie Voivodeship	$Z = 0.010X_1 - 0.523X_2 + 0.443X_3 - 0.551X_4 + 11.49X_5 + 2.532X_6 - 1.642X_7 + 8.873$	2006
T. Maślanka	Universal	$Z = -1.44979 + 3.55401X_1 + 2.14847X_2 - 0.33302X_3 + 4.81862X_4 + 0.05236X_5 + 2.52164X_6$	2008
T. Korol	Universal	$Z_b = -1.97 + 2.35X_1 - 2.90X_2 - 2.68X_3 + 0.79X_4$ $Z_n = -3.49 + 9.93X_1 - 0.05X_2 - 0.62X_3 + 1.19X_4$	2010
A. Waszkowski	Universal	$Z = 0.821X_1 + 0.769X_2 + 0.349X_3 - 0.284X_4 + 0.23*8X_5$	2011
F. Wysocki, A. Kozera	Enterprises from the meat industry sector	$Z = 0.11890 - 3.3753X_1 + 0.86735X_2$	2012
M. Sukiennik	Enterprises from the mining industry	$Z = -0.67848 - 1.62561X_1 + 7.23048X_2 - 0.0042X_3 + 4.61266X_4 + 20.06342X_5 - 0.01874X_6$	2013
M. Tymoszuć	Universal	$Z = 14.71330X_1 - 0.00157X_2 - 0.03304X_3 + 6.80845X_4 - 7.35595$	2013
R. Jagiełło "Przemysł"	Enterprises from the industrial sector	$Z = -1.8603 + 12.296X_1 + 0.1675X_2 + 1.399X_3$	2013

Cont. table 1.

R. Jagiełło "Budownictwo"	Enterprises from the construction sector	$Z = -1.9943 + 3.799X_1 + 0.572X_2 + 0.04X_3 + 1.36X_4$	2013
R. Jagiełło "Handel"	Enterprises from the trade sector	$Z = -3.237 + 3.638X_1 + 2.473X_2 + 0.479X_3 + 0.404X_4$	2013
R. Jagiełło "Transport"	Enterprises from the transport sector	$Z = -2.266 + 1.645X_1 + 2.868X_2 + 0.21X_3 + 0.733X_4$	2013
R. Jagiełło "Usługi"	Enterprises from the service sector	$Z = -2.24461 + 2.122X_1 + 5.738X_2 + 0.07X_3 + 0.323 X_4$	2013
M. Potoczna, S. Wiśniewska	Enterprises from the industrial sector	$Z = -0.5390X_1 - 0.1581X_2 + 0.0633X_3 - 0.1529X_4$	2017
S. Herman	Enterprises from the industrial sector	$Z = 1.293X_1 + 4.169X_2 - 0.432X_3 + 0.696X_4 + 0.322X_5 + 0.342$	2017

Source: Own study based on: Mączyńska (1994); Pogodzińska, Sojak (1995); Gajdka, Stos (1996); Hadasik (1998); Wierzba (2000); Hołda (2001); Sojak, Stawicki (2001); Stos, Gajdka (2003); Appenzeller, Szarzec (2004); Hamrol, Czajka, Piechocki (2004); Prusak (2005); Mączyńska, Zawadzki (2006); Kasjaniuk (2006); Maślanka (2008); Korol (2010); Waszkowski (2011); Sukiennik (2013); Tymoszek (2013); Jagiełło (2013); Potoczna, Wiśniewska (2017); Wysocki, Kozera (2012); Herman (2017).

Among all the early warning models used, 20 of them have been the so-called *universal models* - with the possibility of applying to the assessment of economic entities from various industries - and 11 models that can be used when assessing the financial situation of enterprises from a specific sector. Additionally, in the case of two models of M. Kasjaniuk, the models, apart from being applied to specific sectors, may also be used in a specific region (the province where the company operates). The models selected for the study have been evaluated for the effectiveness of the forecasts. For this purpose, financial data have been collected from 172 entities, of which half declared bankruptcy and half of them were in good financial condition. Data were collected using the EMIS information service (www.emis.com). The data period was 2011-2020. Due to the fact that some of the models are applicable only to a specific sector, companies have been adapted to each model. The study has consisted in assessing the collected financial data of business entities over a 5-year period using individual discriminatory models and then assessing the correctness of classification of individual entities. The verified models have supplied the following types of assessments:

- the correct diagnosis;
- the misdiagnosis, including type I and type II errors;
- the lack of diagnosis, due to lack of data or the so-called area of uncertainty.

If the diagnosis was correct, the model classified a company with good financial condition as an enterprise 'not at risk of bankruptcy.' On the other hand, a company that filed a petition for bankruptcy was categorized as 'threatened with bankruptcy.' In the case of a wrong diagnosis, the model could assess the bankrupt enterprise as not threatened by bankruptcy (type II error), or the enterprise with a good financial condition as an entity 'at risk of bankruptcy' (type I error). The lack of diagnosis was the result of the inability to assess the examined unit due, among other things, to the incompleteness of the financial data. The lack of

an assessment could also be the result of a situation in which the result was in the so-called uncertainty area. The model in the area of uncertainty cannot define precisely the assessment of a given company. Several of the analyzed models in their assumptions use just such a range in which no diagnosis is obtained.

4. Results

This section presents the results of the verification of 31 early warning models. Due to the extensive data, Table 2 presents the data in a synthetic approach, allowing the reading of the most essential information resulting from the study. The results for the last 3 years of the study are presented.

Table 2.
Effectiveness of early warning models - selected years

Model author	Effectiveness of forecasts		
	3 years before bankruptcy	Two years before bankruptcy	One year before bankruptcy
E. Mączyńska	68%	72%	83%
M. Pogodzińska, S. Sojak	51%	57%	61%
J. Gajdka, D. Stos (Model 4)	71%	73%	77%
D. Hadasik (model 1)	69%	72%	78%
D. Hadasik (model 8)	65%	67%	79%
D. Wierzba	62%	64%	81%
A. Hołda	83%	89%	92%
S. Sojak, J. Stawicki	69%	75%	86%
J. Gajdka, D. Stos (Model 5)	77%	83%	89%
D. Appenzeller, K. Szarzec (Model 1)	75%	79%	83%
D. Appenzeller, K. Szarzec (Model 2)	72%	75%	80%
M. Hamrol, B. Czajka, M. Piechocki	80%	86%	94%
B. Prusak (model 3)	59%	67%	78%
B. Prusak (model 4)	65%	76%	79%
E. Mączyńska, M. Zawadzki (INE PAN F)	76%	82%	89%
E. Mączyńska, M. Zawadzki (INE PAN G)	79%	82%	93%
M. Kasjaniuk for Podkarpacie	77%	78%	83%
M. Kasjaniuk for the Lublin region	75%	76%	84%
T. Maślanka	78%	81%	85%
T. Korol	82%	87%	96%
A. Waszkowski	79%	85%	88%
F. Wysocki, A. Kozera	71%	72%	81%
M. Sukiennik	88%	89%	92%
M. Tymoszuik	89%	91%	93%
R. Jagiełło "Indusrtý"	78%	86%	92%
R. Jagiełło "Construction"	81%	82%	86%
R. Jagiełło "Trade"	77%	82%	87%
R. Jagiełło "Transport"	75%	81%	87%
R. Jagiełło "Services"	72%	83%	89%
M. Potoczna, S. Wiñniewska	75%	79%	84%
S. Herman	83%	85%	91%

Source: Own study.

The data presented show that in the period of 3 years before bankruptcy the model of M. Pogodzińska and S. Sojak was the least effective, reaching an efficiency of 51%. In turn, the model that evaluated the best was the method of M. Tymoszuik with the result of 89%. Two years before bankruptcy, the poorest results were again achieved by the model of M. Pogodzińska and S. Sojak (57%). The highest value was also achieved by the model of M. Tymoszuik (91%). During this period, in each of the analyzed methods, the effectiveness achieved better prognostic values than in the previous period. All of the models analyzed achieved the best results one year before bankruptcy. Here, the precision of forecasts ranged from 61% (model of M. Pogodzińska and S. Sojak) to the level of 96% (model of T. Korol).

Table 3 presents the classification of early warning models based on the effectiveness of forecasts. The models, as in the previous tables, have been arranged according to the time of their creation to ensure consistency for all tables.

Table 3.

Classification of early warning models based on the obtained results

Autor modelu	Model place		
	3 years before bankruptcy	Two years before bankruptcy	One year before bankruptcy
E. Mączyńska	26	25	20
M. Pogodzińska, S. Sojak	31	31	31
J. Gajdka, D. Stos (Model 4)	22	24	30
D. Hadasik (model 1)	24	25	29
D. Hadasik (model 8)	27	28	26
D. Wierzba	29	30	23
A. Hołda	3	2	5
S. Sojak, J. Stawicki	24	22	15
J. Gajdka, D. Stos (Model 5)	12	9	9
D. Appenzeller, K. Szarzec (Model 1)	16	17	20
D. Appenzeller, K. Szarzec (Model 2)	20	22	25
M. Hamrol, B. Czajka, M. Piechocki	7	5	2
B. Prusak (model 3)	30	28	28
B. Prusak (model 4)	27	19	26
E. Mączyńska, M. Zawadzki (INE PAN F)	15	11	9
E. Mączyńska, M. Zawadzki (INE PAN G)	8	11	3
M. Kasjaniuk for Podkarpacie	12	21	20
M. Kasjaniuk for the Lublin region	16	19	18
T. Maślanka	10	15	17
T. Korol	5	4	1
A. Waszkowski	8	7	12
F. Wysocki, A. Kozera	22	25	23
M. Sukiennik	2	2	5
M. Tymoszuik	1	1	3
R. Jagiełło "Indusry"	10	5	5
R. Jagiełło "Construction"	6	11	15
R. Jagiełło "Trade"	12	11	13
R. Jagiełło "Transport"	16	15	13
R. Jagiełło "Services"	20	9	9
M. Potoczna, S. Wiśniewska	16	17	18
S. Herman	3	7	8

Source: Own study.

The models that ranked in the first three positions in the last year of the study are shown in bold in Table 3. It is worth noting that the best forecast accuracy has been found in the so-called universal models, not dedicated to a specific industry. All these models are models created after 2000. The highest efficiency among the so-called sector models had the model of R. Jagiełło, designed for the evaluation of enterprises in the manufacturing industry sector, and the model of M. Sukiennik for the evaluation of enterprises in the mining sector. In each of the periods analyzed, the weakest results came from the model of M. Pogodzińska and S. Sojak. The model of M. Pogodzińska and S. Sojak was created in the 1990s. Similarly, to other models created in the same decade, they did not achieve the effectiveness that would allow them to get a better position than 20. Additionally, in the last period analyzed, the last three positions were taken by models created in the 1990s. This is certainly evidence that there is a certain period from the time of construction when such a model can be used. Beyond this time, such a model becomes poorly plausible.

Three years before bankruptcy, the models of M. Tymoszuć (89%), M. Sukiennik (88%) and S. Herman (83%) were the most effective. Thus, there were two universal models and one so-called sectoral model. In the following period, the models of M. Tymoszuć and of M. Sukiennik as well as of A. Hołda were again the most effective. So again, there were two universal models and one sector model. In the last year of the study, the most effective were the models of T. Korol, M. Hamrol, B. Czajka, and M. Piechocki (the Poznań model), as well as of E. Mączyńska and M. Zawadzki. In this case, all three models were so-called universal models. Sector models took the next places – of R. Jagiełło for enterprises from the manufacturing industry sector and of M. Sukiennik for enterprises from the mining industry. Universal models took the next places once again. The obtained results of the study allow for the conclusion that there is no significant difference between the effectiveness of models dedicated to the assessment of enterprises from a specific industry, and the so-called universal models, applicable in various sectors of activity. This means that sector models are not a guarantee of obtaining better forecasts for the assessment of the financial condition of enterprises. In some cases, sector models were even characterized by lower effectiveness than universal models.

5. Discussions

The study conducted allowed for the classification of early warning models according to the accuracy of the forecasts. There is a tendency that the longer the forecast period, the lower the effectiveness of the models. The results in this respect are consistent, among others, with the research of K. Adamowicz and T. Noga (Adamowicz, Noga, 2014, pp. 643-650, and also of T. Korol (Korol, 2010, pp. 148-150). Importantly, in the last year of the study, the so-called universal models achieved the best results. This is different from the views of,

inter alia, T. Noga and K. Adamowicz (Adamowicz, Noga, 2018), but at the same time consistent with the results of the research carried out by W. Lichota (Lichota, 2017), or B. Prusak (Prusak, 2005). A similar position to the possibility of using discriminatory models to evaluate enterprises from various sectors is expressed by A. Kopiński and D. Porębski (Kopiński, Porębski, 2015).

At the same time, the conducted study confirms the position of S. Jones, who stated that the excess of indicators used in early warning models - after exceeding a certain number - makes the model less reliable than, respectively, models with a smaller number of measures (Jones, 2017). In addition, the study allowed to refute the thesis that models that use data from the cash flow statement in their construction are characterized by a higher reliability than models that are based only on data from the balance sheet and the loss and profit account (Maślanka, 2008). Therefore, one should agree, inter alia, with the views of A. Hołda and R. Pitera, who, on the basis of the research carried out, also showed that there is no correlation between the use of cash flow statement data and the increase in the diagnostic effectiveness of early warning models (Hołda, 2001; Pitera, 2014).

The results of the study also indicate that reaching for models whose construction took place several decades ago is not the best solution. Most of the models developed in the 1990s showed poor prognostic efficiency. The results of research by other authors also largely confirm this opinion in this area (Grice, Dugan, 2001; Rutkowska, 2006; Korol, 2010; Kitowski, 2012).

6. Conclusions

Of the 31 models, 8 of them were characterized by effectiveness greater than 90% in the last period analyzed. 17 methods achieved a forecast effectiveness of 80% and more. None of the 31 models used in the study showed 100% accuracy of the forecasts in any of the analyzed years. However, all models achieved prognostic values above 50%. Importantly, the models dedicated to the assessment of the financial situation of enterprises from a specific sector or region did not show better results than the so-called universal ones. It is also worth emphasizing that the oldest models held low positions in the analyzed period, which proves that the moment of the model creation influences its effectiveness. It is also worth remembering to use, if possible, the models not older than a dozen years to assess the bankruptcy prediction. The study conducted also verified the issue of selecting the number of indicators for the model and the positions in this regard. Well, the number of measures used by individual methods does not significantly increase the accuracy of the early warning model forecasts. The results of the study even indicate that an excessive number of financial indicators in the method not only fails to improve the effectiveness of a given model but, in many cases, even reduces the effectiveness of a given model. However, it is also worth remembering that too few such indicators in the

models also limit the predictive effectiveness of early warning models. It is also worth referring to the analysis period. Namely, the latest data came from the period of both the Covid-19 pandemic and the effects of the outbreak of war in Ukraine. Such situations, which are difficult to predict, certainly have a negative impact on the financial situation of various entities in the economy. However, referring to this type of phenomenon to the reliability of early warning models, no significantly worse diagnoses were noticed in the assessment of the financial situation of the enterprises included in the research sample. It can be concluded that such phenomena do not have a significant impact on the poorer credibility of the tested models.

The study conducted seems to be a significant contribution to the issue of assessing the effectiveness of early warning models and using models that appear to be the most reliable in this regard. This is because the studies that are based, first of all, on a large number of entities are much more reliable than similar analyzes based on small samples. Secondly, some models that are inadequate to the collected samples are often used. And finally, in economic practice such early warning models, which are characterized by high credibility and, at the same time, best suited to the specifics of the enterprise being assessed, are equally infrequent. Moreover, it can be noticed that despite an exceptionally large set of tools allowing for the assessment of the company's financial situation, the tools other than discriminatory models are still used sporadically. It is the discriminatory models that are still the most popular type of methods that have been used for several decades. Their popularity may be due to their good effectiveness, which was also confirmed in the study, but it is also a result of the application simplicity of such models. The combination of these two aspects is the answer why this type of early warning models is of great interest to many people.

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SUSTAINABLE DEVELOPMENT UNIVERSITIES: KEY INITIATIVES AND IMPACT ON STUDENT AWARENESS AND ENGAGEMENT

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Purpose: This paper aimed to examine what the most important initiatives and sustainable development goals are visible in the activities of sustainable development universities (SDUs), where sustainable development issues are considered a priority in the opinion of students from in total 10 countries around the world, and how this affects the awareness and involvement of students, the main stakeholders of SDUs.

Design/methodology/approach: The study was conducted among students at universities using the CAWI questionnaire in 2022. In the further part of the work, a statistical study was carried out using the non-parametric Pearson's Chi-square test for 2×2 tables and the PQStat 1.8 program from PQStat Software.

Findings: The study showed that students positively perceive initiatives and sustainable development goals at universities and actively participate in them, especially at public universities. Moreover, research has shown that the university's efforts towards sustainable development increase students' awareness and involvement in sustainable development, contributing to creating a more sustainable future and "Society 5.0".

Research limitations/implications: The study focused on the association between university initiatives and students' awareness and involvement, but it cannot establish a causal relationship. There might be other factors influencing students' engagement that were not explored in this research. Furthermore, the study primarily focuses on students, thereby excluding the perspectives and involvement levels of other stakeholders such as faculty, staff, and local communities. Understanding the views of these groups is critical for a more comprehensive assessment of SDUs' impact on sustainable development.

Practical implications: The article can guide universities on what sustainable development activities students need and how universities can achieve sustainable development goals.

Originality/value: The article fills the gap in the analysis of how the activities undertaken by sustainable development universities in the field of sustainable development affect the awareness and involvement of students.

Keywords: managing sustainable development, sustainable development universities, CAWI survey, awareness.

Category of the paper: research paper.

1. Introduction

For over 20 years, academic institutions have consistently been recognized as important partners in developing local sustainable development projects. The discussion of sustainable development is not new, but it is now more important than ever to look for innovative strategies, techniques, and tools to advance the sustainability argument in the context of higher education (Filho, 2011). Due to their experience, specialized knowledge, and contributions to regional development, universities become significant governance players. They have a huge potential to actively assist sustainable development because of their strong ties, especially with civil society players (Sedlacek, 2013). Universities must be ready to actively play this essential role given the opportunities provided by the Sustainable Development Goals to advance sustainable development in higher education as well as the importance of this subject and its global scope. Additionally, the Sustainable Development Goals give universities a special chance to consider how they run their institutions and may motivate them to put forth even more effort to improve their sustainability—not just in terms of operations but also in terms of research and instruction (Leal Filho et al., 2018). It is more important than ever to take into account the viability of creating academic programs that can actually equip graduates with the necessary knowledge and values, the ability to engage in critical thought, and the drive to address the vast array of problems connected to non-sustainable states, according to Sibbel (Sibbel, 2009). The major objective of the manuscript was to investigate which institutions involved in sustainable development execute projects and objectives, and how this influences student engagement and awareness, who are these universities' primary stakeholders what is novelty at work. There are many papers that examine sustainability issues in universities (Al-Naqbi, Alshannag, 2018; Brugmann et al., 2019; Gomes et al., 2022; Holmes et al., 2022), but they are more concerned with assessing students' understanding of the issue and determining what these activities are. Our manuscript fills the gap in the analysis of how the activities undertaken by universities in the field of sustainable development affect the awareness and involvement of students.

2. Literature review

In order to increase awareness of the need for a balance between the environment, the economy, and society, the idea of sustainable development is disseminated through the transmission of information. Universities play a key role in this process by serving as a link between scientific understanding and common sense (Mazon et al., 2020). Increasing students' awareness of sustainability should be a major focus for higher education institutions, according to Michel and Zwickle (Michel, Zwickle, 2021). By taking into account their three fundamental

tasks, which are training, research, and knowledge production and transfer, universities are a critical component to achieving Sustainable Development and Sustainable Development goals (Purcell et al., 2019b; Waas et al., 2010). They also have a moral obligation to future people to create a more sustainable and engaged society. With the pro-sustainable movement gaining strength, achieving sustainability on college campuses has drawn attention from all over the world (Moganadas et al., 2013; Sustainable markets..., 2015). The "University Charter for Sustainable Development" created by COPERNICUS is one of the key documents promoting university-community collaboration. According to the Magna Charta of European Universities and in accordance with the UNCED recommendations for environment and development education, universities have a responsibility to spread environmental literacy and encourage the practice of environmental ethics in society. Universities are urged under the Charter to "... commit themselves to an on-going process of informing, educating, and mobilizing all the relevant parts of society regarding the consequences of ecological degradation..." (The University Charter..., 1993). It is crucial to consider how social, political, and economic factors might be included in efficient planning and management of sustainable development processes (Łukomska-Szarek et al., 2023; Ulewicz, Blaskova, 2018). Although there have been some developments in the Higher Education for Sustainable Development field, there are still numerous challenges that need to be overcome (Leal Filho et al., 2019). To achieve progress in helping societies becoming more sustainability orientated, Universities' leaders, faculty, and students worldwide are challenged to co-work to build upon the foundations already laid to develop sustainable societies (Ramos et al., 2015). It is also necessary to take a learning and process-oriented approach, instead of focusing solely on the output of SD integration activities (Barth, 2013). It is important to motivate faculty, staff, and students to consider sustainability's core values and modify their behavior on a daily basis to support sustainability goals and efforts. Therefore, students can represent the most effective sustainability projects (Helferty, Clarke, 2009; Holmberg et al., 2008; Hopkinson et al., 2008; Leal Filho et al., 2019; Pereira Ribeiro et al., 2021). How can the members of these organizations act as more powerful role models and agents of change in all societies, ask Lozano et al. (Lozano et al., 2013). This is our chance, educators and students alike. In the past two decades, there has been an increase in awareness of the role that universities may play in assisting countries in becoming sustainable societies. The institutionalization of sustainability in higher education stands out among the alternative responses, aiming to make the switch to a design that has been dubbed a sustainable university. According to Velazquez et al. (Velazquez et al., 2006), a sustainable development university (SDU) is a University that places priority on reducing negative effects on the environment, society, economy, and health at the local, national, and international levels. Whether these are produced by the use of its resources when doing its outreach, teaching, or research or by assisting society in the shift to sustainable lifestyles. SDUs are new educational environments that "enable individuals to reflect through multicultural, global, and future-oriented perspectives, on their responsibility for the complex effects of decision-making and behavior",

according to authors Adomßent et al. Currently, capacity building activities are primarily focused on two areas: internally-focused activities aimed at building capacity within a local community to promote sustainable development among a larger group of stakeholders and externally-oriented activities aimed at building capacity within a local community to train students and staff towards a more sustainable university and campus (Shiel et al., 2016). Universities can make a significant contribution to sustainable development by educating and preparing their students to meet the challenges, as well as by increasing the capacity of their own internal structures and systems to operate more sustainably (Rosak-Szyrocka, Zywiolok et al., 2022; Szyrocka et al., 2023). Finally, universities can make a difference externally by helping to increase the capacity of stakeholders throughout their communities through education and research (Rosak-Szyrocka et al., 2024; Rosak-Szyrocka, Apostu et al., 2022; Shiel et al., 2016). By accelerating implementation through research and development, teaching, curriculum development, good governance, networking, reporting, and extension activities, SDU culture offers the best solution for achieving sustainability development goals (Leal Filho, Viera Trevisan et al., 2023; Purcell et al., 2019a). The conversion of universities into SDU gives a setting for conducting experiments to address complex issues and encourage community involvement (Aleixo et al., 2016; Filho et al., 2015; Leal Filho, Simaens et al., 2023). The importance of higher education in fostering sustainable behavior has been the subject of several research in the past (Meyer, 2015). According to Torgler et al. (Torgler, García-Valiñas, 2007), aiming to avert environmental harm depends in part on education. Higher education is a crucial element connected with environmental awareness and sustainable activities (Rampasso et al., 2019; Rosak-Szyrocka, Apostu et al., 2022). On the basis of these research, Meyer (Meyer, 2015) examines the possible causal link between educational attainment and environmentally friendly behavior. The research finds a clear causal relationship between the two factors and comes to the conclusion that rising levels of education are followed by rising levels of pro-environmental behavior. When considered together, these findings imply that higher education may have a significant influence on people's behavior, creating a pool of human resources to help with the transition to greater sustainability. University students can assist, promote, and accomplish progress if they understand the breadth of the sustainability development goals, according to Alomari and Khataybeh (Farouq Alomari, Abdullah Khataybeh, 2021). The knowledge, attitudes, and conduct of tertiary students concerning SD were examined in a number of research. To investigate undergraduate engineering students' comprehension of SD, authors Azapagic et al. (Azapagic et al., 2005) performed a global survey. The research found that even while students had little awareness of SD and had major gaps in their understanding of its economic and social elements, they still anticipated that SD will be increasingly crucial for future generations. A further finding of the research was that students had a fair amount of familiarity with important environmental laws, regulations, and policies.

3. Research Methodology

The aim of the article was to examine what the most important initiatives and sustainable development goals are visible in the activities of sustainable development universities (SDUs), where sustainable development issues are considered a priority in the opinion of students, and how this affects the awareness and involvement of students, the main stakeholders of SDUs.

The research sample in this study refers to a subset of students from universities in 10 countries around the world who identified their universities as Sustainable Development Universities (SDUs). These students were selected to provide data and insight into their perceptions of sustainability initiatives and goals at their SDU. These students are considered the main stakeholders within SDUs as they directly experience and interact with the sustainable development initiatives and goals of their respective institutions. The sample includes both undergraduate and postgraduate students from various academic disciplines. It consists of individuals who hold sustainability issues in high regard, as they have chosen to pursue their education in universities that prioritize sustainable development. Due to the use of the CAWI questionnaire, the research sample represents a technologically literate group, comfortable with online surveys, and potentially more inclined towards sustainability awareness. The research sample is international and diverse, reflecting a broad range of cultural perspectives and sustainable development practices. By including students from both public and private SDUs, the sample aims to capture variations in sustainability initiatives and goals implemented across different types of institutions. The research sample is a dynamic group of students contributing to a more comprehensive understanding of the impact of SDUs on student awareness and engagement in sustainability efforts. In this study, the research population consists of students from SDUs around the world. However, the research sample represents only a fraction of this larger population, and the findings are based on the characteristics and responses of the students who took part in the survey using the CAWI questionnaire.

The method used to select the research sample is Computer-Assisted Web Interviewing (CAWI) questionnaire. This online survey allows researchers to reach a diverse and geographically dispersed group of students efficiently. The CAWI questionnaire was distributed among students at various universities, and those who voluntarily responded constituted the research sample. By using this method, a broader range of students from different countries and universities could participate, providing valuable insights into their perspectives on sustainable development initiatives and goals.

The results presented in this article are part of a broader study (Rosak-Szyrocka, Apostu et al., 2022), which aimed to collect data and information on understanding, assessing and analyzing the impact of universities on sustainability in the context of society 5.0 from the perspective of the university's main stakeholder - students. The title of this study is: "Univeristy 4.0 Sustainable Development in the Way of Society 5.0". The full version of the

questionnaire consisted of 21 closed-ended questions and 8 questions on respondent characteristics. The questionnaire from the main study entitled above was addressed to students studying at private and public universities, at different years and levels of study, in different fields of study, coming from 13 selected countries around the world (9 from Europe and 4 from Asia). The survey was conducted electronically (CAWI questionnaire) from April to December 2022. Responses from 301 respondents were obtained. The responses to one of the questions in the survey were filtered: *Do you consider sustainability issues at the university where you study to be a priority?* 188 respondents answered "YES" to the above question. Universities, where sustainability issues were considered a priority by students, were identified and named "Sustainable Development Universities (SDUs)". Responses from these respondents were the basis for further analysis. Students from 10 of the max. 13 countries surveyed identified their Universities as Sustainable Development Universities (SDUs).

As part of the analysis of the results studied, the percentage characteristics of the metric characteristics of the respondents who indicated their Universities as SDUs were characterized first. On this basis, the profile of a typical student studying at SDUs was indicated. In order to obtain information on the importance of sustainability initiatives that were definitely undertaken by SDUs, a Pareto diagram was developed. Using it, the structure of the "Definitely YES" responses to the question *What sustainability initiatives are undertaken by the university where you study?* was analysed. In order to obtain information on the visibility of the goals of sustainable development in SDUs activities, an analysis of the percentage structure of "Definitely YES" responses to the question *Please assess which, in your opinion, the goals of sustainable development are the most visible in the university's activities* was performed using a Pareto diagram. This made it possible to identify the priority goals of sustainable development at SDUs from the students' perspective.

In order to gather students' opinions on SDUs' sustainability efforts, an analysis of the percentage structure of their responses to a series of questions regarding their interest, pride, active participation, evaluation of the university's activities, and acquired knowledge about sustainability during their studies at SDUs was conducted. The questions are: *Are the actions your university has taken toward sustainability important to you?*, *Are you proud of the initiatives your university is taking toward sustainability?*, *Do you actively participate in such initiatives?*, *Do you think the university could do even more for sustainability?*, *Did you gain additional knowledge about sustainability during your studies?*, *Do you think public awareness will increase due to the university's sustainability initiatives?*. Analysing the structure of the percentage of "Yes" answers to these questions will provide an understanding of the level of involvement and perception of the university's sustainability-related activities by students.

To obtain information on the effectiveness of SDUs in building students' awareness of sustainable development, the following questions were asked: *Do you think universities are effective in building students' awareness of sustainable development?*, *Do you think that universities are taking action for sustainable development because society expects them to do*

so? and the percentage structure of "Yes" answers to these questions was analyzed. A hypothesis was also formulated that students studying at public SDUs participate more actively in sustainability initiatives undertaken by these universities than students at private SDUs, which was verified using the non-parametric Pearson's Chi-square test for 2×2 tables and the PQStat 1.8 program from PQStat Software of Poznań (Poland). The hypothesis was verified at the assumed significance level of $\alpha = 0.05$.

4. Research Results

The results of the analysis of the percentage structure of students studying at SDUs (i.e., where sustainability issues are prioritized in the opinion of students) are shown in Figure 1.

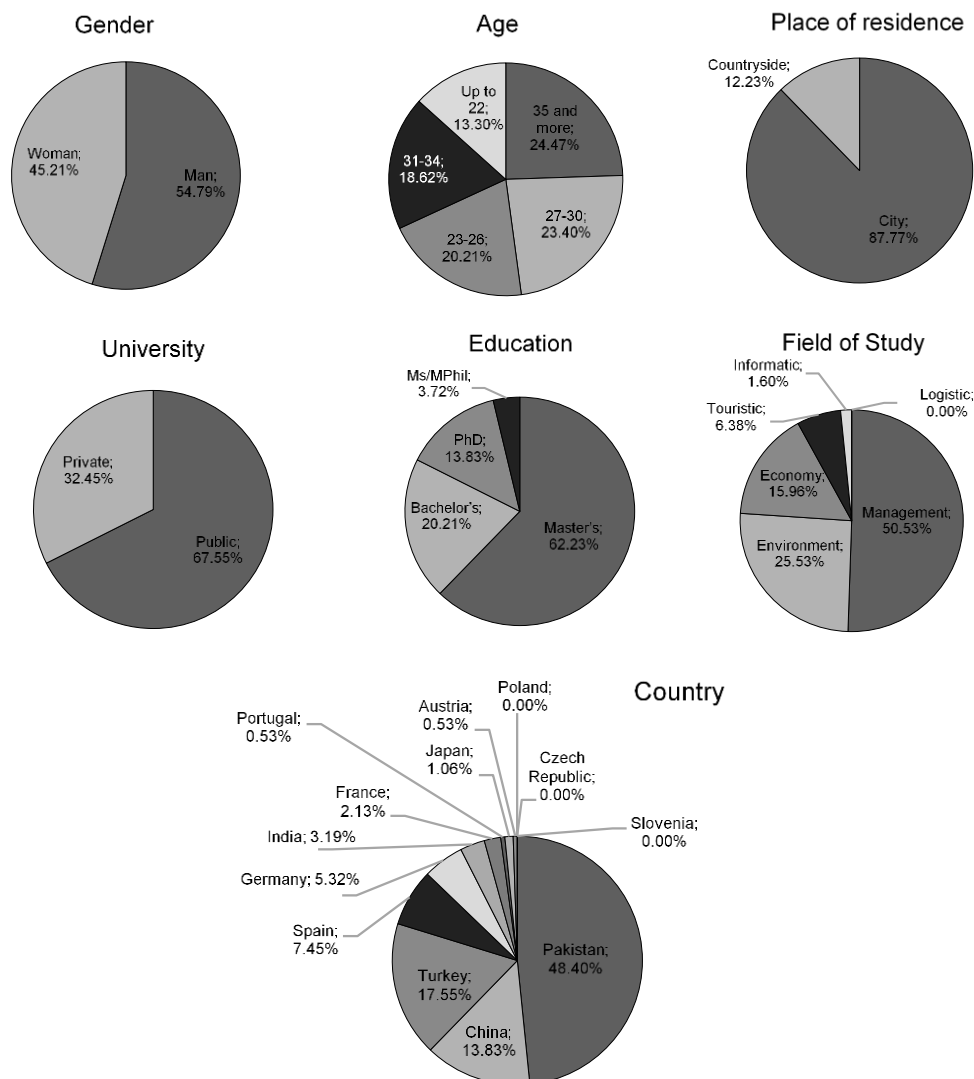


Figure 1. Percentage structure of respondents' characteristics - students studying at SDUs.

Source: own study.

Based on the presented percentage structure of respondents' characteristics, the profile of a typical (most frequent; based on the modal value statistics) student studying at SDUs can be indicated. He is: male, aged 35 or older, residing in a city area, studying at a public university, at the second degree level (Master's degree), majoring in Management, coming from Pakistan.

The following sustainability initiatives were identified, which were definitely undertaken by SDUs according to students studying at SDUs (Figure 2).

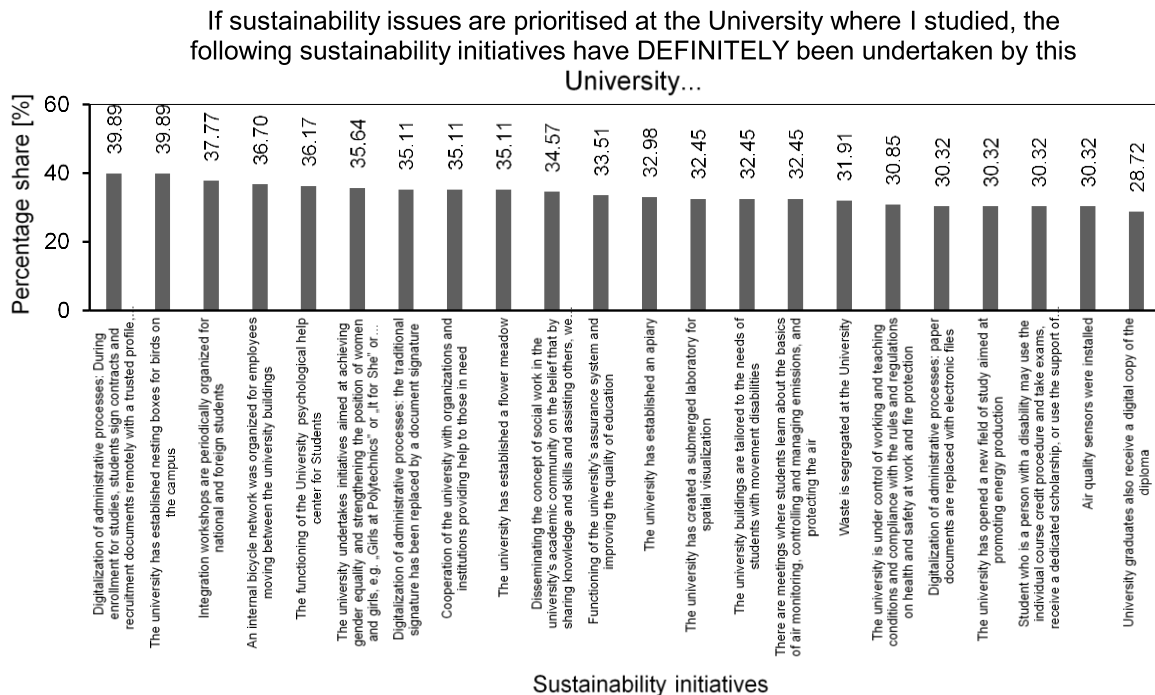


Figure 2. Pareto diagram of sustainability initiatives that were definitely undertaken by SDUs in the opinion of students.

Source: own study.

As can be seen from the Pareto diagram (Figure 2), the TOP 5 sustainability initiatives implemented by SDUs according to students are: 1. Digitalization of administrative processes: during enrolment for studies, students sign contracts and recruitment documents remotely with a trusted profile, qualified signature, or e-ID card (39.89%), 2. The university has established nesting boxes for birds on the campus (39.89%), 3. Integration workshops are periodically organized for national and foreign students (37.77%), 4. An internal bicycle network was organized for employees moving between the university buildings (36.70%), 5. The functioning of the University psychological help center for students (36.17%). According to students, these initiatives are particularly important to SDUs in terms of sustainability. Through digitalization, environmental protection, integration, sustainable transportation and psychological support, the SDUs surveyed are setting ambitious sustainability goals and looking out for the well-being of their students.

The following sustainability goals were identified, which were by far the most prominent in SDUs activities according to students studying at SDUs (Figure 3).

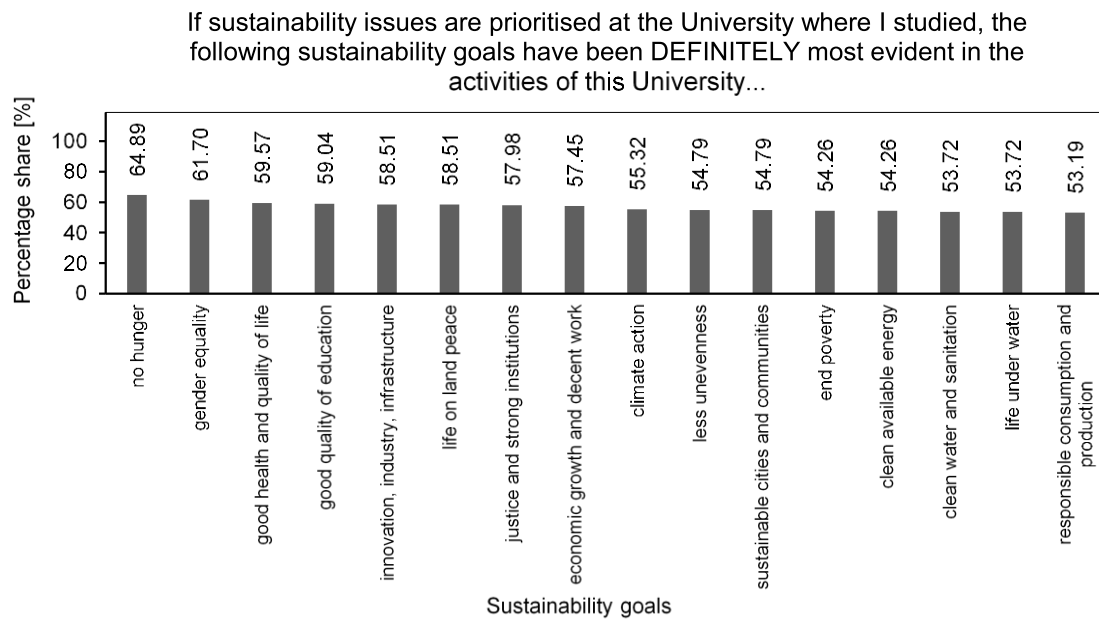


Figure 3. Pareto diagram of the sustainability goals that were by far the most prominent in SDUs activities according to students.

Source: own study.

The TOP 5 sustainability goals that were by far the most prominent in SDUs' activities according to students (Figure 3) were: 1. No hunger (64.89%), 2. Gender equality (61.70%), 3. Good health and quality of life (59.57%), 4. Good quality of education (59.04%), 5. Innovation, industry, infrastructure (58.51%). Analysis of student opinions indicates that the most important sustainability goals for SDUs are the elimination of hunger, gender equality, and good health and quality of life. These results indicate SDUs' social commitment and SDUs' awareness of issues critical to building a sustainable future. In addition, education and innovation are also important areas for SDUs, showing that students understand that through the development of science and infrastructure, SDUs contribute to achieving sustainable development.

The results of the analysis of the percentage structure of responses to the questions on interest, pride, active participation of students, evaluation of SDU activities, and knowledge gained by students on sustainability during their studies at SDUs are shown in Figure 4.

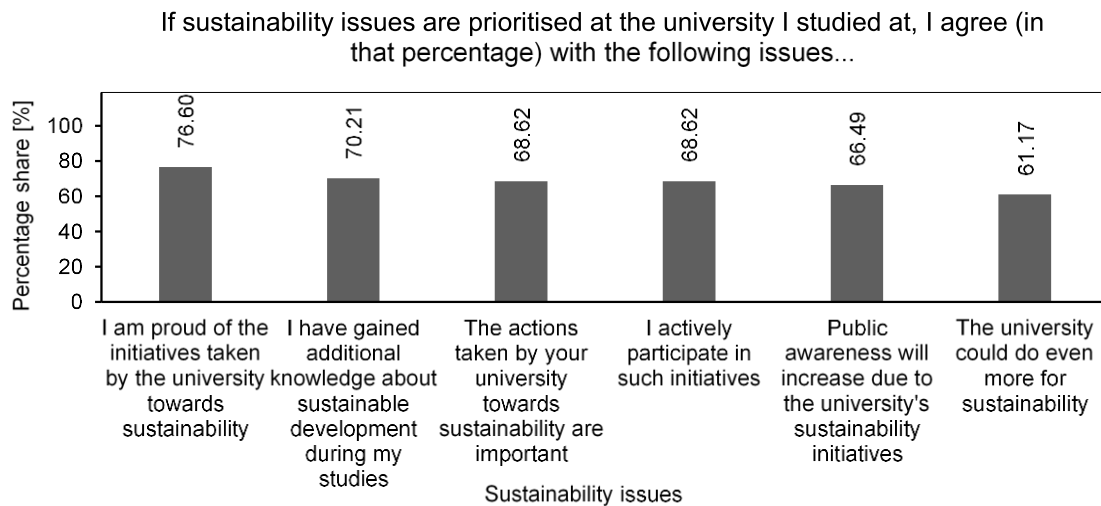


Figure 4. Pareto diagram of sustainability issues with which students studying at SDUs agree. 1st set of opinions.

Source: own study.

As can be seen from Figure 4, students studying at SDUs are most proud of the sustainability initiatives undertaken by SDUs (76%), getting an extra one on sustainability during their studies (70.21%), and the importance of actions taken by SDUs towards sustainability (68.62%). 68.62% of students studying at SDUs confirmed their active participation in sustainability initiatives. Thus, students not only feel pride and gain knowledge, but also actively engage in sustainability activities, which is important for promoting awareness and social change. SDUs play a key role in inspiring and engaging students in sustainability initiatives. These results suggest that SDUs are effective in influencing students' awareness and involvement in this important field, which can contribute to creating a more sustainable future and a "5.0 society."

The results of the percentage structure analysis on the effectiveness of SDUs in building students' awareness of sustainability are shown in Figure 5.

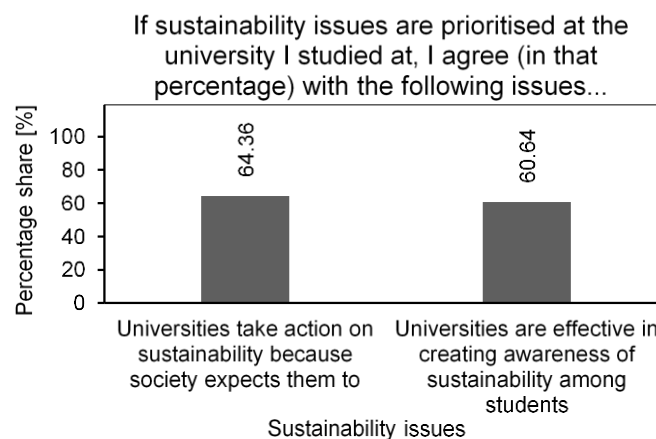


Figure 5. Pareto diagram of sustainability issues with which students studying at SDUs agree. 2nd set of opinions.

Source: own study.

As can be seen from Figure 5, SDUs' activities in the area of sustainability as perceived by students are mainly driven by society's expectations (64.36%). This suggests that SDUs are responsible for responding to society's needs and demands regarding sustainability. SDUs also play an important role in building students' awareness of sustainability according to students (60.64%). This implies that SDUs effectively contribute to educating and informing students about sustainability issues, which also leads to greater awareness and involvement in the subject.

The promotion of student involvement in and active participation of students in sustainability initiatives may depend on the legal status and form of ownership of SDUs (private universities vs. public universities). The following hypotheses (null and alternative) were verified:

H_0 : there is no dependence between the legal status and form of ownership of SDUs and the active participation of students in SDUs' sustainability initiatives.

H_1 : there is a dependence between the legal status and form of ownership of SDUs and students' active participation in SDUs' sustainability initiatives.

These hypotheses were verified using the non-parametric Pearson's Chi-square test for 2×2 tables. The expected frequency table does not contain any values less than 5. Cochran's condition was therefore met, making this test applicable.

At the accepted level of significance $\alpha = 0.05$, the Pearson's Chi-square for 2×2 tables test performed confirmed the truth of the alternative hypothesis ($p = 0.008687$). There is a relationship between the status and form of ownership of SDUs and active participation in sustainability initiatives undertaken by the university. Thus, it can be concluded that the status and form of ownership of SDUs significantly determine the active participation of students in initiatives undertaken by the university in the field of sustainability. Students studying at public SDUs participate more actively in sustainability initiatives than those studying at private SDUs, as confirmed by the cumulative column chart by row (Figure 6).

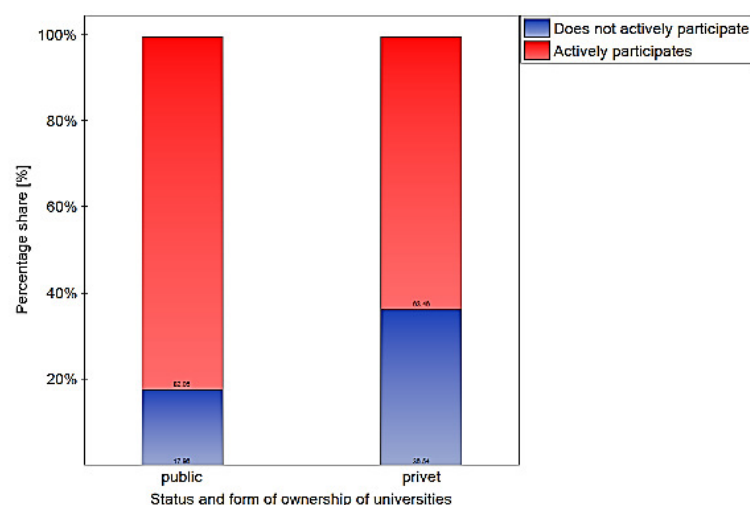


Figure 6. Percentage share of "active participation" responses type to sustainability initiatives by private and public SDUs.

Source: own study.

The proportion of responses of the "active participation" type for public universities (82.05%) is significantly different (higher) than for private universities (62.46%). Public SDUs often have more community involvement and may offer more sustainability-related programs and initiatives, such as courses, research projects, awareness campaigns or volunteer opportunities. The presence of such programs can influence greater student involvement in sustainability initiatives at the university. Public SDUs also often have a greater impact on the local community and can be more socially conscious. This can lead to greater student awareness and involvement in sustainability issues. Public SDUs can promote values of social responsibility, sustainability and community involvement. This culture of the institution can influence students' attitudes and behaviors toward greater involvement in sustainability initiatives.

5. Conclusion

The purpose of the article was to study what sustainable universities are doing to take initiatives and pursue sustainability goals, and how this affects the awareness and involvement of students, the main stakeholders of these universities. In the course of the research and analysis conducted, it was identified that the digitization of administrative processes, bird nests on campus, the organization of inclusive workshops, the establishment of a bicycle network for employees, and the operation of a psychological support center for students are the most visible initiatives undertaken by SDUs for students. In turn, students said that the most visible sustainability goals in SDUs' activities are fighting hunger, gender equality, good health and quality of life, high quality education, innovation, industry and infrastructure. The survey also showed that students studying at SDUs are proud of the university's sustainability initiatives. A large number of students expressed satisfaction with the additional knowledge about sustainability gained during their studies and the importance SDUs place on sustainability activities. In addition, the results showed that SDUs' sustainability activities are mainly driven by society's expectations, indicating that these universities are responding to society's needs and actively taking them into account in their activities. It was also proven that students studying at public SDUs participate more actively in sustainability initiatives than students studying at private SDUs. This suggests that there is a difference between the two types of universities in terms of student involvement in sustainability initiatives. In conclusion, the results of the study show a positive reflection of the implemented initiatives and set goals for sustainability at SDUs on student opinions, which demonstrates the success of these Universities in achieving their sustainability missions. Continuing these efforts can further increase students' awareness and involvement in sustainability topics, contributing to a more sustainable future and a "5.0 society". In the course of further analysis of the survey results obtained, the authors also

intend to verify, among other things, whether there are significant differences in the sustainability goals and initiatives undertaken by private and public SDUs, whether students' active participation in sustainability initiatives is significantly related to a particular field of study or year of study at SDUs.

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THE SITUATION IN THE FIGHT AGAINST THE PANDEMIC IN UKRAINE JUST BEFORE THE WAR WAS IMPROVING

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Purpose: The aim of the article is to compare the efficiency of pandemic management in two conflicting countries - Russia and Ukraine. The thesis about the superiority of Russia over Ukraine in terms of many social and economic factors seemed obvious. Reality measured with logically defined data contradicts this thesis. The use of statistical data ended on the day the war began.

Design/methodology/approach: Each of the two considered countries was treated as an administrative structure divided into regions (oblasts). It was assumed that the quality of regional management by the central authority should be assessed on the basis of fair and equal treatment of all regions. This assessment was made for two statistical factors - the number of deaths and the number of vaccinations, whose distribution in the country was assessed according to the Gini index.

Findings: Just before the war broke out – in February 2021, indicators of efficient pandemic management in the regions were better for Ukraine than for Russia. Ukraine recovered from the pandemic faster. This is a rather unexpected result. The article justifies the historical background of the centuries-old social and political relations between Russia and Ukraine, also using the position of Poland in these relations.

Research limitations/implications: The presented research, together with its methodology, can be repeated for any administrative structure (state, group of countries), regions, cities, etc. An obvious requirement for conducting such research is the availability of reliable data on deaths and vaccinations.

Practical implications: The method can be used to assess the efficiency of pandemic management at any administrative level (states, regions, groups of cities, etc.).

Originality/value: An important novelty and the result of the research is the discovery of the Ukrainian organizational advantage in the fight against the pandemic just before the outbreak of the war.

Keywords: Ukraine's war with Russia, COVID-19, vaccinations, pandemic deaths, pandemic management.

Category of the paper: Research paper.

1. Introduction

At the beginning of the article, let us recall a few statistical data characterizing the pandemic situation in Ukraine from the very beginning of the pandemic - numbers, facts, and dates. In Ukraine, the Covid-19 coronavirus infection was first diagnosed on March 3, 2020, in Chernivtsi. On March 13, the first death due to a coronavirus infection was recorded. We should remember that the first in-the-world prediction of the day of one million cases was provided by Koczkodaj et al., 2020 but it was only restricted to the beginning phase of the pandemic.

From March 12, 2020, by order of the Cabinet of Ministers, a quarantine was established on the entire territory of Ukraine. Trade establishments were closed, except for grocery stores, pharmacies, gas stations and banks. Metro lines in Kyiv, Kharkiv, and Dnipro have also been suspended, and intercity and interregional road, rail, and air services have been suspended. The quarantine lasted until May 22, 2020. It should be noted that these measures were taken to prevent the spread of the coronavirus disease. Because as of March 16, 2022, only 16 people were infected in Ukraine. The measures taken had the expected effect, it allowed to avoid the first peak of infection, which occurred in the spring of 2020 and was observed in many European countries. During the quarantine period of spring 2020 in Ukraine, a gradual increase in the number of new cases was observed, the value did not exceed 580 new cases per day ([https://index.minfin.com.ua/...](https://index.minfin.com.ua/)).

Nevertheless, in the future, there were new outbreaks of infections. Thus, in the pre-war period, four surges were observed in Ukraine:

- The first peak came on November 28, 2020, when 16,585 people fell ill in one day.
- The second surge came on April 2, 2021, when 20,003 people fell ill in one day.
- The third peak came in November 2021, when 28,477 people fell ill on November 4, 2021.
- The fourth peak occurred immediately before the war, on February 4, 45,022 new cases were detected (<https://phc.org.ua/>).

However, due to a successful population vaccination campaign in late 2021, the death toll during the fourth-largest wave did not greatly exceed the peak of the first wave. Thus, the maximum values of the dead during four outbreaks of infection with the coronavirus disease were:

- 297 people died on December 11, 2020;
- 486 people died on April 7, 2021;
- 861 people died on November 9, 2021;
- 322 people died on February 16, 2022.

These and other figures led us to the idea of analyzing the effectiveness of the management of the pandemic in Ukraine before the start of the war (<https://moz.gov.ua/>).

The main purpose of this paper is to try to prove the thesis that just before the war, Ukraine as a homogeneous and effectively governed state had progress in combating pandemics. It took appropriate steps to reduce differences in the state of pandemic risk between regions (oblasts). These are significantly positive developments, as there are three oblasts within the country already affected by the 2014 war - Crimea, Donetsk and Luhansk. The latter two were partially excluded from Ukrainian jurisdiction in an attempt to break away from the mother state, cooperating with the later aggressor - Russia. Despite this, pandemic data were obtained for both of these separatist regions. It did not succeed for Crimea, which is entirely under Russian control and was omitted from this research. Statistical research aimed at checking the homogeneity of infections in the country for diagnostic purposes and the homogeneity of organizational efforts measured by the vaccination rate is, according to the authors, extremely logical. Striving for fair treatment of all one's society in democratic countries should be an obvious principle of exercising power.

The article considers only factors related to the pandemic and assesses the efficiency of the state. In doing so, it was assumed that the most relevant and measurable factors in assessing the effectiveness of the fight against the pandemic would be the number of deaths and the number of vaccinations per population. Consideration of the number of new infections, widely regarded as the most important factor in the spread of a pandemic due to its indeterminacy, was dropped. The testing capabilities and laws governing the obligation and circumstances of reporting infection were and are different in each country. Asymptomatic passing of infection often left no statistical trace of the disease.

Considering the pandemic situation in Ukraine before Russia's aggression, i.e., by 24.02.2022, one can see that compared to the aggressor, covid statistics are quite similar. The hypothesis of a significant developmental, cultural or technological lag in Ukraine cannot be considered valid.

Ukraine's cultural heritage has a tradition dating back more than a thousand years, originating in the autonomous Principality of Rus, and in its long history it has developed its cultural code enriched by cultural patterns drawn from various geographic directions. Modern times have been heavily influenced by the Russian domination of the country (1795-1991), which lasted about two centuries, including its continuation of the Soviet domination of the country. It followed the collapse of the Polish, Ukrainian, Lithuanian and lands of present-day Belarus - the Polish-Lithuanian Commonwealth - as a result of the Partitions (1772-1795) and the incorporation of Ukrainian lands into the Russian Tsarist Empire. This meant that after nearly four centuries the Polish-Lithuanian Commonwealth ceased to exist as a state, and in Ukraine, western cultural patterns began to be replaced by the Russian partitioner with a system of state organization imposed by force. However, the cultural heritage of the former ROP in terms of spiritual culture and national myths continued to be cultivated until the rise of

nationalism (Snyder, 2009) and the great geopolitical changes resulting from the two world wars.

The end of World War I resurrected the hope of rebuilding its own, already national state. This was fostered by the expulsion of Russia from its ethnic borders by the armies of the Central Powers. De facto, under German protection, the foundations of nation-states were being formed, but their defeat in the West opened up competition for self-determination for the peoples of this part of the continent. While Poland managed to defend its independence in the war against the Soviet army, Ukraine, although separated as a Soviet Republic, was incorporated into the Land of the Rades and subordinated to Moscow.

Communist ideology, making the promise of revolutionary change of the system after the overthrow of the tsarism, remained a conglomeration of empty slogans and platitudes without confirmation in reality. The permanent transition period, characterized by the struggle against the omnipresent enemies of the people, was marked by the perfection of the system of surveillance and repression in all areas of social life (Pipes, 2008). Russian historian Lev Gumilev points to the leading role of the civilizational pattern, different from the European because Asian, which determined the formation of Soviet statehood (Gumilev, 1996). Attention is drawn to the superiority of the Soviet system over the tsarist one that preceded it in terms of both broader and deeper state control over the individual, who, moreover, was denied subjectivity in favour of an imaginary communist community (Kucharzewski, 1990). While russification and conversions to Orthodoxy were made under the tsars, the Soviet project involved comprehensive social engineering leading to the creation of a new Soviet man, living in a Soviet state and functioning in a communist economy. The inculcation of a collectivist mentality was linked to indiscriminate violence. Among the societies subjected to the Soviets, Ukrainians were the most massively and severely affected. Notable in its tragic consequences was Stalin's deliberately induced Holodomor (artificially caused famine - 1932-1933), which was intended to break the moral backbone of Ukrainian society and facilitate the creation of *hominum sovieticorum* (Heller, 1988). The clash of ideas with the realities of creating a new system was aptly described by H. Carrère D'Encausse in exposing both Lenin's pre-revolutionary intentions and presenting the later unificationist efforts to eliminate the differences in the lives of individual national groups and give them a common form (Carrère d'Encausse, 1992).

Stalin's ethnic cleansing and World War II took a strong toll on the cultural identity of Ukrainians. In the post-Stalin era, they joined in the reconstruction of their still-Soviet republic and gradually incorporated alongside Russians in the administration of the country. Brammer's "matryoshka nationalism" characterized the Soviet authorities' acquiescence in the coexistence of individual nationalities within a great nation as specific to Soviet nationalism (Brammer, 1993). This enabled, in his view, the birth of nationality movements.

Working from the grassroots and drawing on the rich Ukrainian tradition was a pillar of the revival of the Ukrainian intelligentsia and the expansion of the spirit of national tradition in the broader masses of society. Ukrainian elites had developed enough to attempt to govern the country independently after the dissolution of the USSR in December 1991. The political transition was not easy, and was characterized by social conflicts, the rapid formation of an influential and mutually belligerent oligarchy, a high rate of corruption, and fierce disputes over establishing the azimuth of political and economic integration along the east (Russia) - west (rapprochement with the European Union) axis. These tensions culminated internally, albeit with a behind-the-scenes destructive role of Russia, with the Orange Revolution (2004) or the pro-European Maidan (2013/2014), and externally with Russia's war against Ukraine marked so far by two stages - the annexation of Crimea and the occupation of part of Donbas from March 2014, followed by a further escalation of the already full-scale war from February 24, 2022.

The aforementioned events constitute a list of the most important and not exclusive factors determining the institutional and social conditions of the modern Ukrainian state and society oriented clearly towards Western patterns (Kozlovsky, Yankiv 2021). In the comparative dimension concerning the recent and still aspiring to such a role - the hegemon Russia, it is worth pointing to the recognized indicators reflecting the cultural and institutional characteristics of the compared countries. For this purpose, we used the representation of the dimensions of culture by G. Hofstede, indicators of the extent of freedom of political systems regularly measured by the Freedom House Organization, Perception Corruption Index, and basic economic and quality of life indicators (tab. 1).

Table 1.

Country comparison in dimensions of cultures by G. Hofstede

Dimension of culture	Russia	Ukraine	Poland
Power distance	93	92	68
Individualism	39	25	60
Masculinity	36	27	64
Uncertainty avoidance	95	95	93
Long term orientation	81	86	38
Indulgence	20	14	29

Source: own elaboration based on Geert Hofstede's cultures dimensions <https://www.hofstede-insights.com/fi/product/compare-countries/>, 8.10.2022.

Hofstede's dimensions of culture do not fully describe the cultural differences between Ukrainians and Russians, but nevertheless, provide a basis for pointing out certain distinctions. Hofstede sees Ukrainians as a more collectivist society than Russians, while in the other direction, they are far from the more individualistic Poles. Differences in the masculinity dimension of the culture are similarly perceived. The low-scoring dimension here represents societies' attitudes toward caring for others and quality of life. "Ukrainians, both in the workplace and when meeting a stranger, tend to understate their achievements, contributions or abilities. They speak modestly about themselves, and scientists, researchers or doctors are most

often expected to have a very modest standard of living. Dominant behaviour may be accepted when it comes from the boss but is not valued among peers" (<https://www.hofstede-insights.com/country-comparison/ukraine/>) A similar description applies to Russians, with the difference in results indicating a greater concern for neighbours among Ukrainians.

The similarity between Ukraine and Russia is shown by the level of corruption in both countries, Tab. 2, which is an un-"cured" post-Soviet legacy. It was the high level of corruption that was cited as the main obstacle to real modernization in Ukraine before the war with Russia.

Table 2.

Corruption Perception Index value in Transparency International organization's indicators in 2012, 2017, 2022

	2012	2017	2022
Russia	28	29	29
Ukraine	26	30	32
Poland	58	60	56

Legend: 0 means highly corrupt and 100 means very clean.

Source: <https://www.transparency.org/>, 8.10.2022.

While the indicators of cultural differences inadequately describe the differences that exist between Ukraine and Russia, already the reference to the institutional level and the outcome data of the scope of freedom of the political system and the scope of freedom of the Internet indicate the differences between the studied countries with an indication of a broader scope of freedom in Ukraine (tab. 3.)

Table 3.

The scope of freedom of the political system of Russia, Ukraine and Poland in the indicators of the Freedom House Organization in 2017 and 2022

	Global Freedom Score max 100		Internet Freedom Score max 100		Political Rights max 40		Civil Liberties max 60		Democracy Percentage max 100		Democracy Score max 7		Democracy Sstatus		Freedom in the World Status	
	2017	2022	2017	2022	2017	2022	2017	2022	2017	2022	2017	2022	2017	2022	2017	2022
Russia	19	19	30	30	5	5	15	15	7,14	5,36	1,43	1,32	CAR	CAR	Not Free	Not Free
Ukraine	61	61	62	62	25	26	36	35	39,88	39,29	3,39	3,36	THR	THR	Partly Free	Partly Free
Poland	81	81	na	na	37	34	52	47	73,81	58,93	5,43	4,54	SCD	SCD	Free	Free

Legend: SCD - Semi-Consolidated Democracy; THR - Transitional or Hybrid Regime; CAR - Consolidated Authoritarian Regime.

Source: own elaboration based on Nations in transit and Freedom of the World by Freedom house Organization, <https://freedomhouse.org/>, 8.10.2022.

Despite several dysfunctional burdens on state institutions carried over from the Soviet era, the Ukrainian state has gradually and noticeably raised the scope of civil liberties and democratic transparency. And although it is not a state without flaws such as, above all, continued oligarchization and corruption, it was already clearly more efficient than the state of the former hegemon.

A comparison of the population of the Russian state, as well as the total wealth of its citizens, falls decisively in Russia's favour. This largest state in the world is more than three times more populous than its neighbour and with an annual aggregate GDP nearly seven times larger, although per capita is already only three times larger. This is undoubtedly influenced by the magnitude of the unequal distribution of wealth, as reflected by the Gini index indicating a greater concentration of wealth among wealthy Russians than its dispersion among Ukrainians (tab. 4).

Table 4.

Pre-covid social and economic data for Russia and Ukraine as of 2019

	Population total	GDP current US\$ millions	GDP per capita current US\$	Gini Index 0-100	Human Capital Index 0-1 (2018 & 2020)	People using safely managed sanitation services (% of population)
Russia	143 446 060	1 069,0	11 536,3	37,7	0,7	61
Ukraine	44 386 203	153,9	3 661,5	26,6	0,6	72

Source: own elaboration based on World Bank data, <https://data.worldbank.org/>, 9.10.2022.

In the comparative analysis of the level of civilizational development of the two countries from the perspective of the health and well-being of the two societies, at least two indicators systematically studied by the World Bank deserve attention, namely the Human Capital Index (HCI), which is responsible for predicting the life expectancy of a born child to the age of 18, taking into account the risk of poor health and the degree of education in the inhabited country. This index reflects the improvements in current health and education outcomes that shape the productivity of the next generation of workers. It can also be complemented by the People using safely managed sanitation services indicator, i.e. reflecting the quality and availability of hygienic living conditions in households. While the HCI index minimally ranks the quality of life of Russian residents higher, the opposite is true from the perspective of hygienic conditions. In summary, the two countries differ in terms of economics and quality of life, with an apparent advantage for the wealthy in Russia over Ukrainian society. However, when we compare the broader masses of society the indication is in favor of the Ukrainian state, which before Russia's full escalation of the war provided better living conditions for its residents.

Ukraine here before the attack was a country not particularly distinguished negatively among the countries with which it borders.

2. Comparison with neighbouring countries

Ukraine borders 7 countries and all of them, along with Ukraine, are included in the diagram in Figure 1. The figure shows the number of pandemic-related deaths in each country per million inhabitants.

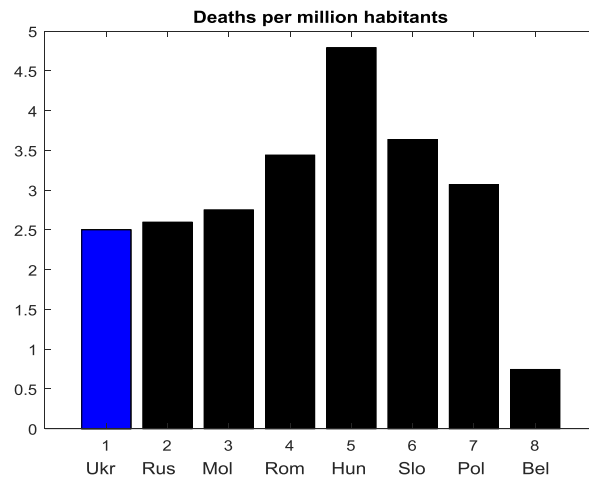


Figure 1. Number of deaths related to the COVID-19 pandemic as of 24.02.2022 in Ukraine and neighbouring countries per million inhabitants.

Source: CSSE JHU Baltimore, USA; <https://coronavirus.jhu.edu/map.html>.

The diagram shows that Ukraine was among the countries that stood out positively according to this criterion. It was in second place in the group of these countries behind Belarus. The next diagram, Figure 2, compares these countries according to the criterion of vaccinations performed, also based on data published by the CSSE of Johns Hopkins University (<https://coronavirus.jhu.edu/map.html>).

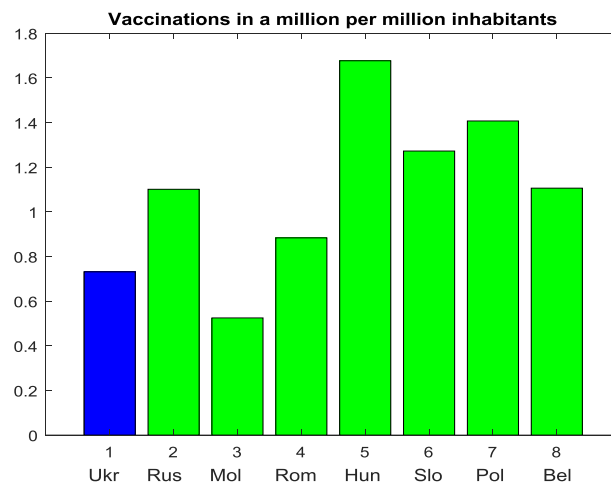


Figure 2. The number of all vaccinations performed in million related to population.

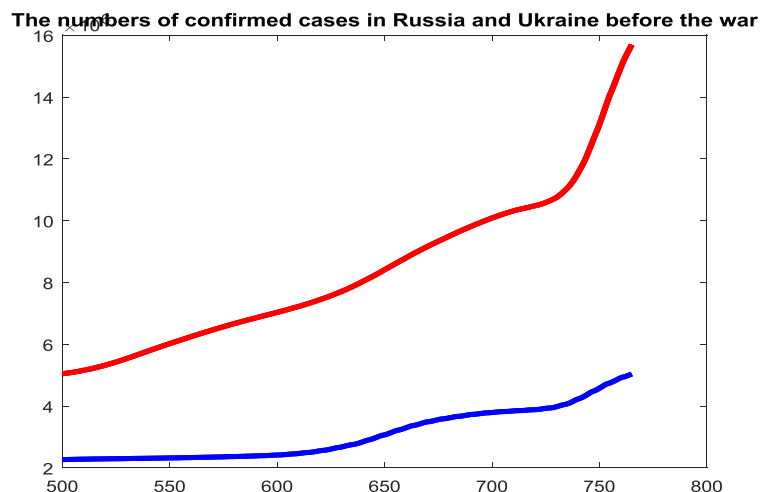
Source: <https://coronavirus.jhu.edu/map.html>.

In Figure 2, the opposite of Figure 1, the higher the bar, the better. This is because it is all about public health and the highest possible vaccination rate of the population. Ukraine does not fare well in this ranking, only Moldova is worse. The manufacturer of the vaccine may not be irrelevant here. According to (<https://www.euractiv.pl/...>), the proposal to vaccinate with Russian Sputnik V benefited Hungary and Slovakia, which for this reason found it easier to achieve a high vaccination rate (<https://www.euractiv.pl/...>, 29.03.2021). Without referring to the political aspects, however, the fact is the lower vaccination rate of Ukrainian society here before the war.

Is it possible, therefore, to put forward a thesis on organizational negligence in Ukraine in the area of fighting the pandemic?

How does Ukraine in general compare with Russia in statistical terms?

For example, on the issue of differential susceptibility to SARS-CoV-2 virus infection in the two countries compared in this article, the following statistical arguments can be made (based on data from the CSSE JHU (<https://coronavirus.jhu.edu/map.html>) widely considered by the scientific world to be reliable and supported). The first, shown in Fig. 3, is a comparison of the absolute number of confirmed infections in Russia and Ukraine.

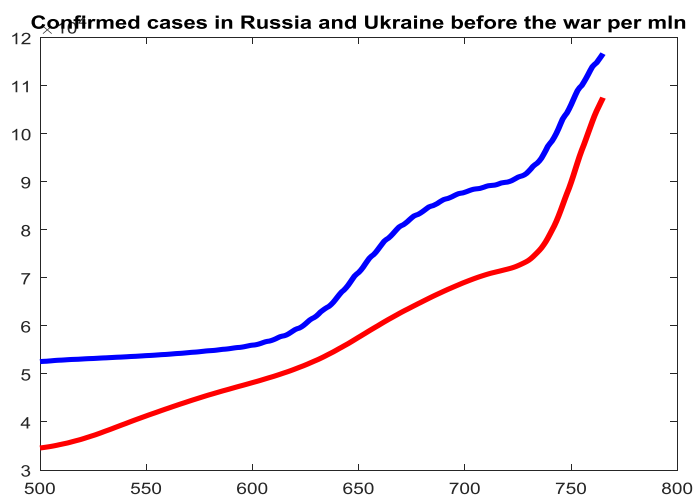


On the abscissa axis the number of days from the beginning of registration of COVID-19 statistics to the start of the war. On the ordinate axis, the number of confirmed cases in millions.

Figure 3. Number of infections of confirmed COVID-19 cases in Russia (upper) and Ukraine in the period until the start of the war on 24.02.2022.

Of course, Russia as a country with several times the population also has more confirmed infections. Is it in proportion to the population?

Figure 4 shows the same statistics converted to population.

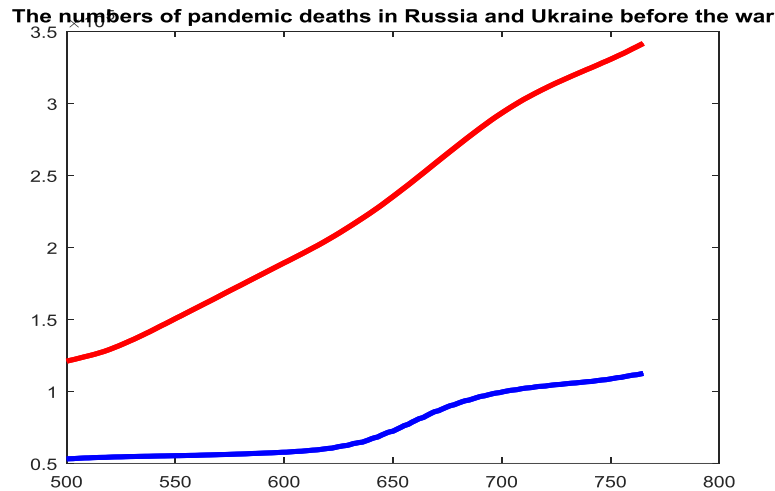


On the abscissa axis the number of days since the beginning of registration up to start of the war. On the ordinate axis, the number of confirmed cases in tens of thousands.

Figure 4. Number of confirmed cases of infection per population in Russia (lower) and Ukraine in the period until the start of the war on 24.02.2022.

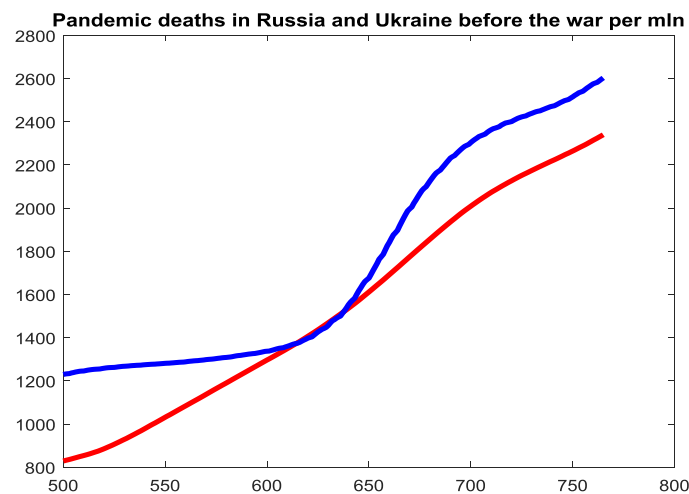
The graph of Fig. 4 already shows a worse situation for Ukraine than for Russia, although in general, the curves are not very far apart. Pearson's correlation coefficient for the observed curves is 0.9784.

A comparison of the number of deaths in Russia and Ukraine in the period before the start of the war may be of similar social significance. Figure 5 shows them in absolute numbers in Figure 6, after normalizing by dividing these values by the population.



On the abscissa axis, the number of days since the start of recording statistics. On the ordinate axis, the number of deaths in the hundreds of thousands.

Figure 5. The number of deaths remaining due to the pandemic in Russia (upper) and Ukraine (lower) until the start of the invasion by Russia.



On the abscissa axis, the number of days of the beginning of listing until the outbreak of war. On the ordinate axis, the number of deaths per million inhabitants.

Figure 6. The number of deaths remaining related to the pandemic in Russia (lower) and Ukraine (upper) per population, until the start of the invasion by Russia.

In Figures 4 and 6 we already see a worse pandemic situation for Ukraine than for Russia, but the difference is not critical. An important question could be raised here, whether the situation in Ukraine was improving, but the war prevented the observation of this trend, or vice

versa - the war hid the growing crisis due to the pandemic. To clarify this question, a criterion for managing the distribution of vaccinations among the regions was put forward.

With the outbreak of the war on 24 Feb 2022, the CSSE institute stopped noting all statistical data on Ukraine.

A method for measuring the degree of uniformity of vaccination in Ukraine's regions.

Referring to comparisons of Ukraine with other neighbouring countries more than with Russia itself, one could ask whether the not-so-good pandemic vaccination situation is changing and in what direction. The experience of many countries shows that one of the most important aspects of good pandemic management is the uniformity of vaccine distribution between regions (Arti, Wilinski, 2021; Chotikapanich, 2008, Gastwirth, 1972).

Let's make the following assumption at the outset of the method - if the distribution of vaccines in a country is moving in the direction of reducing the disparities between regions, this indicates good pandemic management.

The following regions (oblasts) of Ukraine were taken into account:

- Vinnytsia Oblast.
- Volyn Oblast.
- Dnipropetrovsk Oblast.
- Donetsk Oblast.
- Zhytomyr Oblast.
- Zakarpattia Oblast.
- Zaporizhzhia Oblast.
- Ivano-Frankivsk Oblast.
- Kyiv Oblast.
- Kirovohrad Oblast.
- Luhansk Oblast.
- Lviv Oblast.
- Mykolaiv Oblast.
- Odesa Oblast.
- Poltava Oblast.
- Rivne Oblast.
- Sumy Oblast.
- Ternopil Oblast.
- Kharkiv Oblast.
- Kherson Oblast.
- Khmelnytskyi Oblast.
- Cherkasy Oblast.
- Chernivtsi Oblast.
- Chernihiv Oblast.
- Kyiv (Municipality).

So let there be given a certain target territory T , here, Ukraine, which can be conventionally divided into N disjoint smaller territories T_i and making up the target territory T (for Ukraine $N = 25$ oblasts):

For all T_i belonging to T , the sum of T_i equals T , $T = \{T_1, T_2, \dots, T_N\}$ (1)

Each i -th territory has three features P_i , V_i and D_i :

where:

P_i – population in millions living in the territory in 2022 before the start of the war;

D_i – the cumulative number of deaths from SARS-CoV-2 by the start of the war;

V_i – the number of vaccinations with the last dose in the i -th oblast by the same date.

Let's enter the variable - the number of deaths per million population living in the i -th region of a country T_i as:

$$d_i = D_i/P_i, i = 1, 2, \dots, N \quad (2)$$

Whereby P_i should be expressed in millions of inhabitants. Similarly for vaccinations:

$$v_i = V_i/P_i, i = 1, 2, \dots, N \quad (3)$$

In further considerations, the integer variable M_i of the number of one-million population granules in the i -th region T_i will be useful, which can be determined after rounding:

$$M_i = \text{round}(P_i), i = 1, 2, \dots, N \quad (4)$$

The idea of determining the inequality of the distribution of infections and deaths in a country will be reduced to the Lorentz curve model known in economics as the income distribution function of a society. It allows us to determine what percentage of the population earns income above or below a certain level (Gastwirth, 1972).

For the purposes of this model, let's imagine that the entire population of a country is divided into one-millionth granules. Suppose we have two classes of such granules. One represents the amount of deaths in a region and the other represents the amount of vaccination in that region. The granules of each class differ from each other by some characteristic - the number of deaths per million or the number of vaccinations per million population. Therefore, in each T_i - this territory will be associated with two types of granules - granules equal in terms of d_i and other granules equal in terms of v_i . If the granules, separately for each type, are sorted from those with the lowest d_i value starting to those with the highest d_i values, they will form a stepped curve. The lengths of the horizontal segments of such a curve will correspond to the population of each T_i region and the step changes on the ordinate axis will correspond to changes in the d_i characteristic - the number of deaths per million. The integral of such a stepped curve is called a Lorentz curve. It will be a broken curve with the characteristics of the income curve already mentioned in economics. In an identical way, we can construct a Lorentz curve for vaccinations.

Formally, the Lorentz curve can be explained using the following pseudocode proposed by Wilinski, Arti and Kupracz 2022:

```

k = 0; % index of one-million granules
for i = 1: N %oblasts from 1 to N
for j = 1: Mi % Mi - the numer of the granules in i-th oblast
k = k+1;
zk = Li %feature of k-th granula – e.g. number of deaths or vaccinations;
end for j
end for i.

```

The result of the execution of these loops is a vector z_k , $k = 1, 2, \dots, K$ granules of different sizes, approximately as many as there are millions of population in a country (sum P_i). Let's denote the length of the vector z_k as K .

$$K = \text{sum} (M_i) \quad (5)$$

Now let's arrange these one-million population granules according to their L_i values, in ascending order

$$Z_s = \text{sort} (z_k), \text{Ascend} \quad (6)$$

Let's then calculate the integral of the above curve according to the formula:

$$Z_c(k) = \text{sum} (1:k) z_s \text{ for } k = 1, 2, \dots, K \quad (7)$$

In order to normalize this curve, let's determine the sum of all the z_s as $Z = \text{sum} (1:K) z_c$

$$Z_n(k) = Z_c(k)/Z \quad (8)$$

We also place the normalized variable $kn=k/K$ on the abscissa axis. In this way we move along the demographic resources of a country express them in the form of a number belonging to $[0,1]$.

We will calculate the Lorentz curves according to Gastwirth (1972) and the resulting Gini coefficients to determine the uniformity of the number of deaths in Ukrainian regions and then according to the same rules to calculate the uniformity of vaccination.

3. Studies of the distribution of deaths and vaccinations for different oblasts

The study aims to verify the trend of the death rate and the vaccination rate in Ukraine based on measurements taken at two relatively distant moments in time - in September 2021 and February 2022, just before the war.

The assumptions are as follows - if the Gini index for deaths and vaccinations decreases, it will mean a more even distribution of both characteristics across the country, which will be a desirable phenomenon.

Table 5 shows for all regions of Ukraine data measured at two points in time - in September 2021 and February 2022 just before the start of the war.

Table 5.*Data for each oblast in the fight against the pandemic*

Oblast	Population [thousand]	Deaths Sep 21	Deaths Feb 22	Vaccin Sep 21[thous]	Vaccin Feb 22[thous]
	1	2	3	4	5
Vinnitsia	1512	1726	3394	157916	563413
Volyn	1022	1206	2278	70691	318654
Dnipropetrovsk	3100	4676	9199	321025	1339792
Donetsk, for territory under Ukraine's control (18718 km ²)	4063	2479	5357	146571	610434
Zhytomyr	1181	1828	3392	123166	441253
Zakarpattia	1245	1612	2596	83889	305466
Zaporizhzhia	1641	2484	5605	123325	575310
Ivano-Frankivsk	1353	2120	3313	90852	407485
Kyiv	1795	2797	4861	256220	832728
Kirovohrad	906	874	1662	76750	309237
Luhansk, for territory under Ukraine's control (18 306 km ²)	2105	1012	2292	66286	281699
Lviv	2480	3720	6282	237520	970015
Mykolaiv	1093	1885	3417	113455	394356
Odessa	2353	3081	5769	187370	822623
Poltava	1354	1885	3989	186610	609441
Rivne	1143	1217	2416	85104	402574
Sumy Oblast	1037	1355	3033	111173	425891
Ternopil Oblast	1023	1223	2268	86641	353312
Kharkiv Oblast	2602	3687	6641	233724	1047899
Kherson Oblast	1003	1216	2788	98975	362509
Khmelnyskyi Oblast	1231	1926	3532	114578	435505
Cherkasy Oblast	1162	1334	2812	146517	487376
Chernivtsi Oblast	891	1843	3173	68279	283919
Chernihiv Oblast	961	1366	2621	106200	381363
Kyiv (Municipality)	2953	5281	8687	610506	1833499

Using data on deaths (col. 3, tab. 5) and vaccinations (col. 4, tab. 5), at the first time point under study – Sept. 2021 with the population in each oblast (col. 2, tab. 5). Gini coefficients were calculated for the two variables under consideration.

The Gini coefficients for the two distributions are shown in Fig. 7.

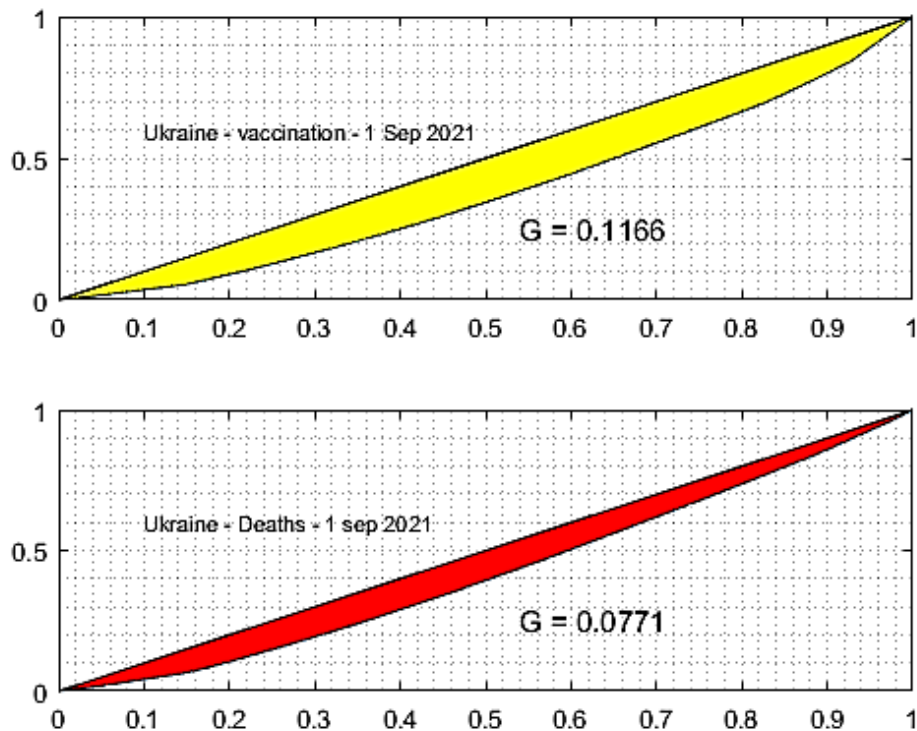


Figure 7. Lorenz curves and Gini coefficients for pandemic deaths and vaccination in Ukraine in September 2021. Gini coefficients are determined by the filled-in fields - for vaccination at the top and for deaths at the bottom.

After performing operations according to the described pseudo-code, it is possible to determine the Lorenz curve which in Figure 7 is represented by an arched broken curve bounding the field from below (in both parts of the figure). If we denote the area under the Lorenz curve as A , the Gini coefficient is the area G expressed as a part (percentage) of the lower triangle of the normalized graph.

$$G = 0.5 - A \quad (9)$$

In the above formula, 0.5 is the area of the lower triangle in the normalized square 1×1 . The diagonal of this square would be the Lorenz curve for an idealized completely uniform distribution of the trait under study.

For the distribution of deaths in the regions of Ukraine according to the methodology described above obtained:

$$GD = 0.0771.$$

And for the distribution of vaccinations:

$$GV = 0.1166.$$

The results can be assessed as a fairly even distribution of both deaths and vaccinations across the country. The world as a whole, for example, has a Gini index for deaths of five times higher, about 0.38 (Wilinski, Bach-Dabrowska, 2022). This implies a great natural "injustice" in the distribution of deaths, globally.

Within the framework of the present study, the task was to check whether the Gini coefficients for deaths and vaccinations for Ukraine change over time, and what is the direction of these changes.

The results on the distribution of deaths and vaccinations by region were collected on February 7, 2022, and so a dozen days before Russia's aggression.

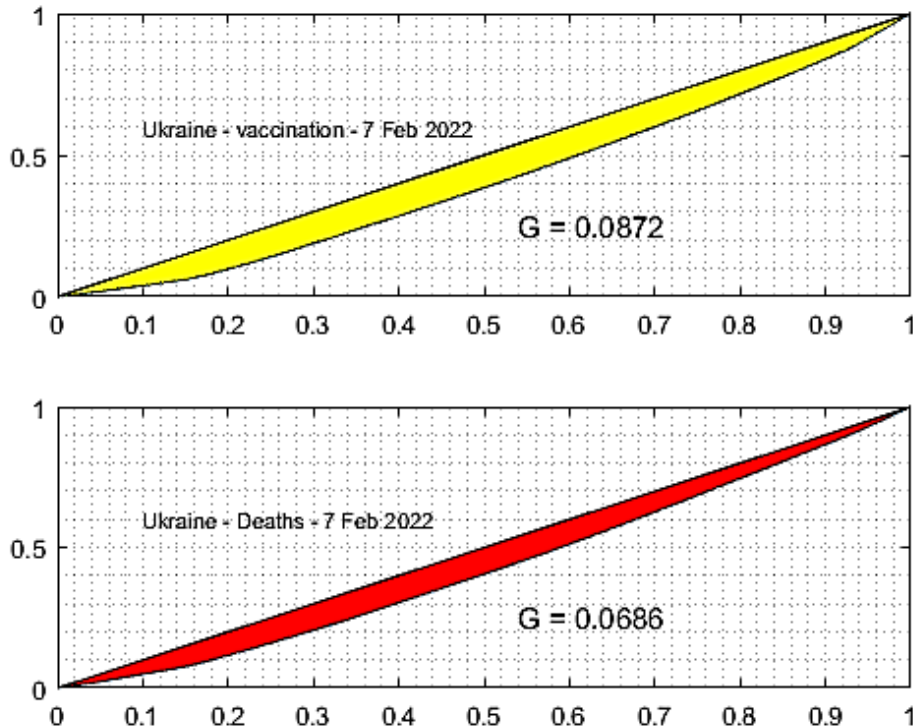


Figure 8. Gini indices for Ukraine calculated a few months after the first observation. Now just before the outbreak of war in February 2022.

The results of these calculations are shown in Fig. 8. The most important conclusion of comparing the graphs in Fig. 7 and Fig. 8 is the conundrum of decreasing Gini coefficients for both factors considered - deaths and vaccinations.

For comparison, we calculated the Gini index for vaccination statistics in the Russian regions as of February 2022. We analyzed the data presented on the website and selected vaccination statistics by region plus or minus as of February 11, 2022. The collected statistics are presented in Table 6.

Table 6.

Data on the population and number of vaccinations in Russia to assess the uniformity of the distribution across the country

NN	Region name	Population vector for each oblast (1x83) in thousand	Vector of the number of vaccinations in region around the 11th of February 2022	NN	Region name	Population vector for each oblast (1x83) in thousand	Vector of the number of vaccinations in region around the 11th of February 2022
1	Republic of Adygea	468,34	220000	43	Murmansk region	724,452	357000
2	Altai Republic	221,559	132839	44	Nenets Autonomous Okrug	44,54	23954
3	Altai region	2268,179	1338386	45	Nizhny Novgorod Region	3144,25	2008478
4	Amur region	772,525	454358	46	Novgorod region	586,129	302504
5	Arkhangelsk region (with NAO)	1114,322	539447	47	Novosibirsk region	2780,29	1716327
6	Astrakhan region	989,43	474366	48	Omsk region	1879,55	1225240
7	Republic of Bashkortostan	4001,678	3085430	49	Orenburg region	1924,58	881700
8	Belgorod region	1531,917	1083531	50	Oryol Region	714,094	406841
9	Bryansk region	1168,771	681533	51	Penza region	1274,06	871023
10	The Republic of Buryatia	982,629	504347	52	Perm region	2556,85	1173000
11	Vladimir region	1323,659	667654	53	Primorsky Krai	1863,01	1109310
12	Volgograd region	2449,781	1700000	54	Pskov region	613,356	296297
13	Vologodskaya Oblast	1139,499	527000	55	Rostov region	4153,76	2079790
14	Voronezh region	2287,678	1519100	56	Ryazan Oblast	1085,15	668975
15	The Republic of Dagestan	3153,857	1446504	57	Samara Region	3131,72	1750000
16	Jewish Autonomous Region	153,831	66802	58	St. Petersburg	5377,5	3285000
17	Zabaykalsky Krai	1043,467	727207	59	Saratov region	2360,96	1538814
18	Ivanovo region	976,918	541938	60	The Republic of Sakha (Yakutia)	992,115	650917
19	The Republic of Ingushetia	524,058	308756	61	Sakhalin region	484,177	242056
20	Irkutsk region	2357,134	1373868	62	Sverdlovsk region	4264,34	2309000
21	Kabardino-Balkarian Republic	870,487	286000	63	Republic of the North Ossetia - Alania"	688,124	269115
22	Kaliningrad region	1027,678	510900	64	Smolensk region	909,856	534809
23	Republic of Kalmykia	267,756	156915	65	Stavropol region	2780,2	1543167
24	Kaluga region	1012,844	531119	66	Tambov Region	980,984	536363

Cont. table 6.

25	Kamchatka Krai	312,704	153448	67	Republic of Tatarstan	3886,4	2591000
26	Karachay-Cherkess Republic	464,219	230933	68	Tver region	1230,19	735111
27	Republic of Karelia	603,067	292753	69	Tyva Republic	332,609	675887
28	Kemerovo region	2604,272	1250100	70	The Republic of Khakassia	528,338	773000
29	Kirov region	1234,78	785297	71	Tomsk region	1068,3	150047
30	Komi Republic	803,477	491198	72	Tula region	1432,57	1176975
31	Kostroma region	620,776	309791	73	Tyumen region without Khanty-Mansi Autonomous Okrug and YaNAO	1552,15	700156
32	Krasnodar region	5687,378	3069826	74	Udmurt republic	1484,46	767350
33	Krasnoyarsk region	2849,169	1362709	75	Ulyanovsk region	1203,97	721436
34	Kurgan region	805,51	469005	76	Khabarovsk region	1298,98	324617
35	Kursk region	1083,584	573000	77	Khanty-Mansiysk Autonomous Okrug - Yugra	1702,24	881700
36	Leningrad region	1911,586	961517	78	Chelyabinsk region	3418,61	1902405
37	Lipetsk region	1113,68	638486	79	Chechen Republic	1516,39	722000
38	Magadan Region	137,767	85858	80	Chuvash Republic	1198,43	704373
39	Mari El Republic	671,455	430301	81	Chukotka Autonomous Okrug	50,04	32892
40	The Republic of Mordovia	770,673	482000	82	Yamalo-Nenets Autonomous Okrug	552,117	274000
41	Moscow	12635,466	6199585	83	Yaroslavl region	1227,38	646000
42	Moscow region	7768,878	4417160				

The calculation of the Gini index and the construction of the Lorenz curve was carried out according to the formulas given above. The result of calculating these indicators on the database of vaccination in the regions of Russia as of mid-February 2022, before the war, is presented in Fig. 9.

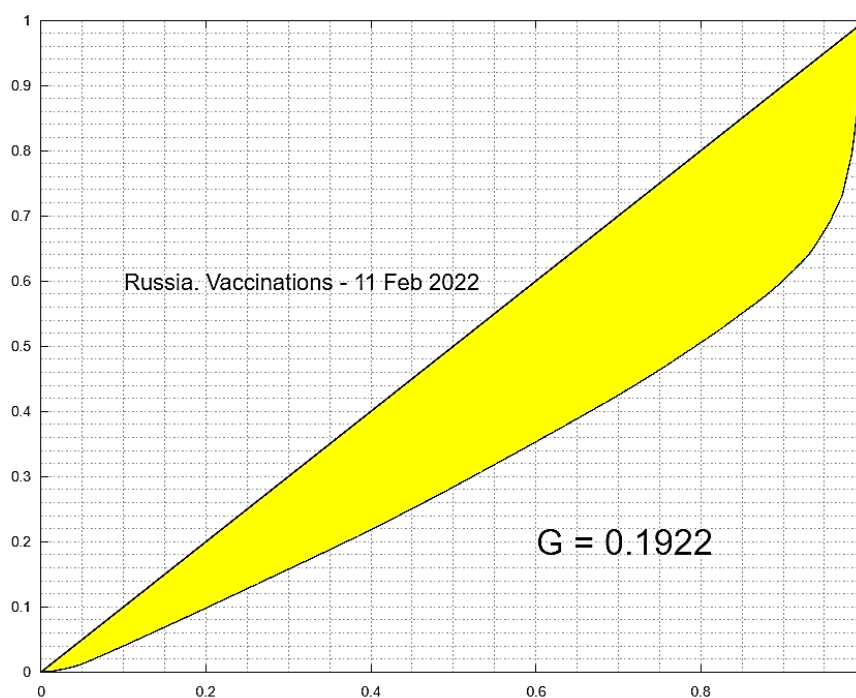


Figure 9. Gini indices for Russia calculated just before the outbreak of war in February 2022.

As can be seen from Fig. 9 the situation with vaccination in the Russian regions in the pre-war period remained quite difficult. The value of the Gini index as of February 2022, $G = 0.1922$, is worse than in Ukraine at the beginning of September 2021, when this indicator was equal to $G = 0.1166$. According to the estimate of the Gini coefficient in February, the situation with the distribution of vaccination on the territory of Ukraine ($G = 0.0872$) was 2.2 times better than in the corresponding period in Russia ($G = 0.1922$).

4. Peculiarities of the vaccination process in Ukraine

The attitude of ordinary Ukrainians towards vaccination gradually changed. If at the beginning of the pandemic in 2020, due to a lack of understanding of the vaccine mechanisms action and elementary fears of the new, a large part of Ukrainians were afraid of the so-called "chipping" with a vaccine, or something like that, various fables spread among the population. Thus, in December 2020, a survey was conducted by the Kharkiv Institute of Social Research on behalf of the Laboratory of Public Interest Journalism with the support of the International Renaissance Foundation. The survey was conducted from December 13 to 23, 2020 using the Computer-Assisted Personal Interviews (CAPI) method. 1,500 face-to-face interviews were conducted using a random sample in settlements of different sizes, representing 5 macro-regions of Ukraine (East, West, South, North, Center) ([https://khisr.kharkov.ua/...](https://khisr.kharkov.ua/)). The study showed that some months before starting vaccination, 40% of Ukrainians were ready to be vaccinated against the coronavirus. Those who are not ready were more - 47%, and 13% of

Ukrainians were undecided. According to this study, 50.6% of respondents among those who did not plan to be vaccinated expressed fears for their health, fearing that vaccination would cause an allergy or exacerbation of the chronic disease, as the main reasons for refusing vaccination. 43.5% of respondents believed that an effective vaccine could not be developed so quickly, therefore they thought that it would not protect against infection and would be dangerous.

But over time, the situation changed, the UNICEF study: Most Ukrainians are ready to be vaccinated against COVID-19 ([https://www.unicef.org/ukraine/...](https://www.unicef.org/ukraine/)) which was conducted in April 2021, showed that most of the respondents had already made up their minds, so 62% of the respondents agreed to vaccination, 34% of the population were against vaccination, and only 3% hesitated in making a decision. In this way, the attitude to vaccination changed from December 2020 to April 2021. Vaccination was started in February 2021.

In connection with the vaccine shortage at the beginning of the public vaccination campaign, on December 24, 2020, the Ministry of Health of Ukraine, by order N 3018/2022 (<https://ips.ligazakon.net/document/MOZ32580>) determined priority population groups for vaccination among them:

1. medical workers, including persons who directly participate in measures to combat the coronavirus disease COVID-19;
2. social workers;
3. persons living in institutions providing long-term care and support and employees of such institutions;
4. elderly people (60 years and older), including people with concomitant diseases who are at risk of developing complications and death due to the disease of the coronavirus disease; the following priorities were defined in this group, starting with people over 80 years of age (the highest priority), and further dividing into cohorts 79-75 years, 74-70 years, 69-65 years, 64-60 years;
5. military personnel who are participating in the Joint Forces Operation;
6. employees of critically important state security structures, including the State Emergency Service of Ukraine, the National Police of Ukraine, the National Guard of Ukraine, the Security Service of Ukraine, the State Border Guard Service of Ukraine, servicemen of the Armed Forces of Ukraine, the Ministry of Internal Affairs of Ukraine;
7. teachers and other workers in the field of education;
8. adults (aged 18 to 59 years; from 16 years old) with concomitant diseases who are in the risk group for the development of complications and the onset of death in connection with the disease of the coronavirus disease COVID-19;
9. people who are in places of restraint and/or detention centres and employees of the places.

These population groups were planned for vaccination in the first place. However, already in April 2021, an opportunity arose and vaccination for the elderly (60+ years) was announced. All adults over the age of 18 who expressed a desire to be vaccinated receive such a possibility from July 21, 2021 ([https://www.ukrinform.ua/rubric-society/...](https://www.ukrinform.ua/rubric-society/)).

Everybody can get vaccinated at the nearest vaccination point, a mass vaccination centre, the enterprises could also be ordered a mobile brigade if there were more than 50 employees. Vaccinations were carried out based on 3,127 vaccination offices, in more than 200 vaccination centres and by the forces of more than 800 mobile brigades. It was possible to sign up for vaccination by calling the registration desk of the vaccination centre or mass vaccination contact centres, and a live queue was formed at vaccination centres.

The third wave of Covid'19 in Ukraine occurred in October-November 2021, it turned out to be the most severe in terms of the number of deaths. Based on forecasts on the eve of the third surge, the Cabinet of Ministers of Ukraine introduced stricter measures. 23 September 2021, the Cabinet of Ministers of Ukraine will amend Resolution No. 1236 on establishing quarantine and introducing restrictive anti-epidemic measures ([https://zakon.rada.gov.ua/...](https://zakon.rada.gov.ua/)).

The changes to the so-called "quarantine decree" contained two key innovations.

The first is the introduction of yellow and green internal COVID-19 certificates. Yellow ones become available to those who have received one dose of the vaccine against the coronavirus disease, and green ones - those who have completed the course of immunization. In addition, certificates soon began to include the entire history of "interaction" with COVID-19, in particular, information on whether a person has already been sick.

The second key change to the Decree concerns the holding of mass events, the operation of entertainment facilities, catering and cultural facilities, and sports centres. Since then, the owners of establishments and organizers of events have been checking the presence of all event participants, users, visitors, and the organizers (employees) themselves, with documents that would confirm receipt of vaccination against COVID-19 or the absence of a person with a coronavirus disease. In our opinion, it was this Resolution that caused the vaccination peak, which fell at the end of October 2021. The dynamics of vaccination in the period from the beginning of vaccination to the beginning of the war can be seen in Fig. 10. The average weekly number of new vaccines, all vaccinations for the blue line and the first vaccinations for the red line were chosen.

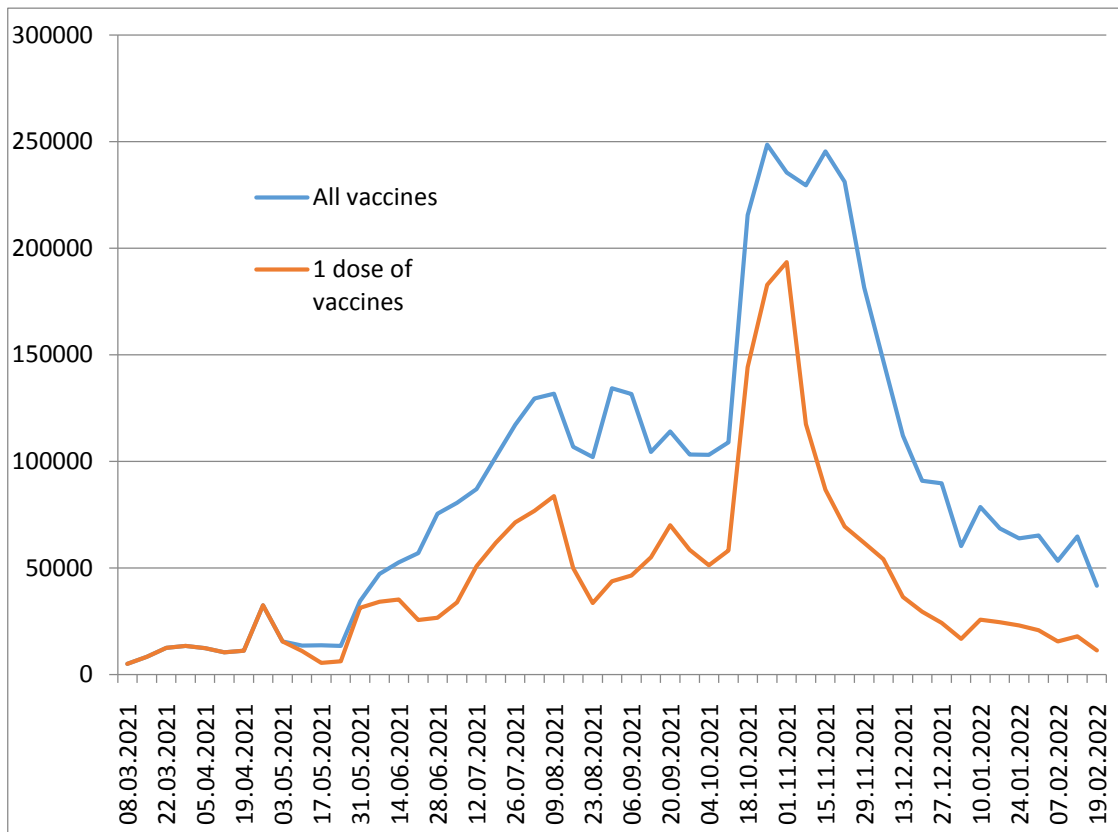


Figure 10. Vaccination dynamic is shown by the average weekly number of new vaccines.

Another tool of influence on unvaccinated persons was the offer of a monetary reward for vaccination.

As you know, in some countries, for additional motivation to get vaccinated, government bodies offer money for vaccination. Such measures have been adopted in some countries for selected population groups. Thus, in Greece, the youth receives a monetary reward. Seniors aged 60 and over receive vaccination rewards in Latvia, Georgia, and Moscow (Russia). All citizens who were vaccinated in Ukraine, Serbia, Mongolia and New York (USA) also can receive a monetary reward ([https://www.slovoidilo.ua/...](https://www.slovoidilo.ua/)).

In Ukraine, on November 15, 2021, a special support program was announced for citizens who completed a full vaccination course ([https://itc.ua/news/...](https://itc.ua/news/)).

The program started on December 19, 2021, and will continue for a year until December 18, 2022. This program also works during wartime. Every citizen over the age of 14 has the opportunity to receive 1,000 hryvnias on an electronic bank card, the reward can be ordered through the Diya application. Diya is a digital platform developed by the Ministry of Digital Transformation of Ukraine to provide various public services to citizens of Ukraine, including storing personal digital documents.

A feature of the use of money received from vaccination was the limitation of the services that can be bought with this money. In this way, state regulation and support of enterprises that were most affected by knockdowns during the Covid-19 pandemic took place.

5. Conclusion

The research conducted allows one to draw a rather unexpected conclusion, at least for those not closely observing the realities of Ukraine. Ukraine handled the pandemic well. It will be rather justifiable to assume that, had it not been for the war, Ukraine was heading in the right direction in the fight against the pandemic by reducing the inequality of vaccination distribution and recording a decreasing variation between regions in the number of deaths following the pandemic.

The article analyses factors which had an influence on the pandemic in Ukraine in our opinion. An assessment of the effectiveness of the management of the pandemic by state management bodies was made. We can observe many positive activities on the part of the Ukrainian authorities, even before the war, but at a time of the growing threat of a pandemic, which confirms the commitment of the Ukrainian government to the rational identification of the threat (Melnyk et al., 2021; Dokova et al., 2021; Kalininchenko, Poltel, 2021; Patel, 2020; Polonova, 2022). During the pandemic, Ukraine particularly strove to maintain its education at the best level of effectiveness (Odintseva, 2022; Semenog, Shamunova, 2020). The main stages of the pandemic were analyzed, and the main challenges related to vaccination and measures to reduce the negative consequences were researched. At the same time, it was assumed that the most relevant and measurable factors in assessing the effectiveness of the fight against the pandemic are the number of deaths and the number of vaccinations per population.

The article also makes a comparative analysis of the course of the vaccination process in Ukraine compared to neighboring countries. The result of comparing the uniformity of vaccination of the population in regions of Ukraine and regions of Russia is interesting, this study showed that the effectiveness of the vaccination campaign in Ukraine was 2.2 times more effective than a similar campaign in Russia at the same time before the war.

Contrary to opinions spread before Russia's war against Ukraine about the inefficiency of the Ukrainian state, which was, according to biased critics, a near-collapsed state, the Ukrainian state demonstrated institutional and managerial agility in meeting the pandemic challenge. Both public administration bodies and the Ukrainian health service effectively handled the vaccination of citizens, who were perhaps more intensely bombarded with disinformation about the alleged harmfulness of vaccines than in other countries. Despite the adversity, Ukrainian services handled the pandemic effectively and efficiently with the resources they had. In general, on the day before the war, the percentage of vaccinated Ukrainians was 38.24% of the country's population, which is 24% less than all applicants according to the April 2021 survey. Of course, in doing so, it should be remembered that at the time of the second observation (February 7, 2022, to be exact), the exodus of the Ukrainian population to neighbouring countries related to the impending Russian threat was already underway, and the population in each oblast was a highly variable figure. Of course, there are more and

more publications in which attempts are made to coolly, and objectively assess the events in Eastern Europe and make their impact on the fate and structure of the entire civilized world (Aslund, 2020; Chandey, 2022). The war forced all Ukrainians, without exception, to change their plans. People took off the masks that protected them from COVID-19 and put on helmets and bulletproof vests to protect themselves from rockets and missiles. On February 24, 2022, the war with COVID-19 ended, and another bloodier war for independence and democratic values began.

Summing up the work from the methodological point of view, it should be noted that the use of the Gini index as a metric for assessing distribution or fair distribution is not a new method. However, the strength of this work, in the opinion of the authors, is not the commonly known method itself, but rather its application in a context that is not necessarily obvious. Here understood as a study of the distribution of deaths in regions throughout the country, as well as vaccinations. While the deaths are clearly a negative consequence, somewhat hidden, of inefficient management, the impact of vaccinations on the course of the pandemic is definitely more controversial. However, the fact that the authors have noticed this factor as a factor worthy of being used in the assessment of pandemic management efficiency is considered to be reasonable and innovative.

The data in the tables used in this work has also been placed in the GitHub repository at: (https://github.com/anonymously-smile/Covid_stat_Ukr_Rus.git).

The authors report there are no competing interests to declare.

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GREEN REPORTING IN THE PERCEPTION OF REPORTS PREPARERS. EVIDENCE FROM POLAND

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Purpose: The main purpose of the paper is to assess the perception of environmental reports preparers related to the obligation towards disclosing environmental information from the perspective of the company interests. The auxiliary aim of the article is to propose integrated green reporting in the context of theoretical foundations, in particular the theory of legitimacy, stakeholders and agencies.

Design/methodology/approach: Surveys were used to assess the perception of preparers of environmental reports. The empirical data was collected in a non-exhaustive survey. In the statistical analysis of the survey data, contingency tables and association measures for categorical variables were used (examination of correlations between pairs of survey questions) as well as logistic regression models and odds ratios (examination of the impact of explanatory variables on the selected survey questions with dichotomous values).

Findings: In the opinion of the respondents, the disclosure of environmental information is useful for stakeholders. They partly agree to extend the mandatory subjective and objective scope of the disclosure of environmental information. However, their opinion depends on some features of the enterprise, capital connections and the type of information shaping the enterprise image. The disclosed environmental information is an important element of influencing the company image, but it is not the most important one.

Research limitations/implications: This research is the first, pilot stage of the overall research. In the next stages, the research sample will be enlarged. The second limitation is the focus on Polish enterprises. As part of the research continuation, we intend to cover other countries.

Practical implications: Appropriate legal arrangements are needed to adequately enforce the scope and quality of reporting focused on environmental information. The author's definition of green reporting refers to a comprehensive, integrated environmental report combining financial and non-financial information arranged according to the substantively separated areas.

Social implications: Our proposed integration of environmental information in one report – green report - that emphasizes the importance of the environmental protection problem, which will increase the transparency and availability of information, and ensure its comprehensiveness for stakeholders, and as a result have a positive impact on environmental awareness in the business operations of enterprises.

Originality/value: The research was conducted from the perspective of preparers and managers that disclose environmental information. Our research is the broadening and deepening of knowledge on environmental information reporting in Poland, as well as participation in the discussion on the desired directions of its development.

Keywords: green accounting, green reporting, environmental disclosures, non-financial statement, CSR.

Category of the paper: research paper.

1. Introduction

The concept of sustainable development affects various aspects of business operations, including the functioning of the respective accounting system (e.g. Schaltegger et al., 2022; Hernádi, 2012; Ignat et al., 2016). One of the most important areas of accounting is green accounting, focused on the registration, processing and reporting of environmental information (e.g. Gonzalez, Peña-Vinces, 2022; Samaraweera et al., 2021; Singh et al., 2019).

Environmental disclosures play an important role in the implementation of sustainable development goals, as many as 5 of which concern environmental protection (un.org.pl). They are intended to provide various stakeholder groups with access to information on the environmental impact of enterprises (Dura, Suharsono, 2022; Schaltegger, Burritt, 2017). Environmental disclosures are mandatory for some companies and voluntary for others (Directive (EU) 2022/2464).

Due to the lack of unified reporting standards, even if such disclosures are mandatory, they are subject to high discretion of the persons preparing the reports or supervising the reporting. Although intensive efforts are being made to extend the obligation of environmental disclosures and their standardization (Directive (EU) 2022/2464), the specificity and diversity of this information undoubtedly prolong and hinder this process (e.g. Turzo et al., 2022; Zou et al., 2019; Wang et al., 2019).

In order to perform the environmental reporting function in sustainable economic development, it is necessary to properly involve the employees preparing these reports and the managers supervising their work. Their positive attitude to environmental disclosures, understanding and acceptance of the need for such reporting is one of the determinants of proper implementation of the environmental reporting function.

Appropriate substantive preparation and ethical attitude of the persons involved in the preparation of environmental reports are also indispensable. Most research on environmental disclosures is focused on the informational content of non-financial statements as well as the method of reporting environmental information and is conducted by analyzing the text of reports (e.g. Vourvachis, Woodward, 2015; Guthrie, Abeysekera, 2006; Mata et al., 2018). Some of the research relates to the assessment of environmental reporting from the perspective

of report users. As part of these studies, methods for analyzing the text of reports and surveys are used.

According to the authors of this article, there is little research on the perception of environmental disclosures by reporters and managers supervising their work. The scarcity of this type of research encouraged us to address this issue.

The purpose of the paper is to assess the attitude presented by the persons preparing environmental reports towards the obligation of environmental disclosure from the perspective of the interests of enterprises. The auxiliary purpose of the article is to expose green reporting as a product of the intensively developing area of accounting - green accounting in relation to accounting theory, in particular the theory of legitimacy, stakeholders and agencies in the context of reporting entities' attitude towards the obligation to disclose environmental information.

In the context of the identified research gap, the following research questions were adopted:

Q1: How do preparers of environmental reports assess their usefulness in the decision-making process?

Q2: How do those preparing environmental reports assess the extension of the subjective and objective obligation of this reporting?

Q3: How do environmental reporters assess the importance of environmental information from the point of view of creating a positive image of the company?

The empirical data used in the article were collected in a non-exhaustive survey based on a survey questionnaire correctly completed by 70 enterprises (employees competent in the field of environmental protection). Due to the purpose of the study, the sample of enterprises was created in a non-probability manner based on the register of the Polish Classification of Activities (PCA).

In the statistical analysis of the survey data, contingency tables and association measures for categorical variables were used (examination of correlations between pairs of survey questions) as well as logistic regression models and odds ratios (examination of the impact of explanatory variables on the selected survey questions with dichotomous values). The calculations were carried out using the R program and selected packages.

The obtained research results broaden the knowledge on the conditions of environmental reporting. The authors' opinions formulated on their basis provide a voice in the discussion on the direction of changes in the regulatory sphere of environmental reporting. The definition of green reporting proposed by the authors refers to the broader context of environmental disclosures, which is the implementation of sustainable development goals. The authors combined the obtained results with accounting theories, in particular the theory of legitimacy and stakeholder theory.

The structure of the paper has been adapted to the defined research goal and research questions. The first part of the paper discusses green reporting against the background of the theory of legitimacy, stakeholders and agencies. The literature was reviewed and research

hypotheses were developed. In the second part, the adopted research methods are described in detail. The presentation of the obtained results in conjunction with references to other studies constitutes the third part of the article. The last part is a summary containing general conclusions from the research and the authors' recommendations regarding the regulatory sphere of environmental reporting and economic practice. This part of the paper also presents limitations in the field of the conducted research.

2. Green reporting as a strategic element of green accounting – literature review

Reporting environmental information plays an important role in the sustainable development strategy (Sustainable Development Goals, Agenda 2030), meeting the stakeholders' information expectations on the state of the environment and the impact of enterprises on the environment, and contributes to the development of green accounting as part of the accounting system focused on environmental issues.

Many definitions of green accounting have been proposed in the literature (e.g. Maunders, Burritt, 1991; Gallhofer, Haslam, 1997; Greenham, 2010; Deegan, 2013; Yang, Zhao, 2018; González, Mendoza, 2020). It is defined as a socio-economic tool that helps companies to adjust the operating rules and business decisions that are necessary to mitigate their impact on the environment by accounting for various environmental activities. Gonzalez and Peña-Vinces (2022) believe that green accounting provides value management and a combination of accounting and environmental aspects owing to which a balance is possible between the development of both the environment and the economy. It is part of one of the most important areas of responsibility towards society (and future generations), which concerns the responsibility for environmental protection. Singh et al. (2019) argue that green accounting reflects the environmental impact of a company's manufacturing and corporate activities. The implementation of environmental concepts translates into the environmentally friendly production, and the achieved financial results affect the long-term success and development of the company (Dura, Suharsono, 2022).

Green accounting is to serve sustainable development, in particular to prevent pollution and deforestation (Schaltegger, Burritt, 2017). According to Islam and Managi (2019) and Russell et al. (2017) green accounting supports economic efficiency and promotes an individual's ability to innovate and eco-efficiency. Gonzalez and Peña-Vinces (2022) distinguish, within the framework of green accounting, as follows: the principles of prevention and integration as well as good practices, disclosure of environmental costs, eco-efficiency, environmental aspects in accounting and preparation of environmental reports.

Samaraweera et al. (2021) consider it reasonable to use the term "green" in relation to defining environmental threads in accounting, because this color means loyalty and harmony, it is associated with nature and minimizing the negative effects of the company on the environment by measuring and assessing processes aimed at improving their eco-efficiency. In turn, Nakasone (2015) claims that green accounting applies only to mining, oil and gas companies, it omits other sectors, e.g., industrial, commercial and service sectors, which also have a negative impact on the quality of the environment.

Green accounting is included both in the sustainable development of enterprises and in the coordination of environmental and social processes, which affects the formation of responsible and long-term business activities (Hernádi, 2012; Ignat et al., 2016). Cairns (2009) and Mason and Simmons (2014) indicate the elements that will enable the integration of green accounting with the company system by: implementing environmental policy, developing environmental strategies, creating environmental financial reports, introducing environmental accounts and disclosing environmental reports documenting processes that reduce the company's environmental impact. Man and Gadau (2011) perceive green accounting as a new dimension of reporting the company results and achievements, which is currently undergoing constant evolution.

In the interests of standardizing the methods of reporting disclosures regarding sustainable development and emphasizing the coherence of the financial statements and the ESG (Environmental, Social, Corporate Governance) report, the European Commission published, on December 16, 2022, a new Corporate Sustainability Reporting Directive (CSRD), which is to replace the existing directive on non-financial reporting, which extends the group of entities (e.g. small and medium listed companies) subject to the non-financial reporting obligation and extends the material scope of disclosures (Directive (EU) 2022/2464).

Reporting will be carried out according to the uniform ESRS (European Sustainability Reporting Standards) standards which, in the environment module, distinguish 5 standards covering: climate change, pollution, water and marine resources, biodiversity and ecosystems, resource use and circular economy (Projekt, 2023). In some entities, the phenomenon of voluntary disclosure of non-financial information, including environmental information, can be observed even before the new CSRD and ESRS standards become legally binding.

The preparation of ESG reports is subordinated to the EU taxonomy, defined as compliance with the EU classification of sustainable activities. In June 2020, the European Union proposed regulations to support individuals in sustainable actions for the environment and climate through a taxonomy that facilitates data disclosure (Rozporządzenie, 2020). The idea of the EU taxonomy is to unify the understanding of what can be considered sustainable economic activity, supporting the achievement of climate neutrality. An important aspect is also reducing the risk of greenwashing (feigning environmentally friendly activities) due to clear criteria qualifying a given type of activity, and support for the development of sustainable investments.

In order for an economic activity to be qualified as sustainable according to the EU Taxonomy, it has to, i.a., (UT, 2023) make a significant contribution to at least one of the six environmental goals: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, protection and restoration of biodiversity and ecosystems.

Currently, the standardization of disclosure of environmental and climate aspects are particularly important. Unfortunately, companies do not always show the appropriate maturity and awareness in this area, which is confirmed by the research of Jastrzębska (2023), who measured the scope of reporting climate-related information by the companies recognized as CSR leaders in Poland using the index of climate-related disclosures. Finally, the researcher concluded that the companies with the title of CSR leaders in Poland do not show high awareness of climate change.

In the accounting theory the following theories are used to explain the extension of the scope of disclosed information, including environmental information: legitimacy, stakeholders, agency and information asymmetry. Each of these theories can justify the disclosure of environmental information in reporting (O'Dwyer, 2021). Legitimation means social acceptance for the actions taken by the company (Ogden, Clarke, 2005; Deegan, 2019).

It is particularly important for the entities whose activities have a negative impact on the environment. Through non-financial reports, they try to gain social approval for their activities, i.e. to create, e.g., a positive image of a pro-ecological company, although in fact they have a negative impact on the environment (Deegan, 2002; Brennan, Merkl-Davis, 2013; Cho, Patten, 2013; Wang, 2016). The research on legitimacy in accounting concerns, i.a., reporting and disclosure of information on environmental protection and pro-social activities (Ogden, Clarke, 2005; Cho, Patten, 2007) as well as social and environmental accounting (Archel et al., 2009; Beuren, Boff, 2011).

The relations between an enterprise and its external and internal stakeholders are analyzed in the context of the stakeholder theory, which is based on the sustainable maintenance of positive relations with stakeholders (Donaldson, Preston, 1995; Freeman, 2010). Stakeholder expectations include a multifaceted presentation of information in economic, social and environmental areas through non-financial reporting. Mutual relations affect, e.g., the development of environmental awareness and strategy, therefore it is important to meet the information needs of stakeholders, which include, i.a., the quality of information (IASB, 2018) and the scope of information disclosed, including environmental issues (Rodrigue, Magnan, Boulianne, 2013; Liesen et al., 2015; Kaur, Lodhia, 2018).

The agency theory is based on the relationship between the parties to the contract, representing specific attitudes, preferring their own benefits and attitude to risk. The agency theory assumes that in certain situations managers may prefer to take manipulative actions being in opposition to the expectations of shareholders and other stakeholders who expect reliable information (Abrahamson, Park, 1994), e.g., on environmental issues. One of the basic

differences between the parties to the contract is information asymmetry, i.e. unequal access to information (Eisenhardt, 1989; Greenwald, Stiglitz, 1990).

Information asymmetry also applies to issues in the area of environmental information disclosure, when external stakeholders have access to fragmentary information only (some of it is kept secret) and created by impression management strategies. Green reporting (GR), also known as environmental reporting (ER), has long been used in the context of financial and non-financial reporting, although with different meanings. In the broadest sense, GR is treated interchangeably with GA and thus evolves within the scope of GA as a basic concept is expanded.

In a narrower sense, GR is part of the company's reporting focused thematically on the natural environment and in this sense it is a product of GA, i.e. this part of the accounting system that is oriented towards identifying, recording and processing all information regarding the company's environmental impact (Rahman, Rahman, 2020). The literature also presents the opinion that GR is one of the voluntary social reporting included in the financial statements (Parker, 1995; Ahmad et al., 2003).

A different approach refers to GR as a statement (account) of the outlays incurred by the company on pro-environmental activities with the effects obtained in quantitative terms (e.g. Oxford Reference, 2023). The WG's information scope is expanding along with the growing social interest in the problem of environmental protection, which results in extending the subjective and objective mandatory nature of these reports by means of the new Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464) effective from January 2023.

In recent years, GR has often been associated with sustainability development (SD) - Sustainable Development Goals (SDG). It is worth noting that out of 17 main objectives, as many as 5 directly relate to environmental problems: SDG 6 "Clean water and sanitation", SDG 7 "Clean and accessible energy", SDG 13 "Climate action", SDG 14 "Life under water" and SDG 15 "Life on land" (CZR, 2023). The document "Transforming Our World: The 2030 Agenda for Global Action", adopted on September 25, 2015 during the UN Summit in New York, became the basis for intensive activities at the global level, which is to be appropriately translated into national and regional activities (Sustainable Development Goals, Agenda 2030).

The effectiveness of actions taken to improve the condition of the natural environment depends, i.a., on the access to environmental information at the level of activity of various entities, in particular those conducting business activity, using their reporting system. M.M. Rahman and M.S. Rahman (2020) refer directly to GR as a tool of environmental sustainability. It is worth noting that environmental issues are indicated as one of the main topics in the concept of social responsibility and the concept of sustainable development in non-financial reports.

In this context, Ahmad et al. (2003) defines environmental information in an annual report as a subset of the corporate social responsibility, which includes information regarding waste management, recycling programs and environment control.

Entities are under an increasing social pressure to disclose the environmental impact of their activities (e.g. Deegan, Gordon, 1996; Camilleri, 2015). For this reason, the environmental aspect has become one of the most important components in corporate reporting. This state of affairs encouraged the authors to define the green accounting as a set of all disclosed financial and non-financial environmental information regarding the effects of the entity's activities on the natural environment, both mandatory and voluntary, regardless of the report type and form they prepare. Environmental reporting is generally associated with environmental non-financial information presented primarily in the activity report, social responsibility report, sustainable development report and integrated report.

Most of the information contained in non-financial reports is used to explain the processes of creating the company's value and its relations with stakeholders, while the role of these reports is to create the company image, establish a reputation and legitimize the activity (Spear, Roper, 2013; Cormier et al., 2004; O'Donovan, 2002; Yuthas et al., 2002). Research by Cormier et al. (2004) confirms that managers disclosing environmental information are guided, i.a., by the importance of a given stakeholder for the company. The studies did not take into account the environmental information contained in the financial statements. The studies conducted so far have not focused on the attitude of persons preparing reports and managers supervising this process towards the obligation to report environmental information, including the extension of the subjective and objective reporting obligation.

Within the identified research gap, the authors adopted the following hypotheses:

H1: Preparers of environmental reports positively evaluate the decision-making usefulness of the disclosed environmental information.

H2: Preparers of environmental reports positively assess the process of extending the subjective and objective obligation of environmental reporting.

H3: Preparers of environmental reporting recognize environmental disclosures as important from the viewpoint of creating a positive image by the company.

3. Data and methods

The empirical data used in the article were collected in a non-exhaustive survey based on a questionnaire survey conducted among 70 enterprises. In non-exhaustive (partial) studies, the subject of analysis is a statistical sample composed of population units (it is a subset of the surveyed population units). Following the purpose of the study, the sample of enterprises was created in a non-probability manner based on the PCA register. The sample was created using the technique of accidental sampling, also known as convenience sampling (Szreder, 2004). The sample is a non-representative one, therefore, it is not possible to generalize the obtained results referring them to the entire population of enterprises.

Contingency tables and association measures for categorical variables as well as a logistic regression model and odds ratio were used in the statistical analysis of the survey data. Calculations were performed using the R program and the *vcd*, *epade*, *DescTools*, *lmtest*, *caret*, *questionr*, *finalfit*, *sjPlot* packages (R Development Core Team, 2023; Aitkin et al., 2009; Fox, 2002).

Contingency tables (Agresti, 2002; Ott, 1984) enable the study of interdependencies between nominal variables. They show the distribution of answers to two selected questions from the survey questionnaire. Contingency coefficients (association measures) provide more information on the studied phenomenon, which assesses the association degree of the analyzed features. Association measures are constructed based on the χ^2 (chi-square) statistic, which shows the deviation of the numbers observed in the cross-section of both features from the theoretical numbers that would be expected if the features were independent. The χ^2 statistics are calculated based on the data presented in the contingency table: $\chi^2 = \sum_i \sum_j \frac{(n_{ij} - \hat{n}_{ij})^2}{\hat{n}_{ij}} =$

$\sum_i \sum_j \frac{\hat{n}_{ij}^2}{\hat{n}_{ij}} - n$, where: n_{ij} – observed values; \hat{n}_{ij} – expected values; n – sample size.

The χ^2 statistic takes values from the range $[0; n \times \sqrt{(r-1) \times (c-1)}]$, where: r – number of rows; c – number of columns in the contingency table. The χ^2 statistic is zero (lower bound) when the theoretical (observed) values are the same as the empirical (expected) values. The upper limit depends on the surveyed population size and the contingency table number of rows and columns. Based on the value of the χ^2 statistic, measures of the interdependence (correlation) of nominal variables (contingency coefficients) can be calculated. These contingency coefficients are the numbers in the range $[0;1]$, they take into account the size of the array and the number of observations. Cramer's V contingency coefficient was used in the analysis of the survey results: $V = \sqrt{\frac{\chi^2}{n \times \min(r-1; c-1)}}$, whose values can be interpreted as follows: $V = 0.00$ – independence of features, $V \in (0.00-0.33]$ – weak dependence, $V \in (0.33-0.66]$ – clear dependence, $V \in (0.66-1.00)$ – strong dependence, $V = 1.00$ – functional dependence.

Logistic regression is used in the analysis of binomial data (Long, 1997; Agresti, 2002; Cameron and Trivedi, 2005). These are often binary data, when the dependent variable takes one of two values (e.g. the respondent's answer *yes/no* to a question formulated in a survey questionnaire). The logistic regression model takes the form of the function $f(x) = \frac{e^x}{1+e^x}$. This model makes it possible to estimate the probability of choosing p_i one of the two options (yes/no) depending on the value of the explanatory variable x (or explanatory variables) based on the formula $p_i = \frac{\exp(\beta_0 + \beta_1 x_i)}{1 + \exp(\beta_0 + \beta_1 x_i)}$, where $0 < p_i < 1$.

To estimate the parameters of the logistic regression model (β) the concept of Generalized Linear Models (GLM) is used, proposed in the article (Nelder, Wedderburn, 1972) and developed in the monograph (McCullagh, Nelder, 1983). Generalized linear models in which the dependent variable has a non-normal distribution (e.g. binomial) are estimated using the maximum likelihood method using iterative optimization algorithms (suitable functions are available in R packages).

In the interpretation of the estimated logistic regression model, the sign of the parameter ($+\beta$ or $-\beta$) is taken into account in terms of probability, which informs about the direction of influence of the explanatory variable on the explanatory variable. The impact of the explanatory variables on the dependent variable is also assessed in terms of the odds ratio ($OR = \frac{p}{1-p}$). Values of odds ratios are calculated from the exponential expression e^β , where the exponent is the estimated value of β . If the value of the explanatory variable increases by one unit, the chance of the explanatory variable taking the value 1 will change (increase, decrease) by e^β times. The interpretation of the numerical values of the odds ratios is as follows:

- if $e^\beta > 1$, then the influence of the variable value on the choice of the *yes* option is positive (increase in the odds ratio),
- if $e^\beta < 1$, then the impact of the variable value on the choice of the *yes* option is negative (decrease in the odds ratio),
- if $e^\beta = 1$, then the influence of the variable value on the choice of the *yes* option is neutral (odds ratio unchanged).

The collection of empirical data was carried out on the basis of the author's questionnaire. The data collection was commissioned to the research agency Biostat Polska. The study covered 70 enterprises (medium and large). Biostat selected a non-random sample of respondents on the basis of PCA codes, specifying the type of business activity. 721 enterprises were contacted. Ultimately, 70 enterprises representing 14 industries (sectors) agreed to participate in the survey. The CATI technique was used to collect the data. The research was carried out between May 18 and June 5, 2023.

The research is of a pilot nature and concerns the reporting of environmental information (financial and non-financial) as a specific area of narrative in accounting from the perspective of those preparing non-financial reports. Due to the thematic scope of the article, the data from the part of the survey devoted to environmental narratives in non-financial reporting were not included in it.

All respondents (employees of the surveyed enterprises) replied that they participated directly or indirectly in the preparation of the non-financial report. The breakdown of respondents by gender is as follows: 56% women and 44% men. In terms of the age structure, the largest group is represented by generation X (born in 1965-1980) – 49% and generation Y Millennials (born in 1981-1994) – 44%. Less numerous generational groups are the BB (Baby

Boomers) generation born before 1964, constituting 4% of the respondents, and the Z generation born since 1995 – 3%.

The survey involved:

- 41% of enterprises employing over 500 employees (one of the criteria met, which is the basis for the mandatory disclosure of non-financial information in accordance with the Accounting Act and Directive 2014/95/EU and the CSRD Directive from 2024),
- 33% of enterprises employing less than 500 to 250 employees (one of the criteria for mandatory ESG reporting in accordance with the new CSRD from 2025 is met),
- 26% of companies with fewer than 250 to 50 employees (ESG reporting obligation for medium-sized companies listed on the stock exchange since 2026).

When specifying the size of the surveyed enterprises, the authors signal new non-financial reporting obligations for them in accordance with the new CSRD Directive.

The survey also includes questions about total assets and net income (these are the other criteria used to determine mandatory non-financial disclosures), but the respondents most often answered "I don't know", which accounted for over 70% of answers to each question. Therefore, it is difficult to unequivocally determine the size of the surveyed enterprises based only on the criterion of employment. Assuming that, in addition to the employment criterion, the enterprises met one of the other two (total assets or net revenues), then it can be stated that, in total, 74% of the surveyed enterprises are large enterprises employing more than 250 employees, while 26% are medium-sized enterprises. Both distinguished features characterizing the company were excluded when building the logistic regression model due to unreliable answers resulting from the lack of knowledge of the respondents.

Among the respondents, 57% are enterprises with foreign capital, the remaining 43% operate without it. The respondents did not show much knowledge about what regulates the preparation of financial statements in their company: 42% of the respondents answered "I don't know", 21% the Accounting Act and 7% IAS/IFRS. 47% of the financial statements issued by the surveyed enterprises are individual statements, and 23% are consolidated statements.

4. Results and discussion

The majority of respondents (94%) said that the disclosure of environmental information is useful to stakeholders when making business decisions. Disclosure is important for the company because it contributes to building a positive image and relations with stakeholders, and legitimizes the activity, especially when it has a negative impact on the environment. The usefulness of environmental information includes: their availability to stakeholders in financial and non-financial reports.

The answers provided by the respondents directly and/or indirectly involved in the preparation of non-financial reports confirm H1, i.e. a positive assessment of the usefulness of the disclosed environmental information.

The surveyed enterprises disclose environmental information in non-financial reporting (50%) and in both financial and non-financial reporting (49%). Only 1% of the surveyed enterprises declared disclosing environmental information in their financial statements. This may indicate that enterprises do not associate financial reporting with the disclosure of environmental information, e.g., they treat disclosed information on fees for landfilling, environmental investments or outlays on environmental R&D as items of the balance sheet and profit and loss account.

A non-financial report is prepared by 81% of the surveyed enterprises and only 19% voluntarily. Among the mandatory disclosures of non-financial information, the most frequently used form of disclosure is the activity report containing a separate section on non-financial information (56%) and the non-financial report (24%).

Mandatory disclosure of environmental information (e.g. by enterprises employing more than 500 employees) was assessed positively by 89% of the respondents, only 11% of the respondents expressed a negative opinion. Such a significant predominance of positive answers may be evidenced, i.a., by: environmental awareness and the need for the company to participate in the global process of saving the environment.

More than half of the respondents preparing mandatory reports (56%) spoke positively about the extension of the mandatory scope of subjective and objective disclosure of environmental information. Such an attitude should be considered satisfactory, considering that the new CSRD will soon introduce such extensions. In turn, the respondents' answers were more varied regarding the question whether the company's managers intend to voluntarily expand the existing scope of environmental information disclosed in the non-financial report.

The majority of respondents (54%) answered "I don't know", 26% said they did not intend to and 20% answered "yes". The provided answers may be the result of the fact that the majority of respondents are not the decision-makers in this regard and do not know what course of action the management board will take. The answers may also result from many reporting obligations and ever-increasing requirements in this matter, which may cause reluctance to make such a decision or adopt a passive attitude towards the upcoming changes.

Contingency tables were used to examine the interdependence between the variables (two selected questions from the survey): B2: Does the company prepare a non-financial report/integrated report? (voluntarily, obligatory), B5: In your opinion, should the mandatory subjective and objective scope of disclosing environmental information be extended? (Yes/No). In the case of mandatory reporting, there were 28 positive responses to the mandatory extension of disclosure and 29 negative responses. In the case of voluntary reporting, however, the responses were not so evenly distributed. There was a clear advantage of 11 positive responses and only 2 responses against the mandatory extension of disclosure. The results

obtained in the first group of enterprises, i.e. in practice the largest ones, often exerting a strong environmental impact, are not so optimistic. This may translate into the reluctance of more than half of the respondents to extend the mandatory disclosures. In the second group, which does not have reporting obligations, there is greater acceptance for the obligatory extension of disclosures, because they do not directly concern these enterprises, so they can be used fragmentarily or selectively for specific purposes, e.g., image-related.

The results of this part of the study allow concluding that H2 was only partially positively verified. Initially, the respondents positively assessed the process of extending the mandatory disclosure of environmental information, however, extending the study to include the determinant of the obligation or voluntary nature of reporting preparation introduces a differentiated approach to this process. In the further part of the study, the authors will additionally explore the problem of extending disclosure by selected factors influencing this process – company characteristics and types of information creating the image.

The environmental information highlighted by the authors of the survey was subjected to an in-depth analysis, which was classified into two groups: disclosed in financial reporting (Table 1) and disclosed in non-financial reporting (Table 2).

Table 1.

Answers to question B6

Option designation in question B6	Environmental information disclosed in financial statement	Yes	No
B6_1	Environmental costs, e.g., waste disposal services	32	38
B6_2	Administrative penalties for exceeding the standards	17	53
B6_3	Environmental expenses, e.g., fees for the use of the environment, fees for landfilling, fees for water abstraction	49	21
B6_4	Environmental investments	45	25
B6_5	Expenditures incurred on environmental R&D	34	36
B6_6	Environmental provisions, e.g., provisions for the liquidation of mining damage	12	58
B6_7	Environmental liabilities, e.g., loans for environmental purposes	15	55
B6_8	Intangible assets, e.g., emission allowances granted and purchased, concessions for the exploitation of natural resources	23	47
B6_9	Fixed assets for environmental protection	35	35
B6_10	Other	11	59

Regarding question B6: What environmental information does the company disclose in its financial reporting? the largest number of positive answers provided by the respondents confirming the disclosures included: environmental expenses, e.g., fees for the use of the environment, fees for landfilling waste, fees for water intake (49), environmental investments (45), fixed assets for environmental protection (35), outlays incurred on Environmental R&D (34). The most negative answers stating the lack of disclosure concerned: environmental provisions, e.g., provisions for the liquidation of mining damage (58), environmental liabilities, e.g., loans for the purposes related to environmental protection (55), administrative penalties for exceeding standards (53).

Table 2.*Answers to question B11*

Option designation in question B11	Environmental information disclosed in non-financial statement	Yes	No
B11_1	CO ₂ and gas emissions	63	7
B11_2	Dust emissions, lead and copper emissions	47	23
B11_3	Climate and environmental risk	29	41
B11_4	Water intake and consumption	59	11
B11_5	Energy consumption	62	8
B11_6	Pro-ecological investments	44	26
B11_7	Sewage (water) discharge	48	22
B11_8	Financial penalties for non-compliance with environmental laws and regulations	21	49
B11_9	Non-financial, administrative and judicial sanctions imposed on the organization for non-compliance with environmental regulations	16	54
B11_10	Waste	62	8
B11_11	Financial support for environmental organizations (e.g. donations)	23	47
B11_12	Support for educational activities in the field of environmental protection	44	26
B11_13	Other	6	64

In turn, regarding question B11: What environmental information is disclosed in the company's non-financial reporting? the largest number of respondents' answers confirming the disclosure concerned: CO₂ and gas emissions (63), energy consumption (62), waste (62), water intake and consumption (59). Most answers about non-disclosure concerned: non-financial, administrative and court sanctions imposed on an organization for non-compliance with environmental protection regulations (54), fines for non-compliance with environmental laws and regulations (49), financial support for pro-ecological organizations, e.g., donations (47), climate and environmental risks (41).

In both cases, the respondents provided a lot of negative answers regarding the item "Other", which may mean that the proposed scope of information disclosed by the authors of the survey was sufficient and there was no need to supplement it with other information. Examples B6_10 include costs related to installations (e.g. photovoltaics), and B11_13 include financing of educational campaigns related to recycling and recovery.

Summarizing the answers of the respondents answering questions B6 and B11 regarding the scope of environmental information disclosed in the financial and non-financial statements, it can be stated that:

- in the case of the first question, only two options were dominated by positive answers about making disclosures (environmental expenses, e.g., fees for the use of the environment, fees for waste storage, fees for water abstraction, environmental investments),
- in the case of the second question, such a relationship was observed for as many as eight options (CO₂ and gas emissions; energy consumption; waste; water intake and consumption; sewage (water) discharge; dust, lead and copper emissions; pro-environmental investments; support for educational activities in the field of environment).

It can therefore be concluded that non-financial reporting is used primarily to disclose environmental information rather than for financial reporting purposes. The dispersion and diversity of environmental information in two different financial and non-financial reports, which are not integrated with each other, is an indication for the authors to propose green reporting.

Another analyzed interdependence concerns two questions: A7: Who prepares the report? – A7_1: unrelated entity, A7_2: corporate group and B6: What environmental information does the company disclose in its financial reporting? – B6_1-B6_10 (see Table 1). The results are presented in Table 3.

Table 3.

Contingency table for questions A7 and B6

Option designation in question B6	A7_1. Entities not related by capital		A7_2. Group	
	No	Yes	No	Yes
B6_1	13	10	25	22
B6_2	18	5	35	12
B6_3	5	18	16	31
B6_4	8	15	17	30
B6_5	9	14	27	20
B6_6	18	5	40	7
B6_7	16	7	39	8
B6_8	16	7	31	16
B6_9	12	11	23	24
B6_10	21	2	38	9

Based on the analysis, it can be concluded that the largest number of negative responses regarding the disclosure of environmental information concerns: environmental reserves (58, including 39 groups and 18 entities not related by capital), environmental liabilities (55, including 39 groups and 16 entities not related by capital), administrative penalties for exceeding standards (53, including 35 in group and 18 in the entities not related by capital), intangible assets (47, including 31 in group and 16 in the entities not related by capital). The most positive responses about the disclosure referred to: environmental expenditures (49, including 31 groups and 18 in the entities not related by capital), environmental investments (45, including 30 groups and 15 entities not related by capital). To sum up, the predominance of all negative answers over positive ones regarding environmental information in financial reporting proves that these reports are not treated by the preparers as an appropriate instrument for disclosing this type of information. They are not well suited to standardizing types of environmental information and their combination with financial information.

The next interdependence to be examined includes the following questions: A7: Who is reporting? – A7_1: unrelated entity, A7_2: corporate group and B11: What environmental information is disclosed in the company's non-financial reporting? – B11_1-B11_13 (see Table 2). The results are presented in Table 4.

Table 4.

Contingency table for questions A7 and B11

Option designation in question B11	A7_1. Entities not related by capital		A7_2. Group	
	No	Yes	No	Yes
B11_1	3	20	4	43
B11_2	6	17	17	30
B11_3	18	5	23	24
B11_4	1	22	10	37
B11_5	1	22	7	40
B11_6	12	11	14	33
B11_7	6	17	16	31
B11_8	17	6	32	15
B11_9	17	6	37	10
B11_10	1	22	7	40
B11_11	17	6	30	17
B11_12	10	13	16	31
B11_13	22	1	42	5

The analysis of the results shows that the largest number of positive answers about the disclosure concerns: CO2 and gas emissions (63, including 43 groups and 20 entities not related by capital), energy consumption (62, including 40 groups and 22 entities not related by capital), waste (62, including 40 groups and 22 entities not related by capital), water intake and consumption (59, including 37 groups and 22 entities not related by capital). The largest number of negative responses regarding the disclosure of environmental information concerns: fines for non-compliance with environmental laws and regulations (49, including 32 groups and 17 entities not related by capital), financial support for pro-ecological organizations (47, including 30 groups and 17 entities not related by capital), climate risk and environmental (41, including 23 groups and 18 entities not related by capital). A significant predominance of all positive answers over negative ones regarding environmental information disclosed in non-financial reporting was observed, which proves the professionalism of those preparing the reports, the need to disclose this information in order to meet the needs of stakeholders and legitimize the company operations.

Based on the findings, it can be concluded that the capital group is superior to the entity not related by capital in disclosing environmental information both in financial and non-financial reporting. This is probably due to the fact that it has reporting obligations regarding non-financial disclosures, including environmental ones. It also has greater obligations towards its stakeholders in terms of informing about its activities in the light of sustainable development.

In non-financial reports issued by enterprises, a variety of information is disclosed, which affects, i.a. building an image. In order to analyze which types of information, in the opinion of the respondents, have the greatest impact on building the image, and which have the least impact, question B9 was formulated: Which information disclosed in a non-financial report/integrated report, in your opinion, is the most important in building a positive message about the company? A five-point Likert scale was used, based on which the respondents could express their opinions regarding eight types of information (Table 5).

Table 5.

Answers to question B9

Option designation in question B9	Types of information	No				Yes
		1	2	3	4	5
B9_1	Environmental information	1	1	16	24	28
B9_2	Human resources information	3	5	21	17	24
B9_3	Human rights information	3	3	11	15	38
B9_4	Social information	3	5	18	19	25
B9_5	Economic information	4	3	22	25	16
B9_6	Corporate governance information	8	5	20	25	12
B9_7	Diversity policy information	8	2	17	25	18
B9_8	Information on compliance with the rules of ethics	3	2	10	22	33

According to the respondents, information on human rights (38), information on compliance with ethical principles (33) and environmental information (28) have the greatest impact. Among the disclosures that obtained the most positive responses together, referring to the 4th and 5th Likert scale, the following should be distinguished: information on compliance with the principles of ethics (55), information on human rights (53) and environmental information (52). It is also possible to indicate the greatest number of answers concerning information of a neutral nature (3rd degree on the Likert scale): economic information (22), information on human resources (21), information on corporate governance (20). The lowest number of significant answers with negligible impact on building the image (1st and 2nd degree on the Likert scale) referred to environmental information (2), information on compliance with ethical principles (5).

In order to deepen the research on the types of disclosed information referring to building the company image, the interdependence between questions: A7 and B9 was examined. The results are illustrated in Figures 1-8. Each figure relates to a specific type of information. The analysis of Figures 1-8 shows that the largest number of disclosures (5th degree on the Likert scale) concerns: information on human rights (38, including 26 groups and 12 entities not related by capital), information on compliance with the principles of ethics (33, including 24 groups and 9 entities not related by capital) and environmental information (28, including 22 groups and 6 entities not related by capital). The dominant disclosures (Likert grades 5 and 4 together) include ethics information, human rights information, and environmental

information. They account for the share ranging in total disclosures from 53% to 79%. The disclosures provided in consolidated statements predominate. Groups dominate on the Likert scale of 3 to 5.

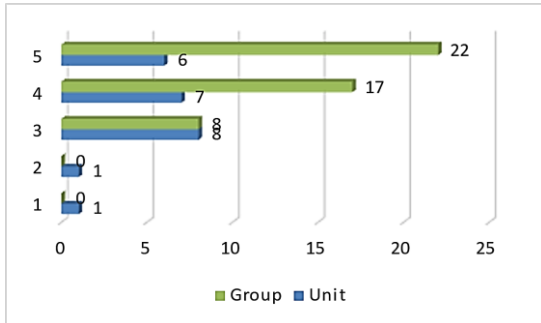


Figure 1. Environmental information B9_1

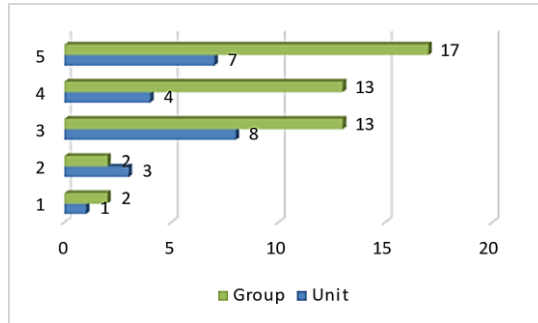


Figure 2. Human resources information B9_2

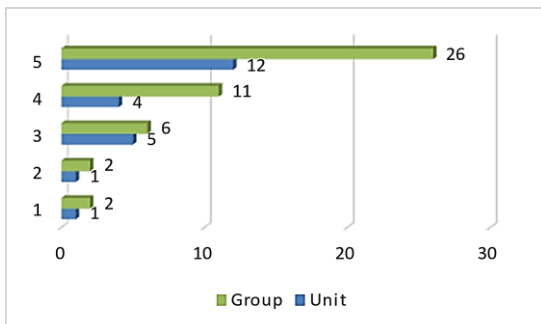


Figure 3. Human rights information B9_3

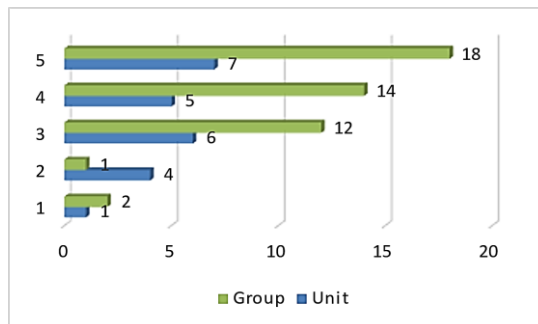


Figure 4. Social information B9_4

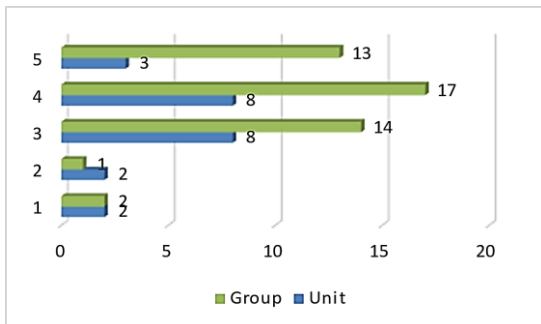


Figure 5. Economic information B9_5

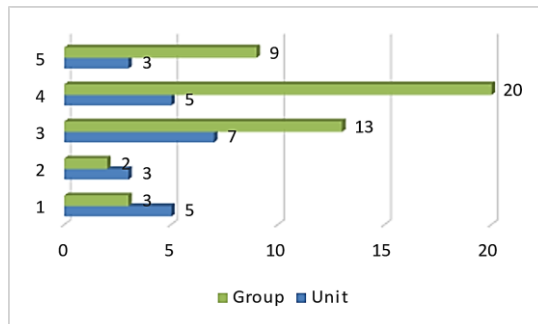


Figure 6. Corporate governance information B9_6

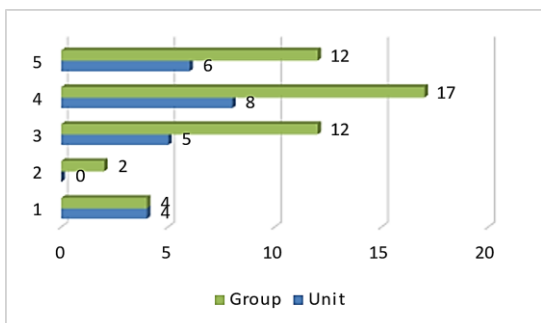


Figure 7. Diversity policy information B9_7

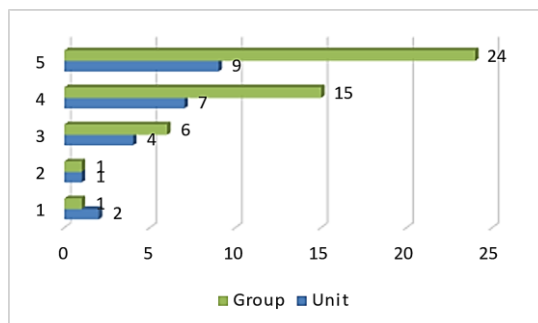


Figure 8. Information on compliance with the rules of ethics B9_8

The results of this part of the study allow concluding that H3 was only partly positively verified. The respondents consider environmental disclosures important from the viewpoint of creating a positive image by the company, but not as the most important factor. The information on human rights and on compliance with ethical principles is more important.

In the context of the evolution of corporate reporting, the authors decided to extend the study by the mandatory subjective and objective scope of environmental information disclosure (see correlation B2 and B5). For this purpose, two logistic (binary) regression models were estimated, based on which the odds ratios used to interpret the obtained results were calculated (Figures 9-10).

The first logistic regression model (Figure 9) examines the influence of explanatory variables (A1, A2, A5, A6, A7), which are the characteristics of the enterprise:

- A1: industry (energy, raw materials, chemical, metallurgy, food, construction, electromechanical, metallurgical, automotive, transport and logistics, wood, paper and furniture, trade, services, pharmaceutical),
- A2: number of employees (more than 500 people, less than 500 to 250, less than 250 to 50, less than 50),
- A5: share of foreign capital in the enterprise (yes, no),
- A6: financial reporting regulations (The Accounting Act, IAS/IFRS),
- A7: type of report (unit, consolidated)

regarding the answer (yes/no) to the question (depended variable): B5: In your opinion, should the mandatory subjective and objective scope of disclosing environmental information be extended? Explanatory variables A3: total assets of the balance sheet and A4: net revenues from the sale of goods and products were excluded as the majority of respondents were unable to specify the value ranges of these components in the company. The lack of reliable information discriminates against these features to be included in the model estimation.

The odds ratio marked in blue in Figure 9 (with values greater than 1) means the positive impact of explanatory variables, i.e. the action stimulating the answer "yes". All variables have a positive impact on extending the mandatory subjective and objective scope of environmental information disclosure. The strongest influence on the answer "yes" was shown by the following characteristics: financial reporting regulations (1.89), share of foreign capital in the enterprise (1.34) and the type of prepared report (stand-alone, consolidated) (1.22). The obtained results show that the mandatory extension of disclosures should be perceived from the perspective of legal regulations (additional and extended), the preparation of individual and consolidated statements that are subject to these legal regulations (The Accounting Act, IAS/IFRS) and the share of foreign capital in an enterprise whose presence also forces some additional actions within the framework of legal regulations.

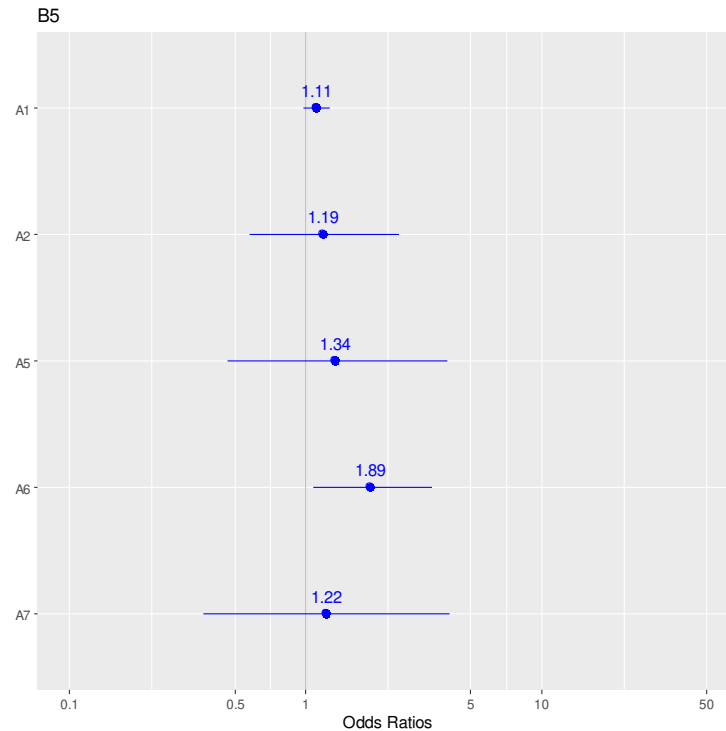


Figure 9. Odds ratios for explanatory variables A1, A2, A5, A6, A7.

The second regression model (Figure 10) examines the impact of the types of information disclosed in non-financial reporting (explanatory variables B9_1-B9_8) on the extension of mandatory disclosures B5 (explanatory variable unchanged). Only in the case of two characteristics, the odds ratio turns red, which means a negative (destimulating) impact on the dependent variable – these are: information on human resources (0.76), economic information (0.56). This information does not have a positive impact on extending the mandatory subjective and objective scope of the environmental information disclosure. The following characteristics have the greatest positive impact on the expansion of these disclosures: human rights information (2.03), social information (1.76) and environmental information (1.53). The logistic regression model confirmed the third place of environmental information among other disclosed information in the "highest impact" category (5 Likert degree), both in building the company image and in extending the mandatory subjective and objective scope of disclosing environmental information. Environmental information plays an important role in extending the mandatory disclosure of such particulars, but it is not essential.

In the opinion of the respondents, the surveyed enterprises, when preparing non-financial statements, use different guidelines, which results in their lack of comparability and makes it difficult to verify the disclosed information. The used guidelines include, i.a.: sustainable development goals (15), ESG (Environmental, Social, Corporate Governance) reporting factors (11), GRI (Global Reporting Initiative) (9), own rules inspired by GRI (6), international integrated reporting guidelines (International Integrated Reporting Council IIRC) (5) and others (e.g. GUS, KOBIZE, ISO 2200).

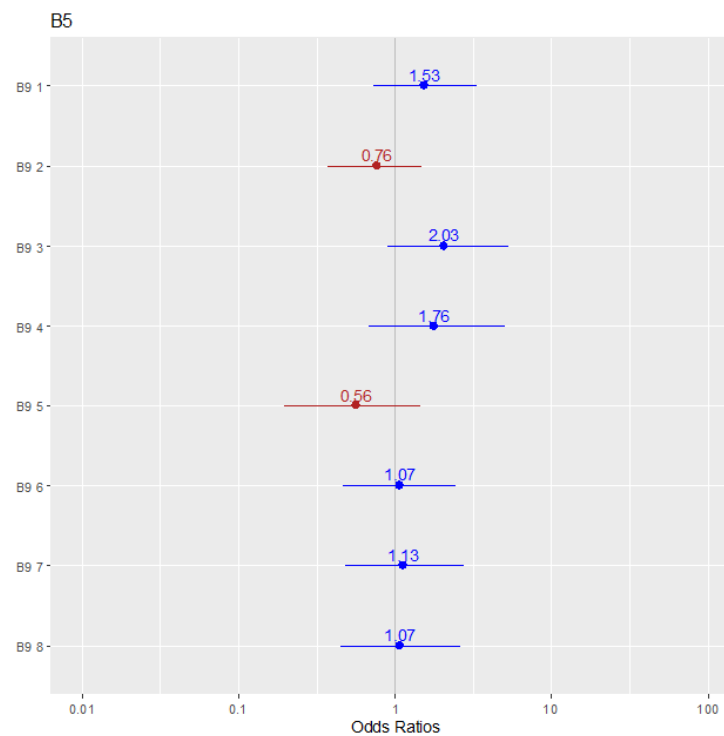


Figure 10. Odds ratios for explanatory variables B9_1-B9_8.

Diverse types of non-financial statements prompted the authors to pose the following survey question – in which non-financial report does the company disclose environmental information? The respondents indicated, i.a.: environmental report (32), sustainable development report (10), ESG report (7), social responsibility report (4), integrated report (2). Most responses concerned the environmental report understood as a report containing non-financial information.

The above two conclusions allow concluding that there is a need to develop unified rules and forms for disclosing environmental information as part of green accounting in the form of green reporting.

In the conducted surveys, the vast majority of respondents expressed the opinion that the reported environmental information is useful in the decision-making process. They also indicated environmental disclosures as important in creating a positive image of the company, although it was not the most important information for them in this context.

The findings are similar to the results of research conducted by Cormier et al. (2004). In these studies, the authors focused on the relationship between managers and stakeholders in the context of environmental information. A survey carried out among managers showed that they grouped stakeholders according to their importance for the functioning of the company and selected environmental disclosures according to this key. The selection made by managers concerned both the type and scope of information. The research results clearly showed that managers subordinate environmental disclosures to legitimize their actions. This, in turn, confirms the theory of legitimacy and the theory of stakeholders in relation to environmental reporting. In our study, the majority of respondents expressed a positive opinion on the subjective and objective extension of environmental reporting. However, an in-depth study of

this problem, divided into groups currently reporting obligatory and voluntary information, showed a fundamental difference. Among the respondents whose companies already report on a mandatory basis, more than half do not want to extend this obligation. A strong approval was expressed by the second group, which now reports voluntarily. Taking into account the fact that currently mandatory reporting applies to the largest entities, most often capital groups, the obtained result proves the reluctance of at least half of them to further extend the mandatory reporting.

The results of our research can be compared with the research conducted by Jaggi and Zhao (1996) among the accountants and managers preparing environmental reports. The respondents indicated specific information or groups of information as important for stakeholders, but the analysis of the reports prepared by them showed that a large part of this information was omitted. According to the authors of this research, it may indicate the reluctance of preparers (accountants and managers) to disclose environmental information, which confirms our research. The research conducted by O'Donovan (2002) indicates that the reporting party, especially managers, use the tactic of presenting general information in order to build a positive image, and avoid specific information that could be confronted with results and actions. The author refers to the theory of legitimacy, but also points to the connection with the theory of stakeholders. The results of the cited studies are consistent with our findings.

In our research, the respondents indicated environmental disclosures as the third, after the information on human rights and information on compliance with the rules of ethics, the group of information important in building a positive image of the company. Placing environmental information in the third place may prove that the companies which exert a negative impact on the environment have more difficulties using them to create a positive image.

In our research, the respondents associated environmental reporting primarily with non-financial information. They attributed less importance to financial information, although this financial statement takes into account the overall positive and negative effects of environmental activities in assessing both the financial and property situation of the company. In addition, the respondents indicated many guidelines contained in different regulations of various entities and institutions as the reporting standards. For example, they pointed to the Statistics Poland and KOBIZE (The National Centre for Emissions Management), ISO 2200 as the reporting guidelines, which in practice means the lack of environmental information comparability as well as different materiality criteria.

5. Summary

The introduction of legislative solutions regarding environmental reporting should be preceded by detailed, in-depth research allowing the diagnosis of the current state from the viewpoint of the activities undertaken by enterprises as part of this reporting. The diagnosis of business practice requires, among other things, examining the attitudes and motivation of the party preparing such reports, as well as identifying and analyzing the factors influencing these attitudes. Achieving the Sustainable Development Goals requires proper communication through green reporting.

It is in the public interest to consciously and pro-environmentally engage people preparing reports and supervising their preparation, fully understanding and accepting the need for such disclosures. Our study constitutes a part of the research area addressing the perception of environmental information reporting by the preparing party and is of a pilot nature. The research results indicate the complexity of preparers' attitude towards the obligation of environmental disclosures.

The respondents are aware of the importance of environmental information to the stakeholders. However, reporting such information may be subordinated to various interests of managers and the enterprise as a whole. As a result, the declared pro-environmental attitude presented by the preparers of the reports does not necessarily translate into the quality of environmental disclosures. In our opinion, appropriate legal solutions are needed that will properly enforce the scope and quality of this reporting. One such tool may be to extract a report dedicated exclusively to environmental problems.

The definition of green reporting we propose refers to a comprehensive, integrated environmental report combining financial and non-financial information arranged according to the substantively separated areas. Such a report will highlight the importance of the problem, and at the same time serve to obtain the relevance and comparability of the presented environmental information, as well as provide a multi-faceted assessment referring to the effects of the actions taken by the company.

In this context, the added value of our research is broadening and deepening the knowledge on environmental information reporting in Poland, as well as participating in the discussion on the desired directions for the development of this reporting. Based on the obtained results, we recommend the identified solutions in this area.

Our research has its limitations. One of them is a relatively small research sample. The research is the first, pilot stage of the research. In the next stages, this sample will be enlarged. The second limitation is the difficulty in comparing our results with other studies because, to our knowledge, there are very few studies of this type. The third limitation is the focus on Polish enterprises only. As part of the research continuation, we intend to include other countries in the research.

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SHAPING THE DIGITAL POTENTIAL OF THE LARGE ENTERPRISE SECTOR FOLLOWING THE IMPLEMENTATION OF THE EUROPEAN DIGITAL DECADE STRATEGY

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Purpose: The article aims to identify changes in the intensity of large enterprises using modern technological solutions due to the regulations in force in the field of gaining digital sovereignty by implementing the European Digital Decade strategy.

Design/methodology/approach: During the research process, data collected from Eurostat were compiled. They concerned the sector of large enterprises operating in the European Union in the years 2014-2022. The research procedure was carried out using the PCA and VIKOR methods, and the ICT dissemination index.

Findings: The research results indicate that there are significant inequalities in the level of digitization and intensity of technology use among large enterprises. Entities located in Cyprus, Malta, Luxembourg, and Estonia have the greatest digital potential. In turn, the smallest technological resources were gathered by enterprises in France, Italy, Germany, Poland, and Spain. Based on the determined indicator of the dissemination of modern technologies, differences in the level of ICT implementation were found. Leaders in the implementation of modern technologies, i.e., Germany, France, and Estonia, were indicated.

Research limitations/implications: Further research should focus on analyzing the use of technological resources for sustainable development, delays in the implementation of ICT technologies, the use of quantum technologies, and the levels of achieving digital sovereignty of entities.

Practical implications: The research results provide business and state managers with information that can be used in the development and implementation of digital transformation strategies to increase digital potential and achieve digital sovereignty.

Originality/value: The authors contribute to research on the digital transformation of large enterprises. They develop a technology diffusion index that provides information about the level of ICT use.

Keywords: digital potential, ICT, Digital Compass, Europe's Digital Decade strategy.

Category of the paper: Research paper.

1. Introduction

Nowadays, enterprises are subordinated to the environment, and in particular to the determinants resulting from the economic state of the country in which they operate. One dimension of the operating environment of entities is the technological environment including a developed and modern technological infrastructure. This also applies to the high degree of availability of information and communication technology (ICT) devices and tools that enable the collection, processing, analysis, storage, sharing, and transfer of data and information (Hossain et al., 2023, p. 11).

Dynamic changes taking place in the operating environment of entities affect the transformations taking place in their business models (BM) (Caputo et al., 2021, p. 494). To a large extent, they reflect the implementation of modern ICT solutions aimed at increasing the competitiveness of enterprises. Therefore, one of the fundamental stimulants affecting the environment and contributing to the development of large enterprises is the ongoing transformation focused on the so-called new economy. This is considered a possible composition of currently generated macroeconomic factors related to the development of modern technologies (MT). Digital transformation (DX) is analyzed from the perspective of an event that contributes to a thorough and strategic restructuring within the existing operations of the organization (Hanelt et al., 2021).

During the intensification regarding the development of the new economy resulting from the digitization process, the prevalence of modern technological solutions being used by large enterprises located in the European Union (EU) countries is strongly differentiated. Although the level of digitization is an important factor determining the competitive advantage of enterprises and the position of a given country in international structures, there is a digital gap between them in the EU (Arbeláez-Rendón et al., 2023, p. 10; de Clercq et al., 2023, p. 6). To compensate for the disproportions resulting from the level of digital intensity, the "Road towards a digital decade" program was introduced. It is part of the European Digital Decade (EDD) strategy, which defines the four overriding goals of digitization regulated in the Digital Compass for 2030: Europe's Way in the Digital Decade, and a continuation of the Europe Fit for the Digital Age strategy.

This study aims to present the level of use of technological resources at the disposal of large enterprises in the territory of the 27 EU countries (EU27) to determine the digital potential and the possibility of shaping and using them to obtain technological independence.

Given the above, the main assumption of the conducted analyses is to find an answer to the general research question: to what extent has the advancing digital revolution influenced the implementation of the digital transformation and the effectiveness of using digitization tools among large enterprises as users of new technologies? The main research question was developed with the following four specific questions: 1. What modern technologies are used

by large enterprises operating in the EU? 2. What are the directions for using new technologies and digital solutions in large enterprises? 3. What is the level of digitization of the EU's large enterprise sector? 4. What are the territorial differences in the level of digitization of the EU's large enterprise sector?

However, the main purpose of the article is to identify changes in the intensity of large enterprises using modern technological solutions due to the regulations in force in the field of gaining digital sovereignty by implementing the European Digital Decade strategy.

Based on the indicated aim and research question, a hypothesis was formulated, which assumes that large enterprises gradually carry out digital transformations. This is characterized by a diverse pace and scope of diffusion of modern technologies, which they adapt through the adopted policy of the EU digital single market, in terms of gaining digital sovereignty, seeing in them a strategic opportunity to achieve a market advantage and the ability to function in a changing, dynamic and uncertain environment.

Taking into account the above thesis, an analysis of statistical data obtained from the Statistical Office of the European Communities (Eurostat) database was carried out using the desk research technique. To interpret the results, principal component analysis (PCA) and the VIKOR multi-criteria decision optimization method were used, and it was proposed to determine a technology dissemination index, which was verified using the Statistica, RStudio, MATLAB&Simulink, and MS Excel statistical packages.

The issues considered in this article have not been the subject of research for the digital potential and the large enterprise sector so far. For this reason, it intends to supplement the information in the research already carried out on the digital transformation of enterprises operating in the EU.

2. Literature review

2.1. Creating digital independence of enterprises

The currently observed dynamic and continuous changes taking place in the environment oblige enterprises to systematically improve business processes. The accelerating pace and unpredictability of transformations in the operating environment of entities mean that their success and survival in new market conditions are determined by their potential and adaptive skills. As a consequence, a competitive and technological advantage in the market is gained by entities that, while operating in the global economy, renew their BM (Reis et al., 2018) and modify their development strategy, taking into account the ongoing DX processes. Therefore, it should be noted that the functioning of enterprises in the old economy was based on achieving the scale effect, while in the digital economy, it comes down to the implementation

of the network effect (Shapiro, Varian, 2007). Thus, the digital economy is considered a type of new economy based on using the Internet and the implementation and proper application of modern technological solutions that determine the progressive phenomenon of digital transformation.

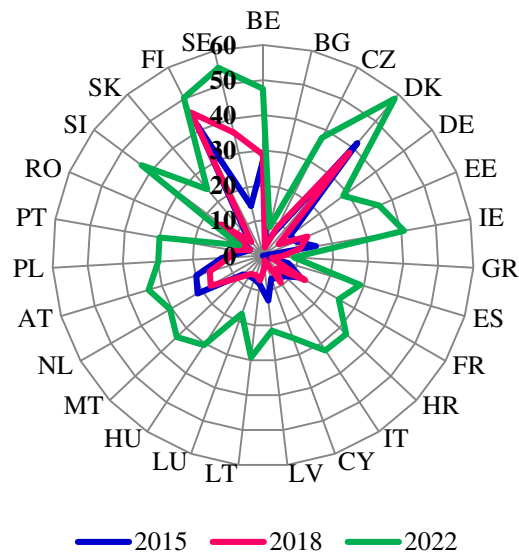
Digitization and the resulting processes related to the dissemination of using new digital technologies are also of key importance in achieving the competitiveness of enterprises (Kraus et al., 2022; Mergel et al., 2019; Westerman et al., 2011; Loske and Klumpp, 2022; Luo et al., 2023). Nevertheless, the pace of digital adoption is not the same in all organizations (Reis, Melão, 2023, p. 3). This is related, among others, to the lack of financial resources for the implementation of digitization, investment difficulties, and unfavorable conditions in adapting the BM.

Progressive DX obliges enterprises to constantly develop and implement newer and much more advanced ICT solutions (Wang, 2013). Its fundamental goal is to digitize the economy, industries, businesses, consumers, objects, and things. The transformation of the aforementioned structures is possible following the dynamic development of ICT, the Internet, and emerging transformational technologies. These include primarily: 1. Internet access (Barrero et al., 2021), 2. mobile technologies (Peris-Ortiz et al., 2020; Viète, Erdsiek, 2020), 3. social media (Nadziakiewicz, 2018; Tourani, 2022), 4. artificial intelligence (AI) (Soni et al., 2020); (Mishra, Tripathi, 2021), 5. virtual reality (VR) and augmented reality (AR), (Farshid et al., 2018; Jolink, Niesten, 2021; Bellalouna, 2021), 6. big data (BDA) (Acciarini et al., 2023; Peng, Bao, 2023; Piccarozzi, Aquilani, 2022), 7. cloud-based applications and services (CC), (Godavarthi et al., 2023; Marston et al., 2011), 8. automation and robotisation, (Siderska, 2020; Ribeiro et al., 2021), 9. ubiquitous connectivity (hyperconnectivity), (Arruda Filho et al., 2022; Gaines, 2019), 10. multi-channel and omni-channel models of product and service distribution, (Ailawadi, Farris, 2017; Thaichon et al., 2023), 11. Internet of Things (IoT) and Internet of Everything (IoE), (Nalajala et al., 2023; Peter et al., 2023; Kumar et al., 2019; Langley et al., 2021; Sestino et al., 2020).

The above-mentioned ICT technologies have evolved from the concept of the digital revolution (Toffler, 1985), the development of the digital economy (Tapscott, 1996), the network society (Castells, 2000) and the phantom of what is now known as virtual reality (Lem, 1964).

The development of ICT technology is related to the dynamic development of the Internet, which functions with the help of the "world wide web" or web (www) information system, enabling digital information processing. Thus, the intensified development of the Internet initiated the DX process through Web1.0, 2.0, 3.0, 4.0, 5.0 applications (Mazurek, 2020).

The intensity and scope of MT use provides information about the level of technological development of the organization and the stage of advancement of business processes. A very high digital intensity index (DII according to Eurostat), the scale of which was 11.3% in 2015 (no data from 2014), 10.1% in 2018, and 29.7% in 2022, was achieved by large enterprises operating in the EU (see Fig. 1).



where: AT – Austria, BE – Belgium, BG – Bulgaria, HR – Croatia, CY – Cyprus, CZ – Czechia, DK – Denmark, EE – Estonia, FI – Finland, FR – France, DE – Germany, GR – Greece, HU – Hungary, IE – Ireland, IT – Italy, LV – Latvia, LT – Lithuania, LU –Luxembourg, MT – Malta, NL – Netherlands, PL – Poland, PT – Portugal, RO – Romania, SK – Slovakia, SI – Slovenia, ES – Spain, SE – Sweden.

Figure 1. Highest level of digital intensity of large EU enterprises in 2015-2022 (% value).

Source: Own elaboration based on Eurostat data.

Depending on the operating environment and available resources, enterprises have a set of technological solutions, which is referred to as digital potential. Currently, an important premise for the implementation of such improvements to increase the potential is a total of six technologies, including four so-called SMAC (Social, Mobile, Analytics, and Cloud) ones (Nayyar et al., 2021; Sedera et al., 2022; Gopichand, 2016) and two consisting of BDA and communication using IoT.

The scope of application and implementation of new ICT technologies affects the achievement of digital sovereignty by enterprises, which is considered an alternative to digital colonialism (Young, 2019). The term sovereignty from the perspective of technology has so far been used to characterize various forms of independence, control and autonomy in the field of digital technologies (DT), BM and content (Bauer, Erixon, 2020, p. 8). Thus, digital sovereignty indicates the ability of states, international organizations and each user to exercise their rights and influence digital platforms and technological enterprises in accordance with their own social and development needs (Zygmuntowski, 2021, p. 27).

The EU's intention is to achieve digital sovereignty by implementing digital strategies that will enable the creation of a sustainable business environment equipped with appropriate technological resources.

2.2. European Digital Decade Strategy

DX provides the basis for carrying out fundamental and strategic transformations in the way businesses operate. At the same time, it obliges managers to change, renew, modify, or implement new so-called digital BMs. Therefore, managers should constantly familiarize themselves with digital solutions, because soon they may not be able to cope with the process of communicating with suppliers and customers effectively and efficiently (Paiola, 2018). Thus, the development of DT in enterprises operating in the EU is an important research issue, especially due to the recognition of its significant diversity.

The issue of digitization of the economy, enterprises and society in the EU is also one of the priority projects for the implementation of the EDD and DC 2030 strategies. As part of DX, on March 9, 2020, the European Commission (EC) adopted a program indicating the basic goals that should be achieved by 2030. They concern four key issues: 1. digitally-skilled population and highly-skilled digital staff, 2. secure, efficient and sustainable digital infrastructure, 3. digital transformation of enterprises, 4. digitization of public services (European Commission, 2021, p. 2). Based on the presented document, by 2030, 75% of enterprises operating in the EU should use CC, AI and BDA technologies. Moreover, over 90% of small and medium-sized entities are required to achieve at least a basic level of the indicator regarding the use of digital technologies. The strategy also assumes doubling the number of technology start-ups (so-called unicorns, with a value of at least USD 1 billion) (European Commission, 2021, p. 15).

In terms of gaining digital sovereignty, the program indicates an increase in the production of cutting-edge and sustainable semiconductors in Europe to 20% of global production. In addition, the strategy envisages having the first quantum computer on the European market (European Commission, 2021, p. 17).

Monitoring of the strategy's implementation will be carried out using multi-annual strategic road maps of digital transformation, which have been prepared for each EU country.

Given the above, the level and potential of digitization of the large enterprise sector in the EU zone should be considered in terms of the implementation of modern technologies, transformation, and achieving digital independence, and the differences between Member States should be determined.

3. Materials and Methods

The problems of this article focus on determining the level of digitization associated with the use of technological resources, which shaped the digital potential of large enterprises from 27 EU countries in the period 2014-2022, according to the EDD strategy. Due to the exit of

the UK from the structures on February 1, 2020, the research carried out in this study concerned the 27 countries of the European Community. While diagnosing this issue, indicators from Eurostat databases in the section on ICT usage in enterprises were used.

The data were collected in June 2023. The research was carried out at the turn of July and August 2023 based on the desk research technique. Large enterprises employing over 250 people located in the following countries were analyzed: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden. In the absence of data for a given year, data from the preceding or following year were used. All indicators with percentage values were reduced to real numbers.

3.1. Principal component analysis

PCA was used to interpret the collected data. This type of method is based on the orthogonal transformation of an n -dimensional set of variables describing the properties of the studied phenomenon into a new uncorrelated set of variables, the so-called principal components (PC). They have a dimension smaller than n and occur as a linear combination of primary variables (Tanaka-Yamawaki, Ikura, 2023, p. 23). The transformation consists of the fact that the variances of successive variables reflect an increasingly smaller structure, and the total variance of all analyzed data creates an equivalent sum of variances of the main components (Bloem, 2023, p. 31). Thus, PCA intends to decompose the variability of the data set into a set of components, in which the first component (PC1) interprets the maximum part of the variability, while the second (PC2) justifies the largest part of the remaining variability (Marquez, 2022, pp. 57-58). The method used to carry out the research is based on the presentation of the input data set by orthogonal transformation of the input matrix into a linear set of new unobservable factors in accordance with the equation:

$$Z_j = b_{j1}S_1 + b_{j2}S_2 + b_{j3}S_3 + \dots + b_{jn}S_n \quad (1)$$

where:

Z_j - the j -th variable ($j = 1, 2, \dots, n$),

$S_1 \dots S_n$ - main components,

$b_{j1} \dots b_{jn}$ - main components coefficients.

Reducing the space dimension of the analyzed data and their juxtaposition into subsets makes it possible to graphically explain the relationships between the examined features and define their significance. The diagram generated during the analysis presents the relationship between the objects for the PC data. Factor loading values, on the other hand, act as correlation/covariance coefficients that run between the original data and PC (Jolliffe, 2016). For the purposes of the analysis of the collected data, the normalized rotation varimax

(maximum of the variance) was used, which allows for the maximum differentiation of loads within the factor. In relation to individual factors, variables grouping the highest values of factor loading about the relative factor were determined (according to the assumed value ≥ 0.7).

In this study, 43 indicators have been compiled that shape the technological resources of large enterprises operating in EU countries (see Tab. 1 in appendix). The calculation of the collected indicators was performed using the Statistica 13.1 statistical package.

3.2. VIKOR multi-criteria decision optimization method

In the second stage of the research, one of the methods of multi-criteria decision support VIKOR (Serbian *Višekriterijumska Optimizacija i Kompromisno Resenje*) was used to analyze and evaluate the use of modern ICT technologies by large enterprises located in 27 EU countries. It is designed to solve decision-making problems in the event of conflicting circumstances and the impossibility of a common set of criteria.

The process of shaping the ranking and the selection of a compromise solution from many alternatives takes into account mutually exclusive decision criteria (Kobryń, 2014, p. 184). Thus, the VIKOR method uses a multi-criteria ranking coefficient, the so-called ranking index, which is based on the distance of a specific solution from the ideal result.

The generated model provides the best alternative from the perspective of obtaining the result closest to the ideal (Opricovic, 1998). Therefore, in the VIKOR analysis, the average and maximum weighted distance from the ideal point is calculated for each decision variant. In the decision-making process, the so-called comprehensive Q_i indicator allows a balance to be maintained between the average and maximum distance.

The VIKOR ranking is created in accordance with an algorithm in which the spread coefficient of the criterion function d_{ij} is determined in order to normalize the criteria for the evaluation of variants in accordance with the formula (Kim and Ahn, 2019, p. 127):

$$d_{ij} = \frac{f_i^* - f_{ij}}{f_i^* - f_i^-} \quad (2)$$

where:

d_{ij} - spread coefficient of the criterion function [-];

f_{ij} - the value of the i -th criterion function for the j -th alternative solution [-];

f_i^* - maximum f_{ij} value when the i -th criterion function shows advantage, minimum f_{ij} value when the i -th criterion function shows a disadvantage [-];

f_i^- - maximum f_{ij} value when the i -th criterion function shows an advantage, minimum f_{ij} value when the i -th criterion function shows disadvantage [-].

Then, the best (f_i^*) and worst (f_i^-) values are determined from all alternatives ($j = 1, 2, 3, \dots, m$) and for all criteria functions ($i = 1, 2, 3, \dots, n$), where it is a benefit criterion that is maximized or minimized by the equation (Zeng et al., 2019, p. 78):

$$f_i^+ = \max_j f_{ij}, f_i^- = \min_j f_{ij} \tag{3}$$

In the next step, weights related to various criteria are assigned. For the purposes of this study, to ensure the comparability of results, weights were determined based on the Shannon entropy $H(p)$ of the probability distribution p , based on the formula (Vale Cunha et al., 2020):

$$H(p) = - \sum_{i=1}^N p_i \ln(p_i) \text{ where it is accepted that } 0 \ln(0) \equiv 0 \tag{4}$$

where:

- n – the number of equivalent variants of the event p (in the case of the conducted research $n = 43$), subsequent p_i (for $i = 1, 2, 3, \dots, n$) are the probabilities of subsequent versions,
- p_i – the probability of the i -th realization of a discrete random variable,
- x_i – the i -th implementation of the random variable p essentially affects the character of the basis for measuring spatial homogeneity and differentiation.

After determining the weights, the compromise ranking indices S_i and R_i are calculated for each of the alternatives, based on the relationship (Siregar et al., 2018, p. 2):

$$S_i = \sum_{j=1}^n \left[w_j \left(\frac{f_i^* - f_{ij}}{f_i^* - f_i^-} \right) \right] \quad R_i = \max_j \left[w_j \left(\frac{f_i^* - f_{ij}}{f_i^* - f_i^-} \right) \right] \tag{5}$$

where:

- S_i, R_i – compromise ranking index,
- w_j – relative weight of the criterion.

In the penultimate stage of the VIKOR method, the indicators are used to estimate the normalized ranking index Q_i (Akram et al., 2022, pp. 7212-7214):

$$Q_i = \sum_{j=1}^n \left[v \left(\frac{S_i - S^*}{S^- - S^*} \right) + (1 - v) \left(\frac{R_i - R^*}{R^- - R^*} \right) \right] \tag{6}$$

where: $S^* = \min_i S_i, S^- = \max_i S_i; R^* = \min_i R_i; R^- = \max_i R_i; v \in [0,1]$ weight measure reflecting the strategy value of most criteria, for the purposes of this article $v = 0.5$ (corresponds to the preferred consensus); the difference $1-v$ is the weight that determines the power of the veto.

The final step is to sort the alternatives S_i, R_i, Q_i in ascending order, resulting in three ranking lists. Next, a compromise solution is proposed according to the variant a' corresponding to the minimum Q_i provided that the assumptions are met (Akram et al., 2021, p. 20):

Condition 1. Acceptable advantage

$$Q(a'') - Q(a') \geq DQ \tag{7}$$

where: a'' is the second variant on the list according to Q and $DQ = \frac{1}{n-1}$

Condition 2. Acceptable stability in decision subtraction

Alternative a' should reflect the best variant according to the S or/and R criteria.

For the purposes of this article, the Q_i index was also the basis for the classification and grouping of linearly ordered objects using the standard deviation method. The assumption of the process of hierarchizing objects is the intervals of values of the synthetic variable Q_i created in accordance with the arithmetic mean \bar{x} and standard deviation σ (Xu, Da, 2010). The created collection of objects is systematized into four groups, which concern clusters with the value of the synthetic variable contained in the following separate ranges (Maldonado-Moscoso et al., 2020):

- group I: $Q_i \geq \bar{x} + \sigma$; very high level,
- group II: $\bar{x} + \sigma > Q_i \geq \bar{x}$; high level,
- group III: $\bar{x} > Q_i \geq \bar{x} - \sigma$; medium level,
- group IV: $Q_i < \bar{x} - \sigma$; low level.

For this study, 43 indicators, included in Table 1 in appendix, were compiled. The collected data were statistically analyzed using the MATLAB&Simulink program.

3.3. ICT diffusion rate

For the purpose of this study, in the last stage of the research, to assess the varied rate and scope of MT diffusion implemented on the basis of the EDD strategy in large EU enterprises, a measure of the dissemination of modern technologies was formulated. The proposed indicator makes it possible to determine the direction and degree of changes in the considered variables in relation to the initial stage. The purpose of this type of analysis is to determine the trend towards the dissemination of ICT and the strength of the relationship between the level of DT and the use of technological resources by large entities operating in the territory of the 27 EU countries.

The initial step in creating the ICT diffusion index was to determine the diffusion coefficient (DF_i). This was calculated based on the difference between the level of the analyzed phenomenon at the analyzed moment in comparison with the previous period ($Q_{i(t-1)}$) and the final period ($Q_{i(n-1)}$). According to the following formula:

$$\Delta DF X_{t/(t-1)} = Q_{i(t)} - Q_{i(t-1)}; \Delta DF Y_{t/n-1} = Q_{i(t)} - Q_{i(n-1)}; (t = 2, 3, \dots, n) \quad (8)$$

where:

$\Delta DF X_{t/t-1}; \Delta DF Y_{t/n-1}$ – fixed-base diffusion coefficient,

$Q_{i(t)}$ – VIKOR index, technological resources of enterprises in the analyzed period,

$Q_{i(t-1)}$ – VIKOR index, the use of modern technologies in the period preceding the analyzed period,

$Q_{i(n-1)}$ – VIKOR index, the use of modern technologies in the final period,

n – the final examined period.

Then, the interdependence of the studied variables was determined by determining the technology dissemination index ICT (CH_i). Its task is to define the degree of convergence of the diffusion coefficient values according to the equation:

$$CH_i = \frac{DFY}{DFX} \quad (9)$$

if:

$CH_i = 0$ lack of interdependence between the degree of digital transformation and the use of technological resources in large enterprises - symmetrical level of digital potential,

$CH_i = 1$ strong interdependence between the degree of digital transformation and the use of technological resources in the surveyed entities - high level of digital potential,

$CH_i < 1$ average correlation between the degree of digital transformation and the use of technological resources in large organizations - negligible level of digital potential resulting from limitations in the implementation of technological solutions,

$CH_i > 1$ increased interdependence between the degree of digital transformation and the use of technological resources in large enterprises - an increase in the level of digital potential resulting from the intensive use and implementation of technological solutions.

In order to carry out this research, 43 indices collected in Table 1 in appendix and the calculated VIKOR index from Table 4 were used, which were analyzed using the MS Excel package.

4. Results

4.1. Technological resources of large enterprises in the European Union

Based on the collected data, which concerned the years 2014-2022, in the initial phase of the research carried out using PCA, the set of technologies available to large enterprises operating in the EU was determined. The study made it possible to identify the factors (technologies used) that contribute to the correlation between the analyzed variables (technological potential). The procedure of graphical projection of PCA data made it possible to distinguish interdependencies and discrepancies between the examined technological solutions used by large enterprises in the comparison of the first two PCs (see Fig. 2).

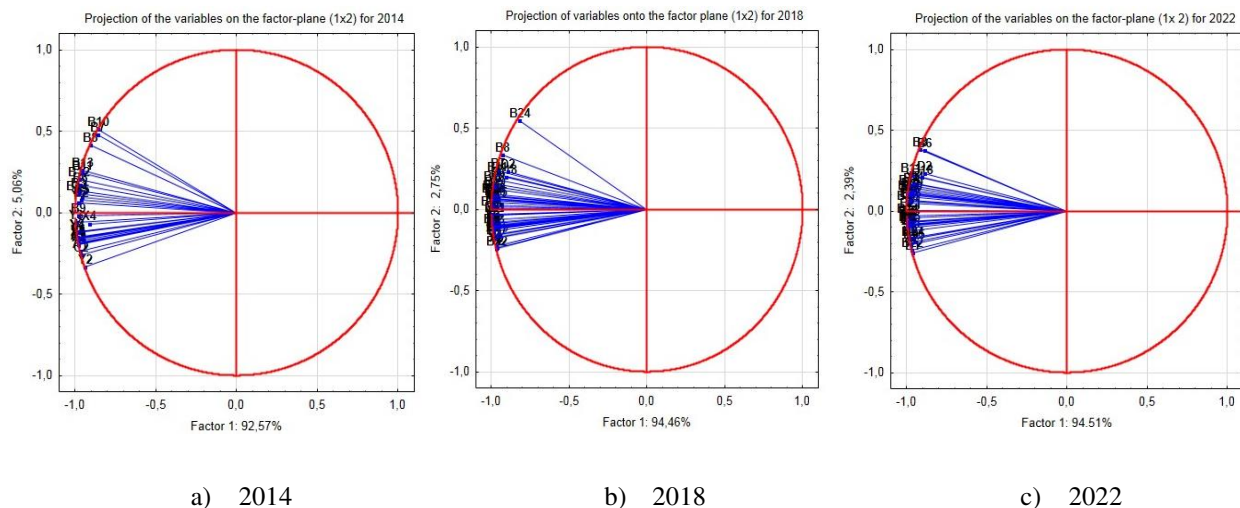


Figure 2. Configuration of the charge vectors concerning the first two principal components for the set of technologies of large EU enterprises: a) scatter of factor charges for 2014; b) distribution of factor loading values for 2018; c) distribution of factor loading values for 2022.

Source: Own elaboration using the Statistica 13.3 package.

Based on PCA for 2014, the dependent variables were transformed into orthogonal components, which together explain 98.32% of the total variance, i.e., the total multivariate variability of the MT application parameters. Thus, the study showed that the digital potential of large enterprises in the EU was diversified due to the resources and technological solutions related to the first three components: PC1 - 92.27%, PC2 - 5.06%, PC3 - 0.69%. The projection plot of the PC1 and PC2 standardized coefficients shows linear combinations of variables. They are responsible for the type of applied technological solutions affecting a circle with a unit radius centered at the origin of the coordinate system illustrating the correlated groups of technological resources determining the digital potential (see Fig. 2a). Both components justify 97.63% of the data variability.

PC2 classifies the analyzed variables into two groups with opposite signs of the coefficients. In the first of them, CC solutions for the purchase of office software (B10) and access to e-mail (B7) have the greatest digital potential. However, the second group, is shaped by tools related to providing content via the Internet, i.e., enterprises that provided descriptions of goods, services, and price lists on their website (Y2) and provided training to employees to improve their ICT competencies (C2). Based on defined factor weightings, a strong positive correlation was also noted for technological resources related to BDA, which are processed in CC. Among the technological solutions of this type is the purchase of CC services, which are delivered from servers made available by service providers (B13), and equipping enterprises with CC-based CRM software for customer relationship management (B11); analytics of big data from smart devices or sensors (B3) - purchase of CC services used over the Internet (B14); and analysis of large data sets that are generated from social media (B5) - analysis of large data sets from the geolocation of mobile devices (B2).

Moreover, PC1 is distinguished by a strong positive correlation, which is related to Internet accessibility, technological infrastructure and cybersecurity. Thus, the digital potential of enterprises was created by technological solutions in the field of using websites to share multimedia content (Y8) and placing online orders, reservations or using the shopping cart (Y4); Internet access (X1) – use of social media (Y6); and employment of ICT/IT specialists in enterprises (C1) – use of computers by employees (X2). In 2014, the digital potential of large enterprises operating in the EU did not show a strong negative correlation.

The conducted PCA also made it possible to identify technological solutions that do not have correlations. This group included large enterprises that purchased office software processed in CC (B10) and had websites with descriptions of goods, services, and price lists (Y2); and purchased database hosting as a CC service (B8) - used customer relationship management programs (A1).

In 2018, PC explained a total of 97.21% of data variability (see Fig. 2b). PC2 highlights a significant number of large enterprises analyzing internal big data using machine learning (B24) and corresponding to a small group of organizations using 3D printing (B22). Based on the obtained PCA results, it should be assumed that factor loads characterized by a positive correlation determine the digital potential of large enterprises operating in the EU. In particular, they should be assigned technological resources that enable the collection, storage, management, and analysis of large data sets. With the use of this type of technology, entities shape the digital potential in the purchase of customer relationship management (CRM) software (B11) and the use of AI technology to manage enterprises (B18); purchase of office software (B10) - use of a company blog or microblogs (Y7); procurement of CC services provided from shared servers of service providers (B13) - application of AI technologies performing text mining (B20); and purchase of a file storage service (B12) and computing power to support software in the enterprise (B9). Enterprise resources are also configured by AI technologies that automate tasks and support the decision-making process (B16) - enabling the use of IoT (B15).

Moreover, PC1 is strongly positively correlated with the technologies that enterprises acquire over the Internet to process services using cloud computing (B14). In addition, organizations used SMAC technology solutions to improve communication because the used websites shared multimedia content (Y8) and enabled the exchange of information through a chat service where a chatbot or virtual agent answered customers' questions (B21); and provided employees with a mobile Internet connection for business use to access the company's e-mail system (X3) - had Internet access (X1). In 2018, organizations used systems that ensure control over resources and products and improve business operations. Therefore, they used CRM (A1) customer relationship management systems - they provided employees with training to improve digital competences in the field of ICT technology (C2).

However, a lack of correlation between the analyzed technologies was observed in the case of the purchase of hosting for the company's database (B8) and the use of websites that provided descriptions of goods or services and price lists (Y2); occurrence of incidents related to ICT security, as a result of which data were damaged as a result of infection (D2) - the use of computers by employees (X2); purchase and use of e-mail in the cloud (B7) - use of 3D printers for prototyping or printing models for internal use of the company (B1); purchase of a CRM system as a cloud service (B11) - the use of AI technology to ensure ICT security (B17); and the use of AI technology for business management (B18) - analysis of large data sets using algorithms for processing and generating natural language or speech recognition (B25). In the analyzed year, large enterprises did not have technological resources that were distinguished by a strong negative correlation.

Based on the Hotelling method, which uses the Lagrange multiplier test related to the maximization of functions of many variables, in 2022, PCs accounted for 96.9% of the variability of the technologies used, which accounted for the digitization potential of large EU enterprises (see Fig. 2c). PC2 presents organizations that purchase financial or accounting applications processed in CC (B6) balanced by the use of 3D printing for their own needs to build prototypes or models (B1).

According to the identified factor weightings, resources based on the purchase of financial or accounting applications processed in the cloud (B6) and the purchase of hosting for the enterprise database implemented as a cloud service (B8) were characterized by a positive correlation; the use of AI technology to manage enterprises (B18) - equipping with CRM systems processed in the cloud (B11); the use of service robots (B4) - running a company blog or microblogs (Y7); and purchase of cloud solutions for file storage (B12) - application of AI technology to conduct written language analysis (text mining) (B20).

However, PC1 is distinguished by a strong positive correlation in the use of chat services, in which a chatbot or virtual agent communicates with the company's customers (B21). This type of dependence was also characteristic of technologies that concerned the use of industrial robots (B23) and the analysis of large data sets from the geolocation of mobile devices (B2). Strong positive links were also based on resources enabling the company's presence on the Internet through the use of social networks (Y6) and websites for sharing multimedia content (Y8); having a website (Y1) - using the IoT (B15); making references to the company's social media profile on the website (Y5) - using different types of CRM software (A1); and posting a description of goods, services and price lists on the website (Y2) - the use of AI technology to ensure ICT security (B17).

Just as in previous years, in the analyzed year, no resources with a negative correlation were identified. Moreover, independent technologies were observed, which concerned the purchase of cloud hosting for the company's database (B8) and the use of 3D printing (B22); the occurrence of incidents related to ICT security, which resulted in the destruction or damage of data (D2) - the use of computers by employees (X2); the use of AI technology for

enterprise management (B18) - big data analysis, for which enterprises use natural language processing and generation or speech recognition (B25); and purchase of CRM software in the cloud (B11) - analysis of large data sets using machine learning tools (B24).

Based on the research conducted using the PCA method, it should be stated that the digital potential of large enterprises operating in the EU depends on the technological resources they have. The surveyed entities use a diverse set of technological solutions that they implement in connection with the ongoing digital transformation. In the surveyed years 2014-2022, organizations based on founding technologies (computer - X2, Internet – X1), classified as Web 1.0 tools of the information network, created their digital potential.

Starting in 2014, they implemented solutions in the field of mobile Web 2.0 technologies developed in the social network by the following solutions: Y4, Y6, Y8, B7, and B11. In addition, large enterprises also collected Web 3.0 technological tools based on the semantic web, which include digital technologies B13, B3, B14, B5, B2, and B10.

In turn, in 2018, organizations continued to implement Web 1.0, Web 2.0, and Web 3.0 solutions. They also used the founding X1 and mobile X3, Y8, and A1 technologies to run their business. Their digitization consisted mainly of using resources in the field of cloud computing B9, B10, B11, B12, B13, B14, and the Internet of Things B15. The next stage of digital transformation of large enterprises was based on the use of automation technologies B1, B18, B20, and B22 based on the mobile and flexible network Web 4.0.

In 2022, organizations based on the Web 1.0 information network (Y1) and the Web 2.0 social network (Y5, Y6, Y7, Y8) used DT characteristics of the Web 3.0 semantic network, i.e., cloud computing tools (B6, B8, B11, B12), big data analytics (B2), and the Internet of Things (B15). In the next phase of digital transformation, the entities used automation solutions that resulted from the use of the mobile-flexible Web 4.0 network consisting in printing three-dimensional 3D objects (B22). In addition, the digital potential of large enterprises consisted of technological resources, in the structure of which hyper-automation technologies based on the Web 5.0 sensory network became dominant. As part of this type of technology, organizations used tools in the field of artificial intelligence (B17, B18, B20, B21), robotics (B4, B23), and machine learning (B24). The essence of these technological solutions is interaction between devices and people.

Based on the conducted research, it can be concluded that large enterprises carried out digital transformation in stages, as a result of which they gathered technological resources necessary to shape the digital potential.

4.2. Application of modern technological solutions in large enterprises

To present the diversity of large enterprises operating in individual EU countries regarding the degree of using ICT solutions, the VIKOR method of multi-criteria decision support was used to balance the diffusion processes of modern technologies (see Tab. 2).

Table 1.

Ranking of indicators of ICT use by large enterprises in EU countries according to the VIKOR method

Years UE country	2014				2018				2022			
	Qi	V	SKE	VIKOR ranking	Qi	V	SKE	VIKOR ranking	Qi	V	SKE	VIKOR ranking
AT	0.735	24%	-3.254	19	0.807	13%	-3.621	20	0.791	12%	-3.207	18
BE	0.767	27%	-3.453	18	0.863	15%	-6.447	16	0.725	15%	-3.631	20
BG	0.868	27%	-2.864	12	0.962	14%	-5.312	10	0.951	12%	-3.377	9
HR	0.913	25%	-3.357	8	0.966	16%	-3.917	8	0.961	16%	-2.948	8
CY	1.000	28%	-3.134	1	1.000	15%	6.245	1	1.000	15%	-3.669	1
CZ	0.710	28%	-3.507	21	0.829	15%	-6.541	18	0.746	15%	-3.674	19
DK	0.819	26%	-3.422	16	0.827	14%	-6.020	19	0.824	14%	-3.522	15
EE	0.970	27%	-3.491	4	0.987	15%	-6.456	5	0.988	15%	-3.621	3
FI	0.826	19%	-1.486	13	0.863	28%	-2.062	17	0.813	24%	-1.649	17
FR	0.275	29%	-0.055	26	0.299	18%	-0.625	27	0.511	26%	-0.241	24
DE	0.436	27%	-3.509	23	0.440	15%	-6.512	26	0.500	15%	-3.638	25
GR	0.909	46%	-0.632	9	0.964	18%	-0.688	9	0.936	24%	-1.676	10
HU	0.824	28%	-3.519	15	0.925	16%	-6.556	13	0.879	15%	-3.684	13
IE	0.885	28%	-3.518	10	0.925	15%	-6.544	14	0.887	15%	-3.671	12
IT	0.251	27%	-3.515	27	0.476	15%	-6.501	25	0.414	15%	-3.643	26
LV	0.965	28%	-3.518	5	0.991	15%	-6.537	4	0.975	15%	-3.663	5
LT	0.932	27%	-3.501	7	0.972	14%	-6.131	7	0.968	14%	-3.500	7
LU	0.976	28%	-3.519	3	0.994	16%	-6.550	3	0.979	15%	-3.681	4
MT	0.998	23%	-1.890	2	0.999	14%	-1.014	2	0.999	12%	-2.696	2
NL	0.566	25%	-3.478	22	0.735	15%	-5.647	21	0.592	14%	-3.494	23
PL	0.387	20%	-2.755	25	0.641	14%	-1.105	23	0.617	14%	-2.167	21
PT	0.815	26%	-3.454	17	0.889	14%	-5.691	15	0.815	14%	-3.527	16
RO	0.825	26%	-3.190	14	0.955	15%	-5.527	11	0.866	14%	-3.457	14
SK	0.881	28%	-3.514	11	0.953	15%	-6.522	12	0.925	15%	-3.663	11
SI	0.955	27%	-3.443	6	0.986	15%	-6.439	6	0.974	15%	-3.622	6
ES	0.420	26%	-3.179	24	0.481	15%	-5.023	24	0.317	14%	-3.419	27
SE	0.716	24%	-2.877	20	0.724	14%	-2.290	22	0.602	12%	-2.957	22
Total EU countries												
\bar{x}	0.764				0.832				0.798			
σ	0.225				0.199				0.198			
V	29%				24%				25%			
SKE	-				-1.421				-			
	1.140								0.979			

where: \bar{x} – average value, σ – standard deviation V – coefficient of variation, SKE – skewness factor;

AT – Austria, BE – Belgium, BG – Bulgaria, HR – Croatia, CY – Cyprus, CZ – Czechia, DK – Denmark, EE – Estonia, FI – Finland, FR – France, DE – Germany, GR – Greece, HU – Hungary, IE – Ireland, IT – Italy, LV – Latvia, LT – Lithuania, LU –Luxembourg, MT – Malta, NL – Netherlands, PL – Poland, PT – Portugal, RO – Romania, SK – Slovakia, SI – Slovenia, ES – Spain, SE – Sweden.

Source: Own elaboration using the Matlab program.

The ranking of countries prepared based on the VIKOR multi-criteria decision optimization method and grouping objects using the standard deviation method presents inequalities resulting from the level of use of modern technologies by large enterprises operating in the EU. In 2014, the range for the analyzed variables between the maximum value for CY of 1.000 and the minimum value for IT of 0.251 was 0.749. After four consecutive years, the difference between the highest level for CY of 1.000 and the lowest level represented by France of 0.299 was equal to 0.701. However, in the same period and the last surveyed year 2022, the diversity occurring within the highest limits for CY of 1.000 and minimum limits for SE of 0.317 reached the lowest value so far of 0.683.

Based on the research carried out using the VIKOR method, a similarity can be observed in the ranking positions occupied by individual EU countries in terms of the use of MT in large enterprises.

In the years 2014-2022, according to the analysis, the leading place was taken by CY, which stood out from other EU countries with significant values of diagnostic features. Large entities operating in this country used the most modern technologies in the field of X1 in 2014-2022 - 100%, Y1 in 2014 - 98%; 2018 – 95.7%; 2022 – 96.9%, Y2 in 2014 - 96.1%; 2018 – 95.7%; 2022 – 96.9%. Additionally, in 2018, 93.2% of them used Y6 solutions and 88.4% implemented C1 technologies. In 2022, 95.4% used X3 tools and 84.5% used B14 solutions.

In 2014, limited resources were available to large enterprises in the field of Y3 technology, which was implemented by 3.4% of entities, B8 - 7.4%, and B9 - 7.4%. They used the fewest technological solutions in the case of B1 in 2018 - 1.4%; 2022 – 1.5%, D2 in 2018 - 1.9%; 2022 - 1.9%, and B16 in 2018 - 2.6%. In addition, in the last surveyed year, 2022, organizations did not use B25 technology - 0%. In second place was MT in 2014-2022, where most large enterprises were equipped with X1 tools in 2014 - 93.5%; 2018 – 98.1%, Y1 in 2014 - 93.5%, 2018 – 97.6% and X3 in 2014 - 89.3%; 2018 – 98.8%. In addition, 92.1% of organizations of this type in 2018 used Y6 tools. However, in 2014 they used the B6 - 2.0%, B9 - 6.1%, and B10 - 6.1% technologies to a limited extent, and in 2018 they used the B25 - 1.2%, B20 - 1.3%, and D2 - 2.6% technologies. The third place in the ranking in 2014-2018 was taken by large enterprises operating in LU, all of which had access to X1 technology (100%). In addition, they also had Y1 solutions in 2014, with 95.5% of entities using them, in 2018 - 96.8%; and X3 in 2014 - 91%; 2018 – 91.1%; and 2022 - 96%.

In addition, the surveyed entities used the C2 technology in 2014 - 65.5%, and 2018 - 72.6%. They were also distinguished in 2014 by scarce technological resources of B6 - 5.5%, B9 – 5.0%, and B11 - 6.5%. In turn, in 2018, they implemented minor technological solutions, B25 - 2.1%, D2 - 4.8%, and B21 - 5.5%. In 2022, third place was taken by large enterprises located in EE. 99.9% of them implemented X1 technologies, 97.8% used X3 solutions and 96.7% used Y1 tools. In addition, 93.1% of entities used Y2 tools. However, they used technologies from the D2 category - 0.7%, B18 - 2.1%, and B17 – 4.8%, to a minimal extent.

In 2014, one of the lowest places in the ranking - 25th - was taken by PL, where 99.6% of large enterprises had X1 technology, 95.3% used X3 tools and 90.9% used Y1 solutions. However, the smallest interest was observed among technological solutions such as B6 - 4.0%, B9 - 4.0%, and B11 - 4.1%. In 2018, IT took the same place with 99.7% of entities using X1 technology, 94.7% of organizations using X3 solutions, and 89.5% of enterprises using Y1 solutions. At a minimum level, the technologies D2 - 2.8%, B25 - 3.3%, B19 - 4.5% and B18 - 5.5% were used. In 2022, this position was taken by DE, where X1 and X2 technologies were owned by all large entities (100%), X3 solutions were used by 99.6%, and Y1 were used by 95.7% of them. The smallest interest in modern technologies concerned D2 tools - 2.6%, B18 - 3.8%, and B19 - 5.1%.

One of the smallest values of the analyzed variables was adopted by the countries classified in 26th place. Among them, FR dominated in 2014 with X1 technologies used in 100%, X3 tools used by 95.8% of organizations, and Y1, used by 90.8% of entities. On the other hand, the use of technological resources was negligible for solutions in B9 - 6.6%, B6 - 6.7%, and B5 - 9.1%. In 2018, this position was taken by DE, where all large enterprises had X2 solutions (100%), X1 technology was used by 99.9%, and Y1 by as many as 96.7% of such entities. The least often used solutions were B18 - 3.8%, B24 - 4.2%, and B19 - 5.1%. However, in 2022, 26th place was taken by IT, in the area in which large entities used the technologies X1 - 99.7%, X3 - 95.9%, and Y1 - 91.8%. They minimally used solutions in the range of B25 - 3.3%, B19 - 4.5%, and B18 - 5.5%.

The classification in the ranking is closed by organizations ranked 27th. In 2014 it was IT with entities using X1 - 100%, Y1 - 88.9%, and A2 - 78.8%. Nevertheless, they used B5 - 7.2%, B9 - 7.4%, and B2 - 9.8% technologies to a minimal extent. From 2018, this place was occupied by FR, dominated by X1 - 99.9%, X3 - 96.2%, and Y1 - 94.7%. In turn, D2 - 3.7%, B25 - 4.2%, and B18 - 4.9% were used to a small extent. In the last year of 2022, 27th position belonged to large companies operating in ES. They were distinguished by the use of X1 technology - 99.7%, Y1 - 96%, and X3 - 89.5%. However, to a small extent, they used modern solutions, such as B21 - 5.5%, B25 - 6.4%, and B18 - 7.9%.

Based on the calculated coefficient of variation (V), the diversity in the use of modern technologies among all large enterprises operating in the EU countries should be considered average. In 2014, this parameter reached the highest value of 29%. However, in the following years, it was at the level of 24% in 2018 and 25% in 2022.

Nevertheless, depending on the location of large entities in the countries of the European Community, stratification resulting from the use of modern technological solutions can be observed. In 2014, it concerned low differences in SE (19%) and PL (20%), large disproportions in IT (46%), and average disharmony for the remaining countries NL (23%), BG, SE (24%), AT, DK (25%), IE, PT, RO, FI (26%), BG, CZ, GR, HR, LT, HU, SK (27%), EE, DE, CY, LV, LU, MT, SI (28%), and FR (29%). On the other hand, in 2018, medium variation was identified in ES (28%) and small discrepancies among the 26 other countries BE, GE (13%), CZ, IE, HU, NL, PL, PT, SE (14%), BG, EE, GR, HR, LV, LT, LU, AT, RO, SI, SK, DE, FI (15%), DK, CY, MT (16%), FR, and IT (18%). In turn, during the last surveyed year of 2022, disproportions in the use of technology at an average level were distinguished by ES, IT (24%), FR (26%), and a small range of differentiation was characterized by BE, CZ, NL, SE (12%), IE, HU, AT, PL, PT, RO, FI (14%), BG, DE, EE, GR, HR, CY, LV, LT, LU, MT, SK, SI (15%), and DK (16%).

Moreover, the skewness coefficient (SKE) was used to determine the direction of differentiation of variable values. Its task was to determine the years in which large enterprises operating in the EU made a significant and minimal amount in the implementation and use of MT. According to this type of criterion, in the analyzed period, the formation of

left-sided skewness with a moderate asymmetry of distribution was observed for all large enterprises operating in 2014 (SKE takes the value of -1.140) and 2022 (SKE is -0.979) and in 2018 (SKE was -1.421) with a strong asymmetry of distribution.

In 2014, the method of applying the analyzed modern technological solutions in large enterprises was distinguished by an asymmetric distribution with very weak negative skewness for FR. A negatively skewed distribution with weak asymmetry characterized IT. The strong left asymmetry was represented by large enterprises located in ES. However, the surveyed entities operating in PL, NL, CZ, SE, FI, DK, RO, BE, SK, IE, PT, BG, HU, GR, AT, HR, EE, SI, LT, LU, LV, DE, CY, and MT had a very strong distribution symmetry.

Over the next four years, i.e., until 2018, large enterprises located in FR and IT were characterized by left-sided skewness with a weak asymmetry of the distribution of the analyzed variables. Moderate asymmetry concerned the surveyed entities located in NL and PL. On the other hand, a very strong asymmetry in the use of modern technological solutions occurred in SE, ES, BE, DK, BK, FI, AT, GR, CZ, RO, PT, IE, HU, SK, HR, LT, EE, CY, LV, LU, MT, DE, and SI.

However, during the next four years until 2022, the surveyed enterprises were also distinguished by a negative left-skew distribution with weak asymmetry in the case of FR (-0.241) and very strong for the remaining 26 EU countries.

According to the designated measures, after a linear ordering of the countries, taking into account the value of the aggregate variable, typological classes were determined. They present the division of EU countries from the perspective of the intensity of implementation and the use of technological resources while creating the digital potential of large enterprises. The results of the analysis are presented in Table 3 and Figure 3.

Table 2.

Typological classification of EU countries according to the intensity of the use of modern technologies by large enterprises in 2014-2022

Typological class	Synthetic measure Qi		Number of states	Countries (value of a synthetic measure)
	limit values	level		
year 2014				
I	≥0.989	very high	2	CY (1.0), MT (0.998)
II	<0.764-0.989)	high	16	BE (0.767), BG (0.868), HR (0.913), DK (0.819), EE (0.970), FI (0.826), GR (0.909), HU (0.824), IE (0.885), LV (0.965), LT (0.932), LU (0.976), PT (0.815), RO (0.825), SK (0.881), SI (0.955)
III	<0.539-0.764)	medium	4	AT (0.735), CZ (0.710), NL (0.566), SE (0.716)
IV	<0.539	low	5	FR (0.275), DE (0.436), PL (0.387), ES (0.420), IT (0.251)

Cont. table 3.

year 2018				
I	≥ 1.030	very high	0	-
II	$< 0.832-1.030$	high	17	BE (0.863), BG (0.962), HR (0.966), CY (1.00), EE (0.987), FI (0.863), GR (0.964), HU (0.925), IE (0.925), LV (0.991), LT (0.972), LU (0.994), MT (0.999), PT (0.889), RO (0.955), SK (0.953), SI (0.986)
III	$< 0.633-0.832$	medium	6	AT (0.807), CZ (0.829), DK (0.827), NL (0.735), PL (0.641), SE (0.724)
IV	< 0.633	low	4	FR (0.299), DE (0.440), IT (0.476), ES (0.481)
year 2022				
I	≥ 0.996	very high	2	CY (1.0), MT (0.999)
II	$< 0.798-0.996$	high	15	BG (0.951), HR (0.961), DK (0.824), EE (0.988), FI (0.813), GR (0.936), HU (0.879), IE (0.887), LV (0.975), LT (0.968), LU (0.979), PT (0.815), RO (0.866), SK (0.925), SI (0.974)
III	$< 0.60-0.798$	medium	5	AT (0.791), BE (0.725), CZ (0.746), PL (0.617), SE (0.602)
IV	< 0.60	low	5	FR (0.511), DE (0.500), IT (0.414), NL (0.592), ES (0.317)

where: data identical to those described in table 1.

Source: Own study.

Based on the conducted research, it should be stated that, as a result of the ongoing DX processes, which result from the established policy of shaping the digital future of Europe, large enterprises implement and use modern technological solutions to a different extent and pace (see Fig. 3).

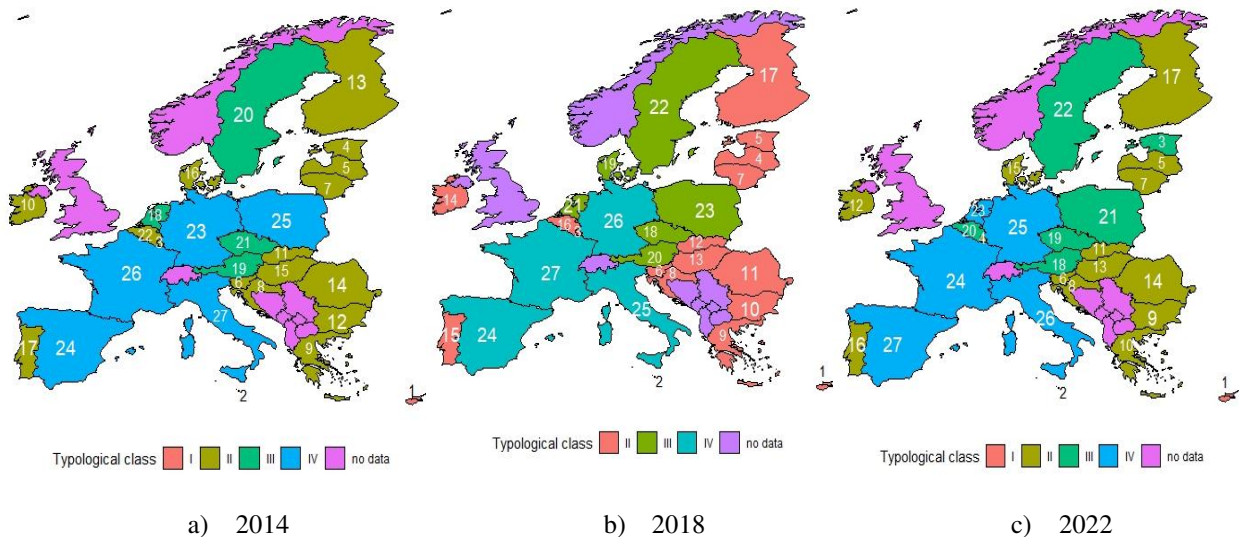


Figure 3. Diversity of large enterprises in the EU in terms of the use of modern technologies: a) in 2014; b) 2018; c) in 2022.

Source: Own elaboration using the RStudio program.

In 2014 and 2022, entities operating in CY and MT formed the 1st typological class and, at the same time, were distinguished by a very high intensity of the use of modern technological solutions (synthetic measure at the level of ≥ 0.989 in 2014 and 0.996 in 2022). The indicated group of countries is distinguished by the highest percentage of large

enterprises in which the scope of application of cloud computing technologies B7, B10, B12, and B14, increasing the level of digitization, has increased. It should be noted that in 2018 large enterprises in the surveyed countries did not form the first typological class. Such a situation may mean that they did not implement modern technological solutions.

The high intensity of technology use was characteristic of 16 (in 2014), 17 (in 2018) and 15 (in 2022) EU countries concentrated in the dominant typological class II. Large entities operating in their area were characterized by a high level of the analyzed variables, due to the value of the synthetic measure, which in the analyzed period reached a value of 0.989-0.764 (2014), 1.030-0.832 (2018), and 0.996-0.798 (2022). Class II organizations were distinguished by a high degree of increase in the use of big data technology B2, B5, cloud computing B6, B7, B8, B9, B10, B12, B14, Internet of Things B15, and social media Y5, Y6, Y8.

Class III with an average intensity of MT use in large enterprises was created by 4 (AT, CZ, NL, and SE in 2014), 6 (AT, CZ, DK, NL, PL, and SE in 2018), and 5 (AT, BE, CZ, PL, and SE in 2020) countries. According to the value of the synthetic measure, which ranged from 0.764-0.539 (2014), 0.832-0.633 (2018), and 0.798-0.60 (2022), the surveyed entities were characterized by an average intensity of implementation and use of technological solutions in the field of cloud computing B7, B8, B9, B10, B12, B14 and availability of social media Y5, Y6, Y8.

The last and 4th typological class was formed by countries (5 in 2014, 4 - 2018, 5 - 2022), which showed the lowest intensity of using modern technologies (the value of the synthetic measure <0.539 in 2014, <0.633 - 2015, <0.60 - 2022). Large enterprises operating in the countries that qualified for this group, due to the analyzed variables, achieve the poorest results. This type of situation is due to the low percentage of technology used in big data B4, B5, artificial intelligence B17, B18, B19, B21, and cybersecurity D2.

The conducted research shows that the scope and intensity of the use of modern ICT technologies in large enterprises operating in individual EU countries are shaped in a variable manner. This situation is a consequence of economic, technological, social, cultural, legal, and international differences. The continuous process of investing in new technologies is the reaction of large enterprises to growing market competition. In turn, the increasing requirements of buyers and the volatility of the environment contribute to the implementation of advanced solutions in the field of mobile, analytical, social, cloud computing, Internet of Things, and automation tools, which consequently affect the BM change. Nevertheless, the use of technological resources in large enterprises depends on the EDD strategy, which is intended to achieve digital sovereignty. Its main goal is to shape the technological potential and digitization processes by the adopted development concept of the surveyed organizations. The conducted research revealed a significant digital differentiation between large entities from EU countries, the so-called leaders (first typological class), which include two countries located in the Mediterranean region (CY and MT), in comparison with the lowest ranked (fourth group) countries of the so-called "old EU" (FR, DE, ES, and IT).

According to the conducted research, it can be concluded that large enterprises are gradually implementing modern technological solutions. They contribute to the achievement of competitive advantage and digital sovereignty and the continuous building of the digital potential necessary to conduct business in a changing environment. These circumstances result from the implementation of the EDD strategy.

4.3. Modeling the digital transformation process of large enterprises

The last stage of the research involved determining the level of dissemination of modern technologies among large entities operating in 27 EU countries. To assess the countries of the European Community from the perspective of the scope of implementing technological solutions in large enterprises, the ICT technology diffusion index was used. It was determined based on the value of the compromise index (Q_i) of the VIKOR method for all analyzed variables in 2018 and 2022 compared to 2014 and 2018, respectively (see Tab. 4). The use of such a concept made it possible to observe the changes that took place in large enterprises in the analyzed years. In addition, it allowed for the differentiation of the countries of operation of the entities due to the ongoing transformations.

Table 3.

The rate of dissemination of modern ICT technologies of large enterprises

UE country	Qi 2014	Qi 2018	Qi 2022	DFX 2018	DFY 2022	CHi
AT	0.735	0.807	0.791	0.072	-0.017	-0.231
BE	0.767	0.863	0.725	0.096	-0.138	-1.440
BG	0.868	0.962	0.951	0.094	-0.011	-0.115
HR	0.913	0.966	0.961	0.052	-0.005	-0.090
CY	1.000	1.000	1.000	0.000	0.000	0.000
CZ	0.710	0.829	0.746	0.119	-0.083	-0.693
DK	0.819	0.827	0.824	0.008	-0.004	-0.458
EE	0.970	0.987	0.988	0.017	0.001	0.035
FI	0.826	0.863	0.813	0.037	-0.050	-1.363
FR	0.275	0.299	0.511	0.024	0.212	8.870
DE	0.436	0.440	0.500	0.004	0.060	14.310
GR	0.909	0.964	0.936	0.055	-0.028	-0.501
HU	0.824	0.925	0.879	0.101	-0.047	-0.462
IE	0.885	0.925	0.887	0.039	-0.037	-0.944
IT	0.251	0.476	0.414	0.225	-0.062	-0.276
LV	0.965	0.991	0.975	0.026	-0.016	-0.624
LT	0.932	0.972	0.968	0.040	-0.004	-0.088
LU	0.976	0.994	0.979	0.018	-0.014	-0.802
MT	0.998	0.999	0.999	0.001	0.000	-0.100
NL	0.566	0.735	0.592	0.169	-0.143	-0.845
PL	0.387	0.641	0.617	0.254	-0.024	-0.094
PT	0.815	0.889	0.815	0.074	-0.074	-1.003
RO	0.825	0.955	0.866	0.130	-0.089	-0.686
SK	0.881	0.953	0.925	0.072	-0.028	-0.392
SI	0.955	0.986	0.974	0.032	-0.012	-0.374
ES	0.420	0.481	0.317	0.062	-0.165	-2.669
SE	0.716	0.724	0.602	0.008	-0.122	-15.250

where: data identical to those described in table 1.

Source: Own elaboration based on data from Eurostat.

Analyzing the years 2018 and 2014 as well as 2022 and 2018, significant differences can be noticed in the degree of disseminating technological resources in the territory of the 27 EU countries. The research shows that in large enterprises located in DE, FR, and EE in the years 2014-2022, the level of implementation of modern technological solutions increased. It should be concluded that the surveyed organizations are distinguished by significant capital involvement while creating digital potential and adapting to the requirements of the digital single market from the perspective of implementing the EDD strategy. In addition, such a situation also results from the intention to meet competition located in other EU Member States. So far, according to the results of the VIKOR ranking and the typological classification (subchapter 4.2), the surveyed entities occupied places in the top five - EE (3rd-5th place, class II), or were classified outside the top twenty - DE, FR (23-27th place, class IV).

In contrast, in the case of CY, the high-technology differentiation index remained unchanged. Therefore, it should be concluded that the dynamics of implementing technological solutions and investment outlays in the analyzed years were not influenced by EU legal regulations resulting from the implementation of the EDD strategy. In addition, in the VIKOR ranking, large enterprises from the analyzed country reached 1st place, and in the typological classification, they belonged to the first group.

In the situation of the remaining 23 EU countries surveyed, where large entities operate, the indicator of diversification in the use of modern technological solutions was characterized by a deficit. Thus, the dynamics of ICT implementation were at a negative level. Therefore, it should be assumed that organizations did not invest capital in technological resources, because having their digital potential enabled them to maintain a competitive position and build digital sovereignty by the assumptions of the EDD strategy.

Based on the conducted research, it should be assumed that the DX of large enterprises takes place gradually with a different level of MT absorption. The process of shaping it is distinguished by significant differences in the surveyed entities located in the territory of the 27 EU countries. Thus, the degree of digitization and the digital potential of large enterprises from the perspective of the EDD strategy among large enterprises in 2014-2022 is at an average level (23 countries with a negative intensity in technology implementation). Nevertheless, the development of the digital infrastructure of large entities in countries where the level of diffusion of access to MT is lower than the EU average is a significant problem. According to the EU digital policy agenda, within the DC 2030 strategic goals, 75% of enterprises (three out of four) in the EU should use CC, BDA, and AI.

According to the conducted research, it can be confirmed that large enterprises carry out digital transformation in stages, characterized by a diverse pace and scope of diffusion of modern technologies, which they adapt through the adopted policy of the EU digital single market, in the field of gaining digital sovereignty, seeing in them a strategic opportunity to achieve a market advantage and the ability to function in a changing, dynamic and uncertain environment.

5. Conclusions

Nowadays, all enterprises are subject to the process of digital maturation, which should be interpreted as an adaptation to rational functioning in a digital environment. The studies of large enterprises operating in 27 EU countries presented in this article allowed for the identification of changes in the use of technological resources, as well as the pace and scope of the dissemination of modern technologies in a changing environment, under the influence of the conditions of the digital single market policy.

It should be concluded that the individual components of digital potential play a fundamental role not only in the process of creating the competitiveness of large enterprises, but also affect the success of their market survival in an uncertain environment. The conducted PCA shows that technological resources shaping the digital potential are used in various areas of the functioning of the surveyed entities. The main technological solutions that are implemented in connection with the progressing digital transformation include tools based on Web 1.0 (skillful use of the Internet, having a computer and a website), and mobile technologies based on Web 2.0 (using social networks, sharing content multimedia, and making purchases and placing orders online). Moreover, to a varying degree, large enterprises digitize their activities as part of the following technologies: digital Web 3.0 (cloud computing, Internet of Things, big data), automating Web 4.0 (3D printing, process automation), and hyper-automating Web 5.0 (using artificial intelligence and machine learning, use of service and industrial robots).

In addition, the results of the conducted research indicate that, among the analyzed entities, there are significant inequalities in the level of digitization and intensity of technology use observed between the Member States of the European Community. The use of the VIKOR method and the grouping of linearly ordered objects using the standard deviation method made it possible to classify 27 EU countries with about 43 diagnostic variables characterizing the digital potential of large enterprises regarding the use and intensity of technological resources. Most large enterprises using modern ICT solutions are located in CY, MT, LU, and EE (countries classified from 1st to 3rd place in the VIKOR ranking for various years). However, entities located in PL, IT, FR, DE, and ES stand out with the lowest intensity of using such solutions (according to the VIKOR ranking, they are ranked 25th-27th).

Based on the determined technology dissemination index, the diversity of the studied phenomenon was assessed and countries where dynamic changes in the implementation of ICT are taking place were identified. A positive indicator of differentiation is characteristic of large enterprises operating in DE, FR, and EE. CY stands out with a constant level of the digital diversity index. However, in other EU countries, negative dynamics of the analyzed phenomenon appear.

The results of the conducted research indicate that large EU enterprises have not yet achieved the strategic goals of the "Road to the Digital Decade", DC2030, and the EDD strategy in the field of digital transformation and increasing the use of new technologies. According to their assumptions, they should have a digital potential of 75% in the use of CC, AI, and BDA. In 2014, the highest degree of digitization was achieved by large entities operating in DK (41.8%), FI (41.6%), and NL (21.5%). The lowest level of use of these technologies was in GR (0%), BG (3.6%), and RO (4.0%). According to the measure of the use of digital technologies, the maximum value was achieved by organizations located in FI (45.5% - 2018; 50.2% - 2022), DK (38.3% - 2018; 58.4% - 2022), and SE (36.0% - 2018; 54.9% - 2022). In turn, the use of such solutions was negligible in large entities in ES (2.5% - 2018), BG (2.4% - 2018; 8.3% - 2022), CY (1.4% - 2018), GR (8.8 % - 2022), and RO (7.4% - 2022).

The issues related to ICT technological resources presented in the article do not comprehensively exhaust those related to the application and implementation of technological solutions that create the digital potential of large enterprises. The components that make up the digital potential, under the influence of the development of new-generation telecommunications technologies (including 6G), strategic EU digitization programs, and environmental conditions, are constantly subject to diversification. For this reason, further directions of research should focus on the analysis of the use of modern Web 3.0, 4.0, 5.0 and subsequent technological solutions for sustainable development, delays in the implementation of ICT technologies, the use of quantum technologies and the levels of achieving digital sovereignty of entities operating in EU countries.

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Appendix

Table 4.
Diagnostic features included in own research

Id. characteristics	Indicator name	V for 2014	V for 2018	V for 2022
Computer software				
A1	Enterprises using software solutions like Customer Relationship Management (CRM)	1.77	1.65	1.53
A2	Enterprises who have ERP software package to share information between different functional areas	1.62	1.51	1.45
Data analysis and processing				
B1	Use 3D printing for prototypes or models for internal use	2.88	1.73	1.88
B2	Analyze big data from the geolocation of portable devices	1.18	1.45	1.41
B3	Analyze big data from smart devices or sensors	1.24	1.28	1.30
B4	Use service robots	4.63	1.70	1.32
B5	Analyze big data generated from social media	1.23	1.59	1.59
B6	Buy finance or accounting software applications (as a CC service)	1.54	1.24	1.19
B7	Buy e-mail (as a CC service)	1.34	1.13	1.26
B8	Buy hosting for the enterprise's database (as a CC service)	1.40	1.23	1.21
B9	Buy computing power to run the enterprise's own software (as a CC service)	1.42	1.28	1.32
B10	Buy office software (e.g., word processors, spreadsheets, etc.) (as a CC service)	1.26	1.18	1.31
B11	Buy Customer Relationship Management (CRM) software (as a CC service)	1.44	1.29	1.29
B12	Buy storage of files (as a CC service)	1.44	1.31	1.29
B13	Buy CC services delivered from shared servers of service providers	1.40	1.22	1.22
B14	Buy cloud computing services used over the internet	1.48	1.37	1.43
B15	Enterprises use IoT	2.88	1.28	1.45
B16	Enterprises use AI technologies automating different workflows or assisting in decision making (AI based software robotic process automation)	3.81	1.36	1.35
B17	Enterprises use AI technologies for ICT security	5.20	1.91	1.84
B18	Enterprises use AI technologies for management of enterprises	5.20	1.29	1.28
B19	Enterprises use AI technologies generating written or spoken language (natural language generation)	3.66	1.55	1.53
B20	Enterprises use AI technologies performing analysis of written language (text mining)	5.20	1.37	1.36
B21	Enterprises with a chat service where a chatbot or a virtual agent replies to customers	5.20	1.39	1.35
B22	Use 3D printing	2.88	1.91	1.81
B23	Use industrial robots	3.81	1.50	1.38
B24	Analyze big data internally using machine learning	3.63	1.12	1.84
B25	Analyze big data internally using natural language processing, natural language generation, or speech recognition	3.74	1.77	1.64
Digital skills				
C1	Enterprise employed ICT/IT specialists	1.61	1.48	1.45
C2	Enterprise provided training to their personnel to develop their ICT skills	1.76	1.60	1.48
Digital security				
D1	Enterprises experienced ICT security related incidents leading to: unavailability of ICT services due to hardware or software failures	3.60	1.58	1.56
D2	Enterprises experienced ICT security related incidents leading to: destruction or corruption of data due to infection of malicious software or unauthorised intrusion	4.25	1.47	1.48
Technological infrastructure				
X1	Enterprises with internet access	1.55	1.47	1.44
X2	Persons employed using computers	1.72	1.89	1.83
X3	Mobile connection to the Internet for business use to access the enterprise's email system	1.58	1.48	1.47
X4	Persons employed were provided a portable device that allows Internet connection via mobile telephone networks, for business purposes	1.20	1.33	1.31
Online technologies				
Y1	Enterprises with a website	1.58	1.50	1.46
Y2	Enterprises where the website provided description of goods or services, price lists	1.84	1.68	1.54
Y3	Enterprises where the website provided order tracking available online	1.50	1.32	1.34
Y4	Enterprises where the website provided online ordering or reservation or booking, e.g., shopping cart	1.39	1.24	1.42
Y5	Enterprises where the website had links or references to the enterprise's social media profiles	1.60	1.43	1.50
Y6	Use social networks (e.g., Facebook, LinkedIn, Xing, Viadeo, Yammer, etc.)	1.55	1.44	1.46
Y7	Use enterprise's blog or microblogs (e.g., Twitter, Present.ly, etc.)	1.49	1.41	1.41
Y8	Use multimedia content sharing websites (e.g., YouTube, Flickr, Picasa, SlideShare, etc.)	1.61	1.47	1.53

where: V- Coefficient of variation.

Source: Own elaboration based on data from Eurostat.

EXPERIENCE BRANDING IN THEORY AND PRACTICE. CASE STUDY

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Purpose: Presenting the essence of modern experience branding (as a result of the available studies and original research), giving an example of marketing tools, methods, and procedures used for Milka experience branding, and to develop recommendations for the interested marketers.

Design/methodology/approach: analysis of secondary sources of information, case study of a selected global brand from the food sector for which broad marketing activities creating its market capital are carried out with prosumer engagement, and participant observation of their selected projects combined with result analysis.

Findings: Marketing ways of impacting (under the analysed brand) stakeholder experiences, taking into consideration contemporary trends and market conditions through the available communication channels and its social media profiles.

Research limitations/implications: The paper was based on literature studies and a case study of a global brand from the food sector. The research problem addressed should be analysed based on a larger number of brands. Moreover, in the next project, opinion surveys among representatives of the brand community of the analysed brand and its key stakeholders are planned for the purpose of personalisation of the brand-related experiences.

Practical implications: Implementation – with customer engagement – of diverse branded marketing activities, such as: raising awareness of the importance of sustainable activities in all the processes of the brand owner, selection of the right components for the brand's products, educating about a healthy diet, providing opportunities for entertainment, education, and fun, engaging the interested parties and personification of activities, adjusting activities to the conditions, and building a real and virtual community.

Social implications: Research shows that branding activities/actions/campaigns do impact customer behaviours, their experiences, attitudes, engagement, changes in the ways of buying and using the brand's products, marketer practices, and – consequently – the entire society and natural environment. They also lead to the promotion – under the brand and with the engagement of its stakeholders – of a sustainable approach to resource management and undertaking projects in line with the 2030 Agenda and recommendations of the ESG directive.

Originality/value: It is the first study of this type (at least in the Polish market) regarding the impact of methodical branding activities on the experiences of the brand's key stakeholders and the resulting practical implications (social, economic, environmental, and managerial).

Keywords: experience branding, sustainable practices, brand projects and campaigns, marketing ways of creating brand-related experiences, case study.

Category of the paper: research paper.

1. Introduction

Contemporary brands play the role of a specific kind of management tool (Ind, Horlings 2016; Bloomstein, 2021; Pogorzelski, 2020; Larsen 2023) which significantly impacts stakeholders' behaviours, engagement, and attitudes. In order to accommodate the conditions and the social, competitive, technical, technological, and managerial trends (Cohen, 2017; Foroudi, Palazzo, 2021; Ghaffar et al., 2023), marketers try to undertake various activities (Keller, 2013; Kerzner, 2022) building the brand's market capital.

In this study, experience branding (a set of activities for the brand oriented at experience management) (Hansen, 2021; Lubin, 2022) is analysed as the key trend in brand management, where the brand is personified and stakeholders establish relationships with it. All the engaged entities should gain multifaceted benefits from experience branding projects (Tarczydło, Miłoś, 2019b; McPhee, Dias, 2020; Robertson, 2021; Sarkar et al., 2023) as an important phenomenon in contemporary management of branded objects.

The aim of the article is to present the essence of modern experience branding, giving an example of marketing tools, methods, and procedures used for Milka experience branding, and to develop recommendations for the interested marketers. For the purpose of the paper, literature studies, a meta-analysis of the available online sources, and own qualitative studies with the use of the case study (how the branding activities of the Milka brand are conducted, how they impact stakeholders' experiences, and what effects they generate), participant observation, and online content analysis methods were carried out.

2. Literature review

Experience branding consists in brand management oriented at creating positive experiences for stakeholders (Smilansky, 2009; Schmitt, 2011; Keller, 2013, Tarczydło, Miłoś, 2019b; Lubin, 2022; Targiel, 2022; Dziadkiewicz et al., 2022). In other words, it is a set of activities including the analysis of the initial situation, planning, organizing,

coordinating, and controlling (Hansen, 2021) of any actions oriented at building the brand's market capital.

Branding (brand creation) is a process (Tarczydło, 2019a; Pogorzelski, 2020; Bloomstein, 2021; *Trzy strategiczne...*, 2023) of creating, maintaining, and developing a unique brand image that helps it become ingrained in consumers' minds and stand out from the competition. Brand strategy (Keller, 2013; Tarczydło, 2018a) is an inherent part of branding, along with practical activities oriented at the visual consistency of every message, high quality of the market offering, responding to customers' needs, engaging stakeholders, caring about sustainable business practices, and flexible activities that respect the current trends.

In general, experience branding is about integrating the brand into the buyer's daily life in such a way that they can make purchase decisions based on personal experiences instead of indirect forms of communication, including advertisements. Participation in brand-related events (Chitty et al., 2018) usually involves the customer's conscious choice and makes it possible for them to become engaged in line with their personal potential (possibilities, interests, skills, talents). The projects/campaigns (Tarczydło, 2018b; Goodson, Walker, 2021; Kerzner, 2022) carried out are intended to positively surprise consumers and make the brand stand out from its competition. Creative activities (Tarczydło, 2018c; Tarczydło, Miłoś, 2019a; Larsen, 2023; Tarczydło, Klimczak, 2021) evoking emotions, creating experiences with the brand, refined and thought-through down to the smallest detail hit the stakeholders' expectations.

The projects carried out are supposed to move the customer (Wan et al., 2016; Cohen, 2017; Tarczydło, 2019b; Ghaffar et al., 2023) by drawing their attention, sparking their interest, making them want to take advantage and take active part. The impressions or experience gained should influence emotions, touch, evoke feelings, but also provide rational arguments, and in consequence, trigger a reaction to the brand that is measurable in some sense.

Experience branding is aimed at building relationships thanks to creating opportunities for personal meetings, for instance, by well-thought-out campaigns, events, and undertakings (Zschiesch, Errichiello, 2021). The described phenomenon serves to build an experiential brand. With reference to well-thought-out projects for the brand and its market capital, the word "experience" should be understood as a direct impression of events not processed mentally and/or as certain wisdom gained as a result of reflection on the perceived undertakings, phenomena, and their interpretation. People gain experiences related to certain things, e.g. brands, over time and under the influence of the factors/stimuli they are able to connect to them (Schmitt, 2011). Psychologists distinguish between physical, mental, emotional, and spiritual experiences (Keller, 2013). According to Schmitt (2011), experiences that can be "sold" include: entertainment, education, esthetics, and escapism.

For the purpose of this paper, it is assumed that a brand is a complex construct, symbol, pattern or their combination, which is taken into consideration in people's decision-making processes (Keller, 2013). Hence, brand managers strive after careful creation of brand-related experiences which translate into value impacting the behaviours of buyers and other market players. In economic practice, business projects engage employees and other entities: partners, Internet users, media representatives, local communities, and the competition, although they are usually addressed to customers. In other words, in the current market conditions, the stakeholder theory should be followed.

According to Freeman (2022, p. 67), the term "stakeholders" was introduced by the Stanford Research Institute in 1963, and initially defined groups without the support of which the organisation would cease to exist. The concept of stakeholders was developed in the 1970s by representatives of the systemic approach. In the 1980s, the subject was taken up by Freeman and his colleagues, according to whom stakeholders are any organisations or individuals participating in creating a project or directly interested in the results of its implementation in the management of an enterprise and/or other branded market object. It is assumed that creating brand-related experiences involves carefully thought-out activities; a process of generating stimuli having an effect on the addressees; creating opportunities to meet and establish relations. In brand management, the right experiential brand strategy, i.e. experience branding, plays a significant role.

Experience managers emphasise the importance of the so-called touchpoints (Bajak, 2022; Lubin, 2022; Questus, 2019), i.e. broadly defined opportunities for interaction, e.g. entering a website, watching a commercial, a visit to the store, a conversation with a customer assistant, participation in a competition, using the mobile application, etc.

Finally, it is important to outline the so-called customer journey (Smilansky, 2009; Tarczydło, Miłoś, 2019b), i.e. all the elements which translate into the sum of interactions occurring in contact with a branded market entity, from establishing contact, through all the stages of cooperation (taking advantage of the offer), including potential interactions, such as the after-sales service, and the marketing tools used, e.g. loyalty card, or signs of nurturing the relationship (based on: Kalinowski et al., 2017, p. 62).

Apart from the journey, the experiential selling proposition (Pogorzelski, 2020, pp. 88-89), which is manifested in the opportunity to connect certain emotions and events that translate into values and experiences with the brand, is also of significance. Examples of such formats include Lidl's "Więcej na radość z życia" (More for the joy of life), Ikea's "Dobry klimat zaczyna się w domu" (Good atmosphere starts at home), Apple/iPod's "Uwielbiam wygląd produktów i to jak się z nimi czuję" (I love the way the products look and how they make me feel).

What should also be emphasised is the importance of contemporary conditions (social, technical and technological, economic, competitive, ecological, and others) (Zschiesche, Errichiello, 2021; Ghaffar et al., 2023; Karman, Gavryshkiv, 2022) determining the

effectiveness of the issues and practices considered. In the era of social media (Karasek, Hysa, 2020; Hansen, 2021; Tarczydło, Miłoś, 2019b) and the widespread nature of sharing knowledge and experiences with other members of the community with whom we stay in touch, and the prosumers' willingness to become engaged in the providers' activities, creating brand-related experiences has acquired special significance.

In economic practice (United Nations, 2023), it is possible to gain first-hand experience in a situation of direct participation in a project. Such experience is particularly valuable because the person was there and had the chance to personally evaluate the situation and analyse it. However, as social beings, people are influenced by others, they communicate and interpret, which is conducive to gaining indirect experience. Additionally, in the cases considered herein, the ultimate experiences are affected by personal factors, such as the general well-being, knowledge, significance of the event, situational context, and many others.

Evoking emotions in order to create the right experiences is a significant phenomenon (Tarczydło, 2019b). Researchers Douglas B. Grisaffe and Hieu P. Nguyen (Pogorzelski, 2020) differentiate between five primary antecedents of emotional attachment to brands, and they include: emotional memory (regarding places, people or situations), socialisation (connected with relationships in a group of friends, family, etc.), traditional customer outcomes, classic marketing tools (from 4P to 8P), and user-derived benefits that the consumers themselves may offer in the process of cooperation/interaction.

The procedure of creating experiences (and evoking emotions in the addressees) and building the "brand – stakeholders" relationship involves (own elaboration based on: Tarczydło, Miłoś, 2019b): marketing tools, opportunities to gain experiences (entertainment, education, esthetics, and escapism), communicating rational and emotional content, evoking emotions (e.g. happiness, sensory sensations, stimulating imagination), causing conditioned associations with the brand and the related projects, and unique and interesting impressions of the stakeholders, which translate into value, building relationships, and promoting satisfaction and loyalty.

The issues presented herein constitute motivation for a review of the available studies related to the subject matter discussed. The KPMG study entitled (Kalinowski et al., 2017): *How to build positive customer experience. Analysis of the leading customer experience management practices in the Polish market* was aimed at conducting a comprehensive analysis of customer experiences in their interactions with the brand. The respondents evaluated buyers' satisfaction from the point of view of the quality of customer service at every stage of gaining experience, at as many touchpoints as possible on the customer-company line. The condition for including a brand in the analysis was reaching the minimum required number of the respondents' answers. In the analysed studies, the basis for the comparisons between brands, industries, and countries is the CEE (Customer Experience Excellence) index. It is calculated based on the evaluation of *Six Pillars™ of Customer Experience Excellence*, taking into consideration their individual impact on building the

experiences of customers in the given country. The aspects studied in particular included: integrity, resolution, expectations, time and effort, personalisation, and empathy.

The study was carried out by an external research agency in the first quarter of 2017 using the CAWI (computer-assisted web interview) method on a sample of more than 5,000 respondents, representative for residents of Poland over the age of 16. The analysis included more than 200 brands providing services or selling products to retail customers across the country or in the largest cities. The study included all the sectors in which companies using the given brand have a significant influence on building customer experience at as many touchpoints as possible on the customer-company line. The selection of sectors is consistent with the study methodology adopted by KPMG Nunwood in other countries. Hence, in the study of the Polish market, nine sectors were included: leisure, electricity and gas providers, catering, logistics, media and telecommunications, travel, non-food retail, food retail, and financial services.

KPMG's analyses show that the key pillar of customer satisfaction in Poland is "integrity" in the context of building trust and keeping promises. Companies rated highly by Polish consumers are those that keep the brand promise, honestly inform about significant elements of their offer, and act in the customer's best interest instead of concentrating solely on their own profits. From the point of view of building excellent customer experience, the critical significance of the brand's "integrity" can be justified by the Poles' relatively low level of trust in other people or entities, emphasised in various sociological studies.

What Polish people rate relatively low is their experiences with companies offering more complex products and services, where customer-company interactions are complicated, frequent, and long-term in nature. In industries of this type, making operations oriented at the customer and their needs requires a complex digital business transformation, the primary aim of which should be to enhance the level of customer experience at the key touchpoints. Such a transformation involves a considerable reconstruction of customer service processes, in particular in selected interactions as part of the customer journey, involving the need to make major changes in the IT systems and adjust them to omnichannel requirements. It is also necessary to build a completely new organisational culture (Delchet-Cochet, 2020; Karasek, Hysa, 2020; Larsen, 2023; United Nations, 2023) so that the customer becomes the actual object of the company's operations.

The results obtained show that even in those industries which are highly rated by Polish customers, not many brands manage to fully meet their expectations.

Moreover, a conclusion comes to mind that experience branding is still a relatively new and complex subject, and the research discussed herein should allow marketers to better understand the consumers' perspective and help them approach the process of creating the right brand-related customer experience and long-term loyalty building in a consistent manner.

3. Own research methodology

The research gap revealed refers to the scope and methodological considerations of experience branding activities of a contemporary brand.

For the purpose of the article, own qualitative studies were carried out with the use of the following methods: case study (oriented at obtaining answers to questions such as: How are the selected brand's branding activities carried out? What do they include? What effect do they have on the addressee, their senses, mind, and heart, and on other stakeholders? How do they engage, what experiences, behaviours, and attitudes do they create? What effects do they generate? What can be learnt from them?), participant observation, and online content analysis. The following research scopes were specified: the temporal scope: March 2022 – June 2023; the subjective scope: the Milka brand, active Internet users, followers; the objective scope: ways and forms of the analysed brand's experience branding, and the spatial scope: websites, the brand's social media profiles, points of sale, and other available channels.

The purpose of the research was to obtain information on the marketing tools, methods, and procedures used in experience branding activities for the Milka brand. The studies were carried out on the brand's website and social media profiles, at points of sale, in the press, on the radio and TV. The studies also included outdoor activities, events, and various projects, such as campaigns and competitions. The authors conducted a qualitative analysis of the obtained resources. They focused in particular on the ways of creating opportunities to gain experiences related to the Milka brand, types of communicated content, the tools and procedures used, and the response and results.

When presenting the object of the studies, i.e. the Milka brand, in a little more detail, it is worth referring to its history. Philippe Suchard started the production of chocolate in his home town in 1826 (Historia czekolady, 2023). The name Milka was entered into the register of trade names of the Imperial Patent Office in Berlin in 1901. It was made up of a combination of the words for two primary ingredients: milk (Milch) and cocoa (Kakao).

The brand's history, tradition, image, and – above all – the outstanding (according to customers) quality of the products constitute the foundation of the brand's platform. The Milka brand's strategic direction undoubtedly is product excellence. The Milka brand offers a broad selection of products in the following categories: chocolate bars, pralines, chocolate-covered marshmallows, candy bars, Milkinis bars, cookies, candies, and special series, e.g. for Christmas (Oferta rynkowa, 2023). The value generator for the brand under analysis is tenderness, which is associated both with feelings and the products. The consistency of the message was obtained by adding more detail to the value generator in the form of the brand promise, which is: Milka – Tenderness is inside. Delicious milk chocolate made with 100% Alpine milk. Encouraging tenderness since 1901, tenderly

touching your palates and hearts (Marka Milka, 2023). Yet the brand promise, no matter how beautiful and attractive, is just a promise. And that promise should be turned into reality. For the purpose of transforming the brand promise into Milka's stakeholders' experiences, methodical marketing activities are carried out – they were covered by the qualitative studies and their results will be discussed here.

4. Milka experience branding – research results

The person responsible for Milka's branding activities in Poland is Daniel Czajkowski (Wirtualnemedi, 2023), Marketing Manager for Poland and the Baltic countries since 2023 (former brand manager, with the company since 2016). Joanna Pszona, Senior *Brand Manager, Milka Biscuits & San*, and Ewa Krawczyk, Junior *Brand Manager* at Mondelez Poland, as well as representatives of specialist agencies, cooperate with him. Until 2022 (Media do kampanii, 2023), the agency responsible for media planning and buying for the campaigns of Mondelez's brands was Mindshare Poland (GroupM/WPP), whereas now, it is the Spark Foundry agency, which belongs to Publicis Groupe.

The marketing strategy is presented in five stages (Questus, 2019): 1) products; 2) emotions; 3) interpersonal relationships; 4) the experience of tenderness/sensory marketing; and 5) incentive campaigns.

Another branding tool observed are the slogans and taglines, such as: “Milka – stay tender”, “Tender tastes better”, “Milka – dare to be tender”, “Follow the tenderness”, “Milka multiplies tenderness”, etc. They are an integral part of the long-term branding strategy. For Milka, five-stage emotional branding is used, oriented at relationships between the brand and the consumer (Branding, 2023): 1) emotional memory – communicating pleasure from just eating the chocolate made with Alpine milk and unique cocoa, e.g. with family (an even more tender chocolate flavour; discover the taste of tenderness in Milka cookies); 2) socialisation – social campaigns under the brand, e.g. “My city is cuddly”; 3) benefits for the consumer – high quality of the chocolate itself, uniqueness of the Alpine milk chocolate and special quality cocoa; 4) marketing mix activities (8P, product, price, place, promotion, participation, physical evidence, and partnership); 5) benefits for the consumer – tenderness of the chocolate itself releases tenderness and empathy in each of us.

In creating brand-related stakeholder experiences, the visual identity system plays a significant role. Apart from the brand logo, colours, and the means of conveying them, its components also include the brand hero. It makes it easier to increase brand awareness, both on the conscious and subconscious level. In this aspect, Milka's distinctive symbol surely is the purple cow, recognisable among both children and adults, friendly and unique, widely involved in offline and online marketing activities, creating the brand's market capital.

Milka's purple cow is a symbol of quality. It is attributed characteristics such as friendliness, credibility, kind-heartedness, and patience. With reference to the Milka brand's symbol and value, consumers associate it with a carefree childhood, the warmth and safety of the family home, fun, pure and clean nature, and a world without any cares or the daily hustle and bustle (Marka Milka, 2023).

Campaigns involving the purple cow may involve dancing together, commemorative photos, hugging and stroking, sending a purple heart on Valentine's Day, product tastings, sports competitions, contests, trips, e.g. bike trips, generating content, the opportunity to participate in and create events, and many others, with references to the current events considered as particularly important.

An important trend in contemporary branding activities consists in respecting the principles of sustainable development (United Nations, 2023; *Trzy strategiczne...*, 2023, *Wiadomości handlowe*, 2023). According to the "brand/engagement" (*Nasze zaangażowanie...*, 2023) tab on Milka's Polish website, the following projects are being carried out: Cocoa Life (a sustainable cocoa sourcing programme oriented at long-term improvement of the living and working conditions of cocoa farmers and their families and ensuring the highest quality of the cocoa); "For the well-being of children" (the programme is aimed at eliminating child labour through active prevention and monitoring of such practices, with emphasis placed on eliminating their sources and causes); "For the sustainable farming of palm oil" (the Mondelez company assures that since 2018, it has been sourcing 100% of its palm oil from suppliers who work in a sustainable and transparent manner). It seems reasonable to conclude that the projects listed above confirm that the analysed brand is implementing a sustainable brand strategy. The case study conducted shows that Milka's various marketing projects do respect the goals of the 2030 Agenda. Additionally, in the "Snacking Made Right" report published in May 2023, Mondelez International stresses how the company's comprehensive approach to environmental issues, social responsibility, and corporate governance (ESG) contributes to its progress in the accomplishment of its ambitious goals for 2025 (reducing CO₂ emissions from production by more than 20%, limiting the use of water by more than 30%, and reducing the amount of manufacturing waste by more than 30%) and creates long-term benefits for the company and its stakeholders. The key projects of the Mondelez concern and the Milka brand include (Mondelez, 2023; *Trzy strategiczne...*, 2023): sourcing raw materials in a sustainable manner, reducing impact on the environment, packaging innovations, supporting local communities, developing the product range in order to meet various consumer needs in terms of nutrition and well-being, while at the same time promoting a healthy lifestyle and responsible consumption of snacks.

Integrated 360 degree marketing communication campaigns are carried out for the Milka brand. Their scope and character was impacted by the biggest changes to the Milka brand within the last 25 years, gradually implemented since the 3rd quarter of 2022. They involve the products (refined recipes and formulas, refreshed packaging design, different shape of the

chocolate pieces), changes to the visual identity system (including adding the eco-code for “Sustainably sourced cocoa” on the packaging), and sustainable projects in the brand’s marketing communications.

The authors have conducted regular research on the activities related to the Milka brand for over a dozen years, including a number of publications (e.g. Tarczydło, Miłoś, 2019b). This is important when determining the specificity of the branding (without access to its owner’s strategic information) because these are long-term projects, and methodical efforts reinforced by regular holiday (Easter and Christmas) (Interaktywnie.com, 2022) and special campaigns provide basis for conclusions. The latest projects are directed towards sustainable experience branding.

The current campaign was launched on 10 May 2023 with the slogan: “Tenderness – the best remedy for the inconveniences of city life” (Nowymarketing.pl, 2023a). The campaign was intended to help the inhabitants of the largest cities in Poland in the hustle and bustle of their daily lives (their quick pace, crowds, traffic, gridlocks, and their effects, e.g. aggression, pollution, difficult situations faced by ordinary people). The brand wants to offer even more tenderness to those who need it most. Therefore, it launched special local activations in public spaces aimed at brightening up people’s lives. Because there is not enough greenery in the cities, as it was replaced by tons of concrete, endless road works, traffic jams during peak hours, crowds at train stations due to train delays, the brand chose the following tagline: “This piece is for you – more tenderness for your city” (Delikatność..., 2023). The dedicated materials for the campaign, the projects and the response thereto were supposed to remind Poles about tenderness, in particular in the difficult moments: the need to make a detour due to road works or closures, an unexpected hold-up in the traffic, a sudden downpour of rain, a heat wave, too many people while waiting on a railway platform, etc.

Dedicated local activations were prepared for the inhabitants of two large cities, namely a unique CHOCOLobby (Polish: “PoCZEKOalnia”) located at the Warsaw Central Station and a mural cleaning the air from pollutants such as nitrogen oxides, VOCs (volatile organic compounds), and sulphur oxides, painted at the junction of the Dubois and Pomorska streets in Wrocław (Marketingprzykawie, 2023). Warsaw’s CHOCOLobby welcomed guests and invited them inside with the slogan: *When it turns out you have more time than initially planned before your train leaves, this piece is for you*. Milka wanted to make the time people spend waiting for their train, which is often longer than expected, more pleasant for the inhabitants of Warsaw and people travelling from the capital city. Throughout the entire month, from 8:00 a.m. to 6:00 p.m., delicious coffee and new Milka products ready for tasting waited for guests at the Warsaw Central Station. The inhabitants of Wrocław, in turn, dealing with smog and air pollution on a daily basis, are now able to admire and enjoy an eco-friendly mural made with paints which reduce the amount of harmful nitrogen oxides. Moreover, the process of painting the mural was carbon neutral.

The current campaign is a continuation of the activities started in 2022, when Milka improved its recipes and formulas and went for more cocoa in every bar of its chocolate (Największe..., 2023). This way, the brand created an even more chocolatey and, at the same time, more tender flavour. The design of the packaging of the entire portfolio of Milka chocolate bars was also changed at the time and the image of the Milka brand icon – the Lila cow – was refreshed. The new design makes it easier to distinguish between various chocolate flavours and find them on store shelves.

The campaign received 360 degree marketing support. A 30-second TV spot was prepared. A number of activities in the media were also planned, starting from a digital campaign, including presence on city light ads, and a broad reach online campaign. Interestingly, the slogans in the individual media and communication channels differed depending on the location. They were adjusted to the current weather or local inconveniences related to road works or traffic. The main tagline, “Even more tenderness”, was displayed at brick-and-mortar stores with dedicated POS materials, including a limited edition packaging of the Alpine Milk 100 g chocolate bars. The stores of the Empik chain offered consumers an additional portion of tenderness for tasting (as many as 700,000 test products) (Nowymarketing.pl, 2023). The agency responsible for public relations, including media relations, was Big Picture, the one responsible for media buying was Spark Foundry, and the agency behind sampling was Smolar. Oglivy prepared the communication strategy and creation, as well as – together with the Endorfina agency – the CHOCOLobby and the mural. Advertising adaptation and digital creations were the responsibility of Publicis Groupe.

From the perspective of over a dozen years of observation of Milka’s branding activities (including in particular marketing communications – relatively easy to monitor and participate in), it can be concluded that there is a clear tendency for adding variety to them and adjusting them to keep up with the technological progress, changing consumer expectations, as well as the legal, environmental, and competitive conditions.

In the last three years, holiday campaigns have been oriented at storytelling. For Easter, Mondelez Poland tells a special story and encourages consumers to take part in a virtual game of searching for Easter treats (Interaktywnie.com, 2022). Easter is a time full of joy, spent with our loved ones. What particularly connects us during this time is the cultivation of Easter traditions. Moments spent with our family become magical and unforgettable. Milka’s Easter commercial inspires consumers to discover new holiday customs and traditions, thanks to which we can create lasting memories. The spot was broadcast on television, on digital platforms, and in social media, such as Facebook and YouTube. Importantly, the story presented in the Easter commercial is strongly rooted in the foundations of the Milka brand, which wants to inspire everyone to enjoy the moments spent with their loved ones. In order to encourage Poles to take part in the virtual game, prizes, an educational element, and the possibility of multigenerational participation were introduced, yet – thanks to the use of Google Maps, which became the board of the game – there was no need to leave the house.

The game included an educational part: each bunny was hiding a titbit related to Polish Easter traditions or Easter customs from other countries. The game was available on mobile devices from 18 March 2021 at wielkanocneszukajki.pl.

In 2022, Milka's Christmas campaign included a number of activities (Interaktywnie.com, 2022a): a charity collection supported by influencers, a special episode of *Who Wants to Be a Millionaire* ("Milionerzy") on TVN, and product placement of a large-format advent calendar in the "Letters to Santa" ("Listy do M.") movie. The brand's winter activation was also communicated on TV and in digital channels.

Another project was called "Influencers for Seniors" (Interaktywnie.com, 2022a). As part of multi-channel activities, a charity campaign called "Let's share some tenderness this Christmas" was carried out via the Siepomaga.pl platform. The money collected was allotted for the modernisation of nursing homes for senior citizens. It was yet another edition of Milka's campaign that focuses on charity, helping and supporting the needy with tender gestures. The brand has committed itself to and has been engaged in conducting activities constituting part of its social DNA, such as helping local communities and charity organisations, for years. The collection was carried out together with the Santa Claus for Seniors Foundation (Fundacja Święty Mikołaj dla Seniora) and the following influencers were invited to promote the campaign: Marta Żmuda Trzebiatowska, Janina Daily, Robert Motyka, Anna Czartoryska Niemczycka, Joanna Pachla, and Anna Kalczyńska. The collected amount was increased by Milka by an additional PLN 400,000. Campaigns in the social media and a supporting display campaign in the Onet portal were conducted at the same time.

Standard advertising activities are carried out on a multi-channel basis, including both television and digital channels. On television, a 30-second image video commercial produced by Wieden+Kennedy was broadcast, whereas as part of the online campaign, the brand went for long and short spots on YouTube, a social media campaign (on Facebook and Instagram), and a display campaign in the Blix shopping app, redirecting users to Mondelez's Allegro store and the kupslodycze.pl website. The agency responsible for media planning and buying, as well as the idea for and execution of the charity campaign, the initiative related to product placement in the "Letters to Santa" movie, and the special episode of "Who Wants to Be a Millionaire" was the Mindshare media agency. The episode of "Who Wants to Be a Millionaire" and the "Letters to Santa" film project were executed in cooperation with TVN Warner Bros Discovery.

To sum up, in light of the studies carried out, it seems reasonable to conclude that Milka's experience branding activities should be considered as methodical, valuable, and exemplary. Moreover, the spectrum of marketing activities, including marketing communications, of the analysed brand, is both impressive and methodically carried out with stakeholder engagement and multifaceted effects for all those involved, which strongly contributes to building its market capital.

5. Conclusions and recommendations

Customers' trust towards the brand is strongly dependent on the emotional satisfaction resulting from each interaction with that brand. Hence, in order to strengthen loyalty, it is necessary to fulfil both the stakeholders' rational and emotional needs in all their encounters with the brand. One of the key challenges for contemporary entrepreneurs is to deliver value to stakeholders, while maintaining sustainable growth of the company. The fundamental question asked by marketers is how effective management of people's branded experiences translates into the company's economic results, in particular in the conditions of strong competition.

Based on the literature studies carried out and the authors' own research, it is reasonable to say that in the current market conditions, the possibility of creating engagement and exciting experiences for buyers, which increase trust towards the brand, loyalty, and profits, seems to be dependent on the right branding strategy.

Effective experience branding should respect the fact that an experience is an internal and subjective response to a direct or indirect interaction between the brand (or a brand-related project) and the stakeholder, throughout the entire duration of their mutual relationship, leading to engagement at the rational, emotional, sensory, physical, and spiritual levels.

We should also take into consideration the fact that contemporary buyers are happy to engage in activities carried out under well-known and valued brands. It is a good idea to administer marketing incentives addressed to stakeholders' consciousness and subconsciousness, creating value, affecting behaviours, supporting the creation of the right experiences, and contributing to strengthening the human-brand relationship, in smaller, but regular doses.

Referring to building an emotional relationship between the consumer and the analysed brand, it should be noted that Milka's experience branding activities include: emotional memory – communicating pleasure from just eating the chocolate, e.g. with family; socialisation – social campaigns connected with Milka, e.g. "Influencers for Seniors", "Let's share some tenderness this Christmas", benefits for the consumer – high quality of the chocolate itself, recipe based on Alpine milk and special quality cocoa; marketing mix – product: high quality chocolate, place: easy product availability across Poland, price: mainstream brand, affordable for most Poles, price index: 110/100, promotion: brand communication based on emotions, benefits for the consumer – tenderness of the chocolate itself releases tenderness and empathy in each of us, allowing us to build deeper and more emotional interpersonal relationships.

In light of the research carried out, the following observations regarding Milka's experience branding seem justified:

- The activities are methodical, creative, systematic, long-term, and carried out by experts.
- The analysed study object has a global branding strategy and, which should be considered an advantage, extensive marketing activities adjusted to the local conditions (this article focuses on the Polish market perspective).
- Milka offers attractive products, with new ones introduced on a regular basis; it shapes its pricing policy and distribution strategy in an appropriate manner.
- Under the brand, integrated 360 degree marketing communication activities are carried out (including campaigns, actions, and projects), adjusted to the stakeholders' expectations, technological progress, the competition's strength and activities, and the current market trends.
- The types of activities carried out for the analysed brand and oriented at creating experiences related to it are innovative and attractive thanks to the use of various tools and regular campaigns; they effectively engage prosumers and stand out against the competition.
- The brand's branding activities are holistic and engage the participants emotionally, through the senses, and rationally.
- In the analysed projects, a sustainable approach and transparency of the activities are clearly stressed, along with orientation at patriotic values, adjustment to the local conditions and other current issues, including rational consumption, a healthy diet, and care about social well-being, in particular when it comes to children.
- Both marketing activities and broader management activities for the brand are coherent, consistent, and long-term in nature.
- In certain aspects, the Milka brand educates, entertains, engages, and increases environmental awareness, and fully respects the principles of sustainable development, the goals of the 2030 Agenda, and the ESG directive.

In the analysed projects, strong emphasis is placed on building relationships between the personified brand and its customers through personalisation, telling valuable and creative stories, transparency, interactivity with the use of video productions and content, and communication in the social media in line with Milka's values important to its community and the directions of contemporary business, i.e. a sustainable approach in all the activities of the brand owner, the Mondelez concern.

The research results obtained consolidate the conviction that various tools for creating experiences are used for the Milka brand, they are methodical in nature, and include broad communication channels in line with the 360 degree strategy, i.e. communication via all the available channels (press, radio, TV, outdoor, the Internet, and even mobile devices). The brand's stakeholders are effectively engaged, which is conducive to building a strong

brand community, both traditional and virtual. All those involved derive multifaceted benefits and the brand's market capital is built with a unique and favorable image.

The authors are aware of the limited character of the qualitative research conducted, and therefore intend to continue their studies based on other entities and plan to expand them by adding response and reception studies, as well as evaluation of this type of marketing projects by the engaged stakeholders.

To sum up, the literature and empirical studies carried out consolidated the conviction that brand managing marketers should think through the following questions: Are proper experiences of employees, customers, partners, media representatives, Internet users, local communities, and others built through marketing programmes? Does the brand keep its promise? Are brand-related experiences that are positive for the addressee created in the process of offering value under the specific brand to a sufficient degree, relative to expectations and trends, taking into consideration activities of the largest competitors? Does the created brand image make it possible to distinguish it from the competition? Is brand loyalty built among customers to whom the brand's offer is addressed? To what degree are the tools that are conducive to creating proper experiences adjusted to the current conditions and characterised by creativity and usability for the addressees? And finally, do they use the possibilities resulting from social, scientific, and technological progress, including the development of the Internet (e.g. social media functionalities) or marketing activities?

Skilfully managed experience branding campaigns comply with trends in behaviours and expectations of clients and other stakeholders; they contribute to rationalization of expenses, they generate diverse benefits (reliable information, building relations, delivering information and entertainment, the possibility of participation in the offeror's activities for the key stakeholders, forming brand community, creating value, efficiently distinguishing yourself from competition...).

That's why activities associated with popularization of methodical marketing practices for personified brands on-line and off-line are necessary. If we want to highlight recommendations for marketing specialists interested in carrying out efficient experience branding campaigns in the food sector, we need to take into consideration the following issues: 1) Adapting all marketing activities to the expectations of contemporary consumers and other stakeholders (media representatives, Internet users, potential social and/or business partners). 2) "Engaging the crowd" in a skillful way, as contemporary stakeholders and Internet users in particular display strong inclination towards prosumer behavior. 3) What should serve as a basis for activities are the results of research concerning, among others, the things that key groups of recipients are interested in, what is important for them and can be linked to the offer and actions under the brand. 4) It is necessary to assume a holistic approach to the human, that is, influencing him on the psychological, physical and spiritual levels. 5) Methodical activities require appropriate budget, hiring professionals,

allocating appropriate amount of time and launching a whole spectrum of activities, including a 360-degree communication campaign. 6) Important success factors are flexibility and speed of reaction. 7) What is also important is skillful positioning and building an appropriate and unique image of the Milka brand which is the only one of its kind. 8) Following the current trends, the basis of success of the chocolate producer is a global, recognizable and strong brand, with which stakeholders establish relations 9) A personified brand, which has particular values, should be sustainable, which means it has to not just provide an attractive offer, generate profits, but also deal with social, branch issues, look after the environment and balanced activities.

Brand managing marketers should undertake activities thanks to which brands, in a way, participate in the lives of their communities. What is particularly important is to refer to the current events, generate content, and enable participation. Consistency, multimedia character, creativity, and a methodical approach are what matters.

In light of the discussion and studies carried out, it seems reasonable to conclude that Milka's experience branding activities should be considered as methodical, valuable, and exemplary. Moreover, they generate multifaceted benefits for all the market players involved (the brand's stakeholders, representatives of its real and virtual communities, and other cooperating and affiliated entities) in line with the social, technical, technological, market, and management conditions, including efforts to follow a sustainable approach in every aspect of the brand owner's activities.

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STAKEHOLDERS' EXPECTATIONS AND EXPERIENCES REGARDING SCHOOL EVENTS. RESULTS OF RESEARCH

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Purpose: bringing closer the essence of the expectations of students, parents and teachers towards school events and the resulting experiences; presenting the results of own research by representatives of the key stakeholders of the selected primary school, assessing its situation in terms of the issues under consideration and identifying improvements; formulation of recommendations for marketers interested in school events tailored to the expectations of participants and aimed at creating their appropriate experiences, as well as achieving goals and generating multi-faceted benefits.

Methodology: computer-assisted survey with combinations of the elements of the Servqual method, Schmitt's strategic experiential modules (sense – stimulating the senses, feel – eliciting emotions, think – intellectual engagement, act – motivation and inspiration, and relate – strengthening relationships), the NPS (Net Promoter Score) metric, and participant observation in events organized by the research object.

Results: research has confirmed that through events, schools may and should manage the relationships and experiences of the interested stakeholders and generate many social and practical benefits. Research with the use of the author's original methodology shows that what stakeholders care about most is for events to elicit emotions (the feel module), motivate and inspire the participants (the act module), and strengthen relationships (the relate module).

Study limitations: planned studies at other schools with different groups of stakeholders.

Practical implications: better implementation of the contemporary school's tasks oriented at stakeholders and their engagement, cooperation development, creating unique experiences while streamlining the school's marketing and management activities, including building its recognisable brand. Attractive ways of providing information, education, inspiration, and activation through events. Streamlining school event marketing activities.

Social implications: building the school community, a number of benefits related to partnerships and integration with local entities, improvement of employee qualifications, activities for the development of the local community in terms of culture, heritage, patriotism, physical activity, environmental protection, and enterprise.

Value: the first study of this type at this type of place and the possibility to actually optimise event marketing activities with notable benefits for teachers, students, parents, and other related stakeholders, and improving the experiences, relationships, and satisfaction level of all those involved.

Keywords: expectations and experiences, school stakeholders, creating experiences, school events, school marketing.

Type of article: research paper.

1. Introduction

The modern school performs educational, shaping and caring functions. It operates in an increasingly competitive environment and is interested in developing its strategic advantage. It is obliged to keep up with trends, fashions and technological progress. In order to meet market conditions, it should consider the use of artificial intelligence, augmented and virtual reality; implement e-books, gamification, support education with video materials and pay special attention to the development of soft skills. These types of practices are fostered by school events, where stimuli can be dosed according to the expectations of the participants, which fosters value generation and creates experiences (Smilansky, 2009) for all stakeholders.

Today's schools also face challenges arising from the industrial revolution. Many students starting their education now will be working in new professions that do not yet exist (CND, 2023). In an Industry 4.0 environment, people talk about Education 4.0 (OECD, 2023), where the emphasis is on personalised, diverse, self-paced learning, based on the child's experiences, projects and individual needs. Digital (Siemieniecka, 2021), technological, innovative and creative skills are becoming increasingly important, as well as empathy, collaboration, interpersonal emotional intelligence and social awareness.

Modern learning is also moving towards free choice of materials, programmes, tools and techniques. It does not matter by what means, it is important to achieve the goal. Adapting to what the labour market will expect from a young person, students should work in projects (Campbell, 2020; Targiel, 2022; Kerzner, 2022; Wolniak, 2022), in groups, learn organisational techniques and manage their time skilfully. Under such conditions, the importance of school events aimed at developing the talents of the participants and achieving their diverse goals increases significantly.

The aim of this article is to present the essence of students', parents' and teachers' expectations regarding school events and the resulting experiences; to present the results of the research conducted by the representatives of key stakeholders of a selected primary school, to assess its situation with regard to the issues considered and to identify improvements; to formulate recommendations for marketers interested in school events tailored to the expectations of participants and aimed at creating relevant experiences, as well as at achieving goals and generating multifaceted benefits. The research into the experiences of the school's key stakeholders (students, parents, teachers) as a result of their participation in the events organised by the school took into account Schmitt's modules – sense, feel, think,

act, and relate, the NPS recommendation indicator and participant observation of the events organised by the analysed research subject with the possibility of interviewing their participants.

2. Literature review

Expectations are suppositions, hopes, desires (Wawak, Bajak, 2023); something that people want and expect from an activity, e.g. an event (Kotler et al., 2021). An organisation should understand the expectations of its stakeholders in terms of how their needs will be met, which will be reflected in meeting those expectations and even going beyond them where possible. Meeting stakeholder expectations is a kind of demonstration on the part of the organisation, which should result in a positive emotion and satisfaction and, in the long term, in the creation of relevant experiences associated with it. At the same time, experience is an individual's response to stimuli and is created as a result of some stimulation (Boguszewicz-Kreft, 2022; Clatworthy, 2022).

Customers, although very important (Kotler, 2021), are not the only target group. An organisation's activities should be focused on stakeholders. According to Freeman (2022) a stakeholder is any individual or group that can directly or indirectly influence or be influenced by an organisation. The school is an example of an institution with a large number of stakeholders (Fazlagić, 2011, p. 31; Wilkin, 2009, p. 88; Hillebrand et al., 2015), beyond its internal framework, encompassing a diverse group of subjects. The school's stakeholders include: teachers, students, parents, representatives of the media, local community, representatives of local authorities, other cooperating entities (Dziadkiewicz et al., 2022). Different stakeholder groups show varying degrees of engagement and interest in the school's activities and performance, and have different expectations of the school and its events. This is due to different stakeholders attaching different importance to different factors. They assess the quality of services through the prism of their expectations and the degree to which these are met (Frankowska, 2011, p. 210).

With regard to expectations, it is worth introducing the concept of the tolerance zone (Szóstek, 2022, pp. 36-37), which states that customer expectations fall between 'desirable' and 'sufficient'. The space between these points is the 'tolerance zone', which is individual to each person. Through stimuli/activities, the individual acquires experiences that they subjectively evaluate (consciously and subconsciously) and as a result are satisfied or dissatisfied. Finally, if they experience something unusual beyond their expectations they will be positively surprised. In such a situation, their emotional involvement can be expected.

Stakeholder experiences are of interest to many researchers and practitioners and are given great importance (Smilansky, 2009; Schmitt, 2011; Hillebrand et al., 2015; Tarczydło, Miłoś, 2019b; Hansen, 2021; Kotler et al., 2021; Boguszewicz-Kreft, 2022; Dziadkiewicz et al., 2022). It should be emphasised that every contact, every interaction that a customer has with a brand/physical product or service influences their experience. Moreover, it is in a way the resultant of the organisation's actions, the senses stimulated and the feelings evoked, which relate to everything the organisation does, but also to what it does not do, but what the stakeholder associates with it. The stakeholder's total experience of the organisation is the result of all the manifestations of the organisation's actions – physical, emotional and sensory. It can therefore be concluded that experiences will be diverse, but they can be grouped together, as exemplified by Schmitt's experience modules (2011, pp. 60-62), which include the sensory module (sense), the emotional module (feel), the intellectual module (think), the behavioural module (act) and the relational module (relate).

In the sensory module, experiences are created by affecting the senses (sight, hearing, smell, taste, touch and sapience). The emotional module refers to the impact on feelings and emotions, which creates affective experiences ranging from moderately positive feelings to strong emotions. The intellectual module refers to the human intellect, which is about creating cognitive experiences that require the consumer to think and engage creatively (Wolniak, 2023). The behavioural module refers to rational thinking, to motivation and inspiration, and patterns that enrich the consumer's life, influencing their lifestyle. The relational module refers to the individual's connections with other people or social groups. As Schmitt wrote (2011, p. 175), an individual forms a bond with a group by purchasing and consuming the products of a chosen brand. Consumer satisfaction resulting from belonging to a group can also be enhanced by the brand's delivery of a positive experience as a result of, for example, organising a successful event.

In this article, the focus is on school events. In the available literature, event is defined in many ways (Alan, Kabadayı, Köksal, 2017, p. 588; Bączek, 2011, p. 7; Tarczydło, Miłoś, 2019b). On the basis of the available definitions of an event, taking into account the specifics of the school, it is assumed that a school event is a specific management tool of the school, enabling meaningful content to be communicated to the participants in a creative, original and surprising way, contributing to the achievement of the school's defined goals and having an impact on those participating, providing experiences and evoking emotions through stimuli that translate into stakeholder experiences.

In relation to event participation, it can be argued that the level of fulfilment of the event participant's expectations and the level of their engagement will depend on the quality and type of experience that will be created through the stimuli provided during the event in which they participate. In order to achieve an experience at the desired level, it may be helpful to take into account the theory of the event participant stepping out of their comfort zone. According to J.B. Bączek (2011, pp. 25-29) the key to the success of an event is to provide

opportunities for participants to step out of their comfort zone. Since an event, by definition, is unusual and unique, the participant must experience something new during the event by entering their discomfort zone, which will raise their adrenaline and heart rate. To illustrate, the author gives the example of organising an event in a rope park between trees for people working at heights. Such an event will not be attractive to the participants – it will not cause them to step out of their comfort zone, because they work at height everyday. It can therefore be concluded that the quality of the experience fails to reach the 'desirable' level.

The results of the research (Alan, Kabadayi, Köksal, 2017) confirm that events that are assessed as inventive, purposeful and well-chosen have a positive impact on participant engagement. At the same time, the participant will find the event attractive and engaging if it is well organised and includes innovative and creative ideas.

Management of school events needs to take into account their high frequency in the education sector and the increasing expectations of their participants. The 'event career' phenomenon has been written about by Richards (2019, p. 87), whose view is that regular participants are becoming increasingly demanding of the events they attend.

In the light of bibliometric research, the education sector has not been sufficiently recognised in the available studies, hence the authors, for the purpose of effectively managing the experiences of key school stakeholders through events taking into account the changing expectations of their participants and related partners in the current market conditions, felt it necessary to conduct a study of this important phenomenon.

3. Methodology of own research

The identified research gap relates to the lack of knowledge about the actual expectations of students, parents and teachers towards school events and their experiences, and consequently the multifaceted benefits for all related stakeholders.

The aim of the research conducted was to obtain information on the actual expectations of students, parents and teachers of the selected primary school towards the events it organises and to relate them to the acquired experiences of the stakeholders interviewed. For the purposes of this study, self-reported research was conducted aimed at answering the questions: What do school stakeholders expect from school events? What are the differences in expectations of events among key stakeholder groups? How do stakeholders assess the level of fulfilment of their event expectations? Which dimensions of experience are most important to stakeholders? What are the differences in the relevance of experience dimensions between stakeholder groups? What is the position of respondents on the possibility of using school events for relationship building and other sublime tasks?

The research was conducted using a computer-assisted survey method with a sample of 361 primary school stakeholders (including 31 teachers, 182 students and 148 parents). A proprietary measurement tool with a combination of elements of the Servqual method, Schmitt's strategic experience modules and the Net Promoter Score (NPS) indicator was designed. Participant observation at selected events organised by the research facility was also used. This enabled interviews with event participants about their specific expectations and lessons learned.

The research object was a primary school in the Oświęcim district, where one of the authors works and is directly involved in its event marketing activities. The research object is characterised by a large number of events organised during the school year, with an average of about three events per week. The school has a reputation for providing high quality education, which is confirmed by a ranking of Małopolska primary schools based on the average results of all subjects taken at the school during the eighth-grade exam.

The research was conducted between April and June 2021. The subject scope of the research included the primary school together with its key stakeholder groups – students, teachers and parents. The main focus of the research was on stakeholders' expectations and experiences of school events.

The research provided an insight into respondents' actual expectations of school events and the resulting experiences. A proprietary research questionnaire was designed for the purpose of surveying, which was used in electronic form via the interankiety.pl website. Modelled on the Servqual method (Woźniak, 2017) and taking into account Schmitt's experience modules (sensory, emotional, intellectual, behavioural, relational) (Schmitt, 2011), a list of 11 questions was developed in order to identify the ideal event (expected value) and then obtain an evaluation of the actual events and the resulting experiences.

B. Schmitt's experience modules were included in the research questionnaire; respondents gave their opinions on 26 statements, including five each for the sensory, emotional, intellectual and behavioural modules and six for the relational module. Responses were given on a five-point scale: 1 – definitely no, 2 – no, 3 – hard to say, 4 – yes, 5 – definitely yes. The results of the obtained surveys will be discussed in detail in the next section of the article. Respondents were also asked to distribute 100 points between the modules according to the principle that the more important the module is to the respondent, the more points they give it. In addition, the NPS indicator (Gitlin, 2023) was used in the survey. Stakeholders responded on a 10-point scale ranging from 1 (definitely not recommended) to 10 (definitely recommended) on the topic of recommending school events for relationship building.

4. Results, conclusions and improvements for the tested object

The survey among key stakeholders identified their expectations of school events organised by the surveyed facility and the resulting experiences. Respondents' expectations are summarised below in order of importance:

- students: entertainment and mood enhancement, opportunity for personal development, fulfilment of passions and hobbies, expansion and acquisition of skills and knowledge, promotion of oneself in the community and opportunity to stand out from other students;
- parents: entertainment, personal development, improvement of self-esteem, broadening of knowledge and acquisition of new skills, making new friends and integration into the school and community;
- teachers: inspiration, motivation, opportunity to develop and pursue passions and hobbies, integration into the community and intellectual engagement.

Point values were also obtained according to the 1-5 scale used regarding the Schmitt experience modules: sensory (sensory stimulation), emotional (emotional arousal), intellectual (intellectual engagement), behavioural (motivation and inspiration) and relational (relationship strengthening). The average response values for expectations and experiences for each group are summarised in Table 1.

Table 1.

Respondents' expectations of school events including Schmitt's modules and resulting experiences

Module	Expectations			Experiences		
	parents	students	teachers	parents	students	teachers
Intellectual	4,03	3,71	3,86	3,56	3,38	3,58
Relational	3,94	3,67	3,90	3,61	3,27	3,55
Sensory	3,97	3,88	4,00	3,74	3,43	3,52
Emotional	4,07	3,89	4,01	3,75	3,43	3,48
Behavioural	4,05	3,85	4,13	3,60	3,40	3,56
Average	4,01	3,80	3,98	3,65	3,38	3,54

Source: own elaboration based on conducted surveys (n = 361; scale: 1 – definitely no, 2 – no, 3 – hard to say, 4 – yes, 5 – definitely yes).

The analysis of the data showed that parents have the highest expectations of school events in the areas of intellectual engagement, strengthening relationships and evoking emotions, while teachers have the highest expectations in relation to sensory stimulation as well as motivation and inspiration. The expectations of the different stakeholder groups in relation to school events are different, thus confirming the opinion of Honey (2016, p. 2), who reports that the opinions of the different stakeholder groups regarding one subject are different, which is due to the different needs and expectations of these groups. Considering the average of all modules, parents have the highest expectations (4.01), while students have the lowest expectations (3.80), for whom additionally the lowest values for each module were recorded.

Students are also the group most dissatisfied with their event experience for each module. At the same time, parents, who are the most demanding, are also the group most satisfied with their experience of attending school events. Table 2 presents the impact of the diagnosed expectations and key experiences on the directions of the school's event marketing policy and proposed improvements to activities.

Table 2.

Impact of stakeholder expectations and experiences on the event marketing of the studied school

Criteria analysis Key school stakeholders	Expectations towards school events	Experiences from school events	Comments, remarks and recommendations for the school organising events	Examples of event activities
Students	Strong involvement of all senses (appropriate music, decoration, costumes, location). Arousing emotions, impact on feelings, desire to feel pleasure from participation. The need to be motivated, inspired, stimulated to a lesser extent.	Experiences below expectations. The lowest quality of experience relates to establishing relationships at events.	Events treated as a permanent, routine part of the learning process. The school should surprise the student to arouse the need to participate, fully engage, generate benefits and offer relevant experiences.	Thematic events with the participation of practitioners/specialists who will present the issue in an attractive way with intense activation (ecological – meeting with a forester, beekeeper; social – meeting with a fireman, policeman, scientist; health – meeting with a nurse, doctor, athlete, nutritionist). Use of modern technology (VR, AI, etc.). Events targeted at students' interests.
Parents	Arousing emotions, impact on feelings, desire to feel pleasure from participation. The need to be motivated, inspired, stimulated. Intellectual engagement (mental effort, stimulating thinking) to a lesser extent.	Experiences below expectations. The lowest quality of experience relates to intellectual engagement at events.	Very demanding group. Suggested increased engagement and consultation on event organisation.	Events involving whole families and the local community: Family picnic, Grandmother's and Grandfather's Day, Mother's Day, Nativity play with programme points to activate all stakeholders.
Teachers	Intellectual engagement (mental effort, stimulating thinking). Strong involvement of all senses (appropriate music, decoration, costumes, location). Arousing emotions, impact on feelings, desire to feel pleasure from participation.	Experiences below expectations. The lowest quality experience concerns the arousal of emotions during the event, the impact on feelings, the feeling of pleasure from participation.	Attention should be paid to organising events exclusively for teachers that engage their senses and evoke emotions.	Competence-enhancing training events outside the school premises. Team-building trips.

Source: own elaboration based on conducted research.

The indicated directions for the optimisation of the school's event activities according to the information gained from the research led to determining the size of the gaps between the value experienced and expected by parents, students and teachers within the framework of the considered modules (Figure 1).

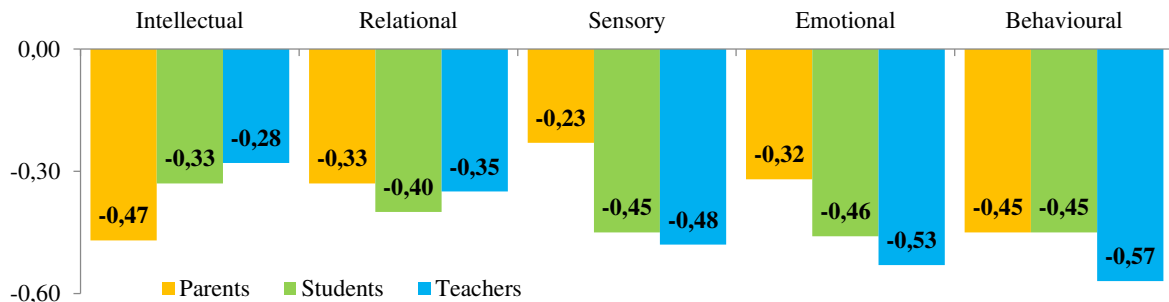


Figure 1. Sizes of the module gaps for the stakeholder groups surveyed.

Source: own elaboration based on conducted research.

The biggest difference between expectation and experience in the area of intellectual engagement was found among parents. This group of respondents has a greater preference for school events that broaden their children's knowledge and engage them mentally so that they can win awards at different levels of competitions.

Among students, the biggest differences between expectation and experience are seen in engaging the senses, evoking emotions as well as motivating and inspiring. Students have higher expectations for event activities that will be attractive from the perspective of sensory experience and at the same time inspire them, broadening the spectrum of their developmental possibilities. This group prefers to participate in events that use the latest event trends.

In the group of teachers, the biggest differences between expectations and experiences are in the areas of arousing emotions, stimulating the senses as well as motivating and inspiring. What is significant here is the all-round engagement of event participants which stimulates, motivates and inspires. Teachers are mainly the organisers of school events and are responsible for the good atmosphere at the events. A group of teachers will enjoy events that are aimed exclusively at them. Their task is to integrate, inspire and develop.

Considering all stakeholders, the differences between expectation and experience with consideration of Schmitt's modules are shown in Figure 2. Based on the results, there is a need, according to the respondents, to organise school events in a way that makes them more engaging, which can result in changes in attitudes and behaviour, reflection and inspiration.

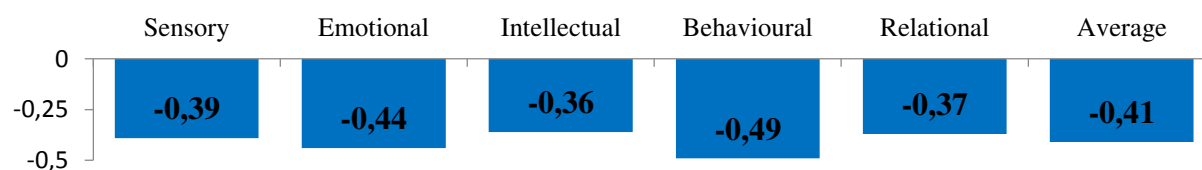


Figure 2. Average gap sizes for experience modules.

Source: own elaboration based on conducted research.

In order to determine the relevance of the stimuli determining their event experience, respondents were asked to distribute 100 points between the different modules – the more relevant a module is in the respondent's opinion, the more points they assign to it. In this way, declarative data was obtained and analysed and weighting values were determined (Table 3).

Table 3.

Weights of experience modules in the opinion of the respondents

Module	Weight value		
	teachers	parents	students
Intellectual (intellectual engagement)	17,5	19,7	20,9
Relational (strengthening relationships)	21,6	20,7	20,2
Sensory (stimulating the senses)	17,3	21,6	19,4
Emotional (arousing emotions)	22,0	20,0	19,2
Behavioural (motivation and inspiration)	21,6	18,0	20,3

Source: own elaboration based on conducted research.

The results showed that the respondents considered all modules to be important, the differences in the scores assigned being small. For teachers, emotions are an important factor influencing experiences, for parents sensory experiences and for students intellectual engagement. In order to determine the level of importance of the modules for each group of respondents, weighted gap values (multiplying the gap values of a module by its weight) (Figure 3) and weighted average gap values for all respondents (Figure 4) were calculated.

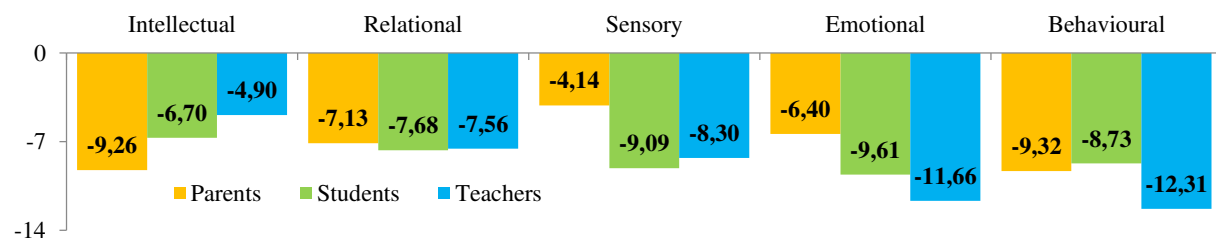


Figure 3. Weighted module gap values for surveyed stakeholder groups.

Source: own elaboration based on conducted research.

The consideration of weighting in the different modules has significantly influenced the size of the gaps in the student group. In addition, the rank of the modules changed, which means that the most important thing is to take care of the right emotional experience and sensory experience at school events. For the other groups, the introduced weights did not significantly affect the size of the gaps between the expected value and the experienced value.

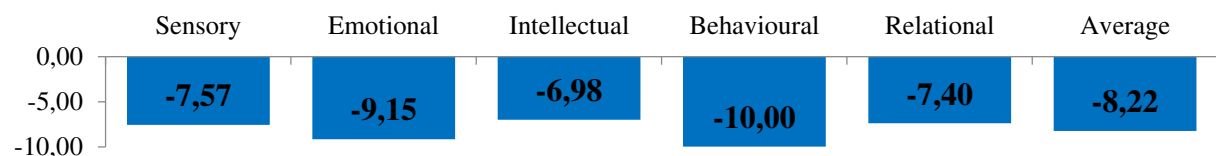


Figure 4. Weighted average gap values for the experience modules.

Source: own elaboration based on the research.

Considering all stakeholders, the order of the modules in terms of weighted gap size did not change – the largest gap is still for the behavioural module and the smallest for the intellectual module. This confirms that special attention should be paid to motivating, inspiring and shaping personalities when organising school events.

Table 4 shows the modules ranked from lowest to highest gap value with their corresponding weights.

Table 4.

Gap values and weights for experience modules as perceived by respondents

Module	Gap value	Weight value
Intellectual (intellectual engagement)	-0,36	19,4
Relational (strengthening relationships)	-0,37	20,0
Sensory (stimulating the senses)	-0,39	19,4
Emotional (arousing emotions)	-0,44	20,8
Behavioural (motivation and inspiration)	-0,49	20,4
Average	-0,41	20,0

Source: own elaboration based on conducted research.

To illustrate the results, a matrix (Figure 5) was created by plotting the gap values (X axis) and weights (Y axis) on the axes. The centre is defined by the average gap and weight values (-0.41;20).

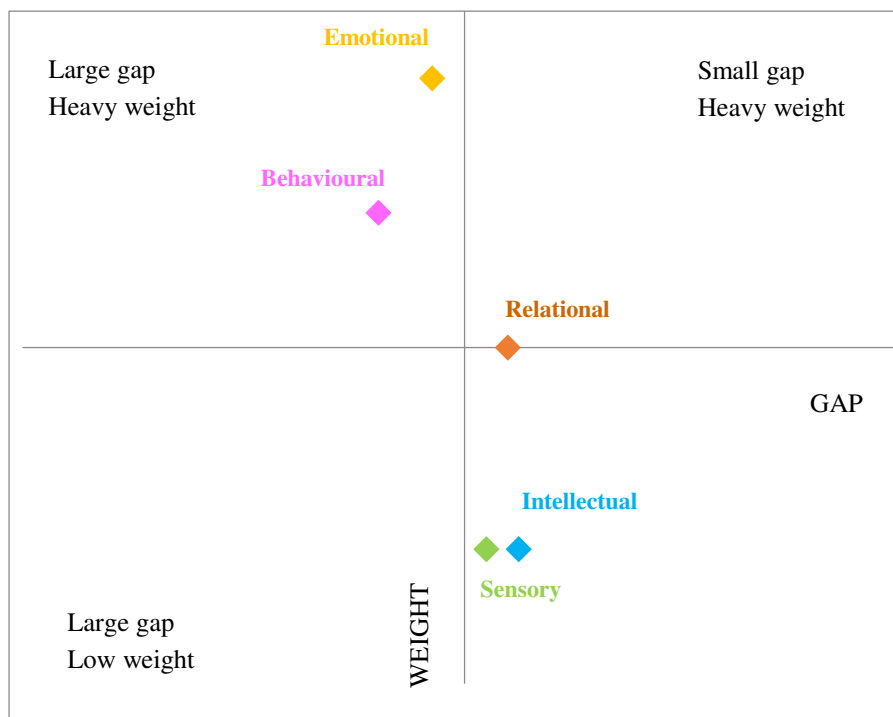


Figure 5. Gap-weight matrix for the experience modules.

Source: own elaboration based on conducted research.

Figure 5 allows the modules to be classified into areas that require the fastest action from the school. Modules with a high gap between expectations and experiences in relation to school events that are important to respondents (have heavy weight) are key. According to all

respondents, these are the behavioural and emotional modules. It is suggested that the school's activities related to these modules should include: selecting the theme and type of event for a specific group preceded by a needs analysis in this regard. Examples of activities considering the fulfilment of this task could be: theatre and dance performances and competitions between parents, children and teachers; joint charity events, fairs with handicrafts made by students with the participation of other stakeholder groups.

Next, it was checked how the modules with a large gap and weight were distributed among the different stakeholder groups. For this purpose, the place on the matrix (gap-weight) of each module was compared for each group of respondents (Table 5).

Table 5.

Place of experience modules in the gap-weight matrix by respondent groups

Respondent groups and experience modules Place in the matrix	Parents	Students	Teachers	Total respondents
Large gap Heavy weight	Behavioural	Emotional Sensory	Emotional Behavioural	Emotional Behavioural
Small gap Heavy weight	Relational Emotional	Intellectual	Relational	Relational
Large gap Low weight	Intellectual	Behavioural	Sensory	–
Small gap Low weight	Sensory	Relational	Intellectual	Intellectual Sensory

Source: own elaboration based on the research.

Considering each group of respondents individually, the key modules (of high weight and gap value) included emotional, behavioural and sensory. In order to secure an appropriate level of experience for all stakeholders, it is essential to address these areas first. Ideally, the gap between experience and expectation should be reduced simultaneously for all stakeholders. The desired state is to provide each stakeholder group with an experience that meets their expectations taking into account all components and achieving a holistic impact. The ideal state means exceeding the expectations of all groups for each module. However, the bridging of gaps should be approached thoughtfully. Obtaining full satisfaction from all stakeholders will be possible through a methodical approach to planning event activities for individual stakeholder groups, taking into account their specific expectations and the differences between them. Hence the conclusion to organise events targeted at specific stakeholder groups, preceded by research and analysis of their personalised desired expectations and experiences.

The survey checked the position of respondents regarding the possibility of using events to build relationships. The NPS values obtained for the teacher and parent groups are at a similar level, respectively: 13 for teachers and 14 for parents. The percentages of promoters (39% and 37% respectively) and detractors (26% and 23%) are also similar. A very different opinion

was expressed by students on this issue. The NPS value for the student group was (-5) with 27% promoters and 32% detractors.

Due to the lack of identification of survey results using the NPS indicator for schools, it is difficult to make a clear reference to the values obtained. It would be useful to compare this with the results of other studies, however, the use of the NPS indicator for schools has not been encountered in the available studies. According to global comparative data, which takes into account the NPS of more than 150,000 organisations, the average score is +32 (Gitlin, 2023). The authors are of the opinion that positive score values (more promoters than detractors) can be taken as satisfactory. Considering the range of the indicator <-100;+100> the value (-5) is not critical. Particularly since, according to global data, up to 25% of subjects obtained values of zero or below.

5. Summary

The literature studies and empirical research carried out give rise to observations and final conclusions. Celebrating important school events fosters relationship management and stakeholder experiences as well as generates many social and practical benefits. The research using the applied methodology showed that stakeholders care most about events evoking emotions (feel module), motivating and inspiring participants (act module) and strengthening relationships (relate module). The results confirmed the differences between groups of respondents in terms of their expectations from events (for students, the most important thing is to stimulate the senses and evoke emotions; for parents, to motivate and inspire; and for teachers, to evoke emotions as well as to motivate and inspire). Differences were also found in the experience associated with participation in events between the different stakeholder groups (the best experiences were associated with sensory stimulation and emotional arousal among students and parents, and intellectual engagement among teachers).

The research work carried out generates a number of implementation benefits including: better implementation of the tasks of a modern school focused on stakeholders and their engagement (Chaffey, Smith, 2017), development of collaboration, creation of unique experiences while improving the marketing and management activities of the school, including building its recognisable brand (Keller, 2013; Ind, Horlings, 2016; Tarczydło, 2018; Tarczydło, Miłoś, 2019a; Hansen, 2021). Attractive ways to inform, educate (), inspire and activate through events. Improving marketing activities related to school events.

All stakeholders gain benefits such as: building the school community, a range of benefits related to partnerships and integration with local stakeholders, improving staff skills (Wolniak, 2023), activities for community development in culture, heritage, patriotism, physical activity, environmental protection, entrepreneurship. Engaging stakeholders

(Dziadkiewicz et al., 2022) in cooperation, promoting the right behaviours: safety, assistance, activity, environmental awareness (Wan et al., 2016; McPhee, Dias, 2020; Scoffham, Rawlinson, 2022), entrepreneurship, making the offer more attractive, innovative ways of transferring knowledge, shaping attitudes, school activities (educational, developmental, in partnership with event participants, social impact, development of cooperation with business representatives; integration and relationship building).

In order to identify recommendations for marketers interested in using school events to meet the expectations of school stakeholders and generate incentives that create relevant experiences, the following actions are reasonable: 1) Particular attention should be paid to organising well-chosen events for key school stakeholders, taking into account their expectations. This should be based on the results of research into event expectations and actual experiences. 2) Decisions should be based on knowledge of stakeholder expectations and not on the school's perceptions. The school's knowledge of its stakeholders should be regularly updated. 3) It should be ensured that the designed activities and incentives are aligned with the competitive structure, technical and technological conditions, current market trends and the actual expectations and experiences of key stakeholders. 4) The school should aim for a state in which what the stakeholder realistically experiences is at least at the level of the promise made. 5) The school's event procedures should operate in a way that generates the desired values and experiences for key stakeholders. Existing procedures should be reviewed to ensure that they meet the expectations of key stakeholders. 6) The habit of making changes to both events and other staff activities to improve the stakeholder experience created should be developed. 7) When organising school events at the research facility, care should be taken to improve the emotional and motivational aspects, as confirmed by the research results obtained. These are important from the perspective of the school's key stakeholders. Their quality experienced during organised events is relatively far below expectations. The emotional aspects need to be improved the most from the perspective of teachers and students, while the motivational aspects need to be improved the most from the perspective of teachers and parents.

The article was based on literature studies and original research using the following methods: case study of a selected primary school, surveys of key stakeholders of the research object and participant observation.

The authors are aware of the limited nature of the research and plan to expand it with other units from the education sector. The undertaken research problem should be analyzed on the basis of a larger number of schools and representatives of their communities.

In conclusion, knowing the expectations of stakeholders and diagnosing their experiences of school events significantly influences the optimisation of school event marketing activities in the current market conditions in the education sector. Research into actual expectations and feelings after attending an event and the associated experiences are an important element in methodical creation of optimal incentives and generation of a unique set of values.

This provides the basis for optimising event marketing activities with measurable benefits for teachers, students, parents and other related stakeholders and improving the experience, relationships and satisfaction levels of all parties involved.

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CORPORATE GOVERNANCE IN THE CONTEXT OF ESG ISSUES IN ICT COMPANIES IN POLAND – RESULTS OF SURVEYS

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Purpose: This study aims to identify and assess the actions taken by ICT (Information and Communications Technology) companies in one area of ESG, namely corporate governance (CG).

Design/methodology/approach: A CAWI (Computer-Assisted Web Interview) type survey method was used. The survey involved 39 organisations with Polish capital operating in the ICT sector. Companies from the SME sector predominated among the surveyed entities.

Findings: The study revealed areas for improvement in the corporate governance mechanisms of companies in the ICT sector in Poland, which may decrease their ability to identify, assess and mitigate the risks of their operations, fulfil their reporting obligations, and gain the trust of their stakeholders.

Research limitations/implications: A purposive selection of entities for the research was used. The research sample did not represent the ICT industry, so the conclusions only relate to the surveyed entities.

Practical implications: the article shows what ICT companies should do to operate sustainably. It highlights the relevance and importance of the latest legislation on non-financial reporting.

Social implications: Corporate governance activities are part of a company's ESG strategy. They have a significant impact on the environmental and social performance of entities.

Originality/value: There needs to be more research in the literature on the corporate governance activities of ICT companies. This article fills that gap.

Keywords: sustainable development, corporate governance, ICT sector, ESG.

Category of the paper: Research paper.

1. Introduction

Increasingly aware shareholders, consumers, business partners and investors are putting pressure on companies to operate sustainably. As a result, leading ICT companies are beginning to demonstrate their environmental and social responsibility. This is manifested, among other things, in formulating ESG strategies, creating positions within the organisational structure to coordinate the implementation of this strategy, and creating policies and procedures to regulate their pro-social and pro-environmental commitment. Companies prioritising ESG take care of organisational governance are better prepared to manage risks, respond to stakeholder expectations and fulfil reporting obligations.

The following part of the study explains the essence of sustainable development, ESG and corporate governance. Then, the approach of ICT companies to implementing the assumptions of the concepts mentioned earlier is described, with particular attention paid to the situation of ICT companies in Poland. The central part of the article is a presentation of the research results devoted to identifying and assessing actions taken by technology companies in Poland in corporate governance.

2. Sustainable development, ESG issues and corporate governance

The most widespread definition of sustainable development and the first was published in 1987 in the Report of the World Commission on Environment and Development: *Our Common Future*. It took 17 years from the appearance of this definition until the abbreviation ESG was used for the first time. At that time, the UN Global Compact's *Whom Cares Wins* initiative highlighted the links and interdependencies between environmental, social and governance factors. The abbreviation ESG has been in use since 2004.

Sustainable development is the socio-economic development of modern societies by meeting their needs, not diminishing future generations' ability to meet them (United Nations, 1987). ESG is not the same as sustainability. ESG is the three areas considered by stakeholders, among others, for non-financial assessment of entities: environmental, social, and governance / corporate governance (CG). ESG is the environmental, social and corporate governance issues that stakeholders consider in the context of corporate behaviour. ESG is an approach to selecting companies for investment that assesses environmental and social factors impact on them, verifying the quality of corporate governance mechanisms. The concept of sustainability is much broader and focuses on the role a company plays in society, the creation of value by managing the impact (both positive and negative) of its activities on people and the environment, and the consequences of its actions for a wide range of stakeholders.

A significant development in sustainable development was the adoption in 2015 of the '2030 Agenda for Sustainable Development 17 Sustainable Development Goals (United Nations, 2015). These goals can be considered through the lens of ESG issues (Figure 1).



Figure 1. Linking the Sustainable Development Goals to ESG areas.

Source: Berenberg, 2018, after Sætra, 2021.

A milestone in developing the idea of measuring sustainability was developing the Triple Bottom Line (TBL) concept. TBL was first introduced in 1994 (Elkington, 1994; 1997, after Chandler, 2017). The concept is associated with the acronym 3P, i.e. people, planet, and profit. TBL is the concept of the equivalence of the economic (financial), environmental and social spheres. The development of the TBL concept became the starting point for the Quadruple Bottom Line (QBL) or Multiple Bottom Line (MBL), among others. QBL is a concept based on four areas (Woodward, Woodward, Rovira Val, 2004): environmental, social, governance, and economical. The triple bottom line approach can become a quadruple bottom line, maximising economic performance only if the interests of all stakeholders can be met by adopting the best corporate governance practices for the company (Achim, Borlea, 2015). Because of these four areas, the acronym ESGE is worth considering. MBL is based on the five areas of ESGEE (Brockett, Rezaee, 2012, after Rezaee, 2015): environmental, social, governance, ethical, and economical. In extended versions of the TBL concept, the area of governance (corporate governance) will appear.

The concept of corporate governance should be considered broadly, not only related to the exercise of corporate governance by and on behalf of the company's shareholders and referring to boards, their competencies, structure and relationship with management. Corporate governance, as a broader concept, from the point of view of internal and external governance, includes other stakeholders such as employees, creditors, customers, suppliers, the local community or the state in the oversight and running of the company. The contemporary understanding of the term corporate governance is broadened to include aspects of corporate social responsibility and increased ethical standards and specific patterns of behaviour for managers, investors, bank employees and audit firms, popularised in the form of codes of good corporate practice.

According to the OECD, corporate governance is the network of relationships between the management of companies, their governing and supervisory bodies, shareholders and other stakeholders (stakeholders in the company's performance). Corporate governance further includes the structure through which a company's objectives are set, the means of achieving those objectives and the means of tracking company performance (OECD, 2004). In the broadest systemic view, corporate governance is a system, i.e. a set of interdependent and complementary legal and economic institutions designed to ensure the proper and economically efficient functioning of joint-stock companies (especially public companies) and to resolve or at least mitigate conflicts (conflicts) of interest of those involved in the company (Oplustil, 2010). The essence of corporate governance is thus to achieve consensus among different stakeholder groups to enhance the credibility of companies. In the context of the idea of sustainable development, it is crucial for the confidence not only of investors in the organisation's future performance but also of stakeholders concerned with the environmental and social impact of the company. Good corporate governance helps build an environment of trust, transparency and accountability necessary for fostering long-term investment, financial stability and business integrity, thereby supporting more substantial growth and inclusive societies. Firms can employ ESG, CG and firm size as strategies to enhance their performance, especially during financial crises (Nisar, Mobarek, Raid, 2023).

Corporate governance is one of the pillars of the ESG concept and applies to all companies, irrespective of their field of activity. At the same time, social or environmental aspects depend on the specifics of the company in question. Corporate governance covers issues such as corporate governance, the structure of a company's board of directors, respect for disclosure obligations to shareholders, executive remuneration, respect for shareholder rights, tax transparency, data protection and anti-corruption and anti-bribery.

Nowadays, non-financial data providers, such as Bloomberg or Refinitiv, use their methodologies to create ESG ratings¹, are starting to play a significant role in the ESG assessment of companies. This data's disclosure heavily depends on companies publishing non-financial reports (integrated, sustainability, CSR, ESG, etc.), often based on specific reporting standards. Both non-financial data providers and organisations promoting their non-financial reporting standards present the structure of ESG issues, including CG, differently. According to ESG core data providers, corporate governance issues are presented in Table 1.

Table 1.*Corporate governance issues by ESG core data providers*

Provider of primary ESG data	Issues	Sub-issues
Bloomberg	Board composition	Director Roles Diversity Independence Refreshment
	Executive compensation	Incentive Structure Pay Governance Pay for Performance
Refinitiv	Management	-
	Shareholders	-
	CSR Strategy	-

Source: own study based on Bloomberg and Refinitiv database.

Harmonisation of non-financial reporting standards is currently a challenge for non-financial lawmakers, particularly in the context of the adoption of the Corporate Sustainability Reporting Directive (CSRD), by the European Parliament in 2022, requiring companies to disclose information on their social and environmental impacts regularly.

Table 2.*Corporate governance issues according to essential non-financial reporting standards*

Organisations proposing a non-financial reporting standard	Issues	Sub-issues
Global Reporting Initiative (GRI)	Governance structure and composition	-
	Nomination and selection of the highest governance body	-
	Chair of the highest governance body	-
	Role of the highest governance body in overseeing the management of impacts	-
	Delegation of responsibility for managing impacts	-
	Role of the highest governance body in sustainability reporting	-
	Conflicts of interest	-
	Communication of critical concerns	-
	Collective knowledge of the highest governance body	-
	Evaluation of the performance of the highest governance body	-
	Remuneration policies	-
	Process to determine remuneration	-
Annual total compensation ratio	-	
Sustainability Accounting Standards Board (SASB)	Business Model & Innovation	Product Design & Lifecycle Management, Business Model Resilience Supply Chain Management, Materials Sourcing & Efficiency, Physical Impacts of Climate Change
	Leadership & Governance	Business Ethics, Competitive Behavior Management of the Legal & Regulatory Environment, Critical Incident Risk Management, Systemic Risk Management

Source: own study based on GRI and SASB.

The leading standard for reporting non-financial data underpinned by the TBL concept is that developed by the Global Reporting Initiative (GRI) or the Sustainability Accounting Standards Board (SASB). The corporate governance issue structures proposed by these organisations are presented in Table 2.

3. Sustainability of the ICT sector

The importance of the ICT sector is overgrowing worldwide. It is seen as a catalyst for the implementation of corporate social responsibility concepts in companies (Hoeltl, 2015), the foundation of the knowledge economy and a critical factor in the competitiveness of national economies (Karahan, 2016; Enowbi Batuo, 2015). The negative impact it has on the environment is also recognised. Studies show that as the sector grows, its contribution to global energy consumption and CO₂ emissions increases (Di Salvo et al., 2017; Paruchuri, 2011). Each phase of the life cycle of ICT products, i.e. design, use and consumption, causes environmental damage. Contributing to the ICT industry's carbon footprint are personal computers, mobile phones, chargers and broadband routers, as well as software (Sissa, 2009; Kern et al., 2018). The current contribution of ICT to global greenhouse gas (GHG) emissions is estimated to be 2.1% to 3.9% (Freitag et al., 2021).

In addition to environmental risks, the sector described generates other risks. For example, encryption technology, on the one hand, provides people with security and privacy and, on the other hand, is difficult to track by law enforcement and intelligence services, making it easier for crime to develop. On the other hand, the use of artificial intelligence systems carries the risk of perpetuating stereotypes and making discriminatory decisions. Accusations have been levelled at ICT companies for colluding with repressive regimes, violating labour rights in supply chains and manipulatively using the data of private social media users (Business & Human Rights Resource Centre, 2018). These companies face workforce diversity, the need for equal pay and equal development opportunities for women and men.

The Global Enabling Sustainability Initiative (GeSI) identifies privacy, social application of ICT products and services, ICT solutions for a low-carbon economy, data security and quality of service as the most critical issues for developing today's technology companies (GeSI, n.d.). Business for Social Responsibility, on the other hand, in defining areas of responsibility for the ICT sector indicates (Cisco, MacAvoy, 2008):

- innovation and software solutions for sustainable development,
- governance, ethics, compliance and transparency,
- global employee management and employee engagement,
- access, privacy and security,
- care for the environment.

It is important to note that research on sustainability in the ICT sector has mainly focused on environmental care and is concerned with Green IT and Green by IT. Green IT means creating sustainable products. Green by IT is a software-based tool that enables organisations to operate sustainably. According to Naumann et al. green and sustainable software is “software whose direct and indirect negative impacts on the economy, society, people and the environment resulting from the development, implementation and use of the software are minimal and which has a positive impact on sustainability” (Naumann et al., 2011). Green by IT are software-based tools that enable organizations to run their business in a sustainable manner.

In 2020, 2468 companies in Poland employed ten people or more in the ICT sector. The number of people working in the ICT sector was 269.0 thousand, with eight out of ten working in ICT services. The value of net sales revenue in the ICT sector in 2020 amounted to PLN 189.1 billion, increasing by 11.0% year-on-year. Services were the most significant contributor to the ICT sector's revenue generation. Their share in the revenues of the entire ICT sector was 80.8%. Enterprises included in the surveyed sector were more innovative than enterprises in the economy as a whole. In 2018-2020, almost half of the ICT sector entities introduced innovations in their company, while the rate for enterprises was 31.1% (Główny Urząd Statystyczny, Urząd Statystyczny w Szczecinie, 2021).

Among the primary benefits associated with the development of the ICT market in Poland, an increase in productivity and labour efficiency, improved social welfare and rationalisation of expenditure in specific sectors of the economy, as well as optimisation of the use of resources are mentioned (Ministerstwo Rozwoju, 2017). That demonstrates the crucial role of this sector in the process of making sustainable development a reality. Previous research dedicated to sustainable development and ESG shows that a significant proportion of technology companies in Poland are at the stage of planning, defining and developing long-term goals and ESG strategies. The main reasons they formulated ESG strategies were: the desire to operate in compliance with laws and regulations, to build a reputation and to maximise new sources of revenue. Entities that implemented this type of strategy placed the most significant emphasis on activities related to the environmental area (35%), followed by corporate governance (29%) and the social area (27%) (ManpowerGroup, 2022).

4. Description of the study

The research problem formulated for the study is contained in the following question: What importance do ICT companies attribute to the issue of corporate governance? The aim of the research was to identify and assess the actions taken by ICT companies in Poland in the area of corporate governance. Data and information were obtained using the CAWI (Computer-

Assisted Web Interview) survey method. The questionnaire survey involved 66 organisations with Polish capital, operating within the scope of "software & computer services". Ultimately, 39 questionnaires were analysed (it was decided to reject 27 questionnaires due to a high percentage of unanswered questions). The majority of the surveyed entities were companies from the SME sector. The respondents were managers or persons responsible for coordinating activities related to implementing the sustainable development concept or related concepts such as CSR and ESG. The survey was conducted between October and December 2021.

Within the area of governance, issues relevant to the development of ICT companies were identified using the expert method. These included: transparency (reporting of non-financial information), data protection, ethics and anti-corruption, and diversity in the composition of governing bodies.

Reporting non-financial information is an opportunity for entities to improve the transparency of their operations, manage risks effectively and gain the trust of key stakeholders. Reporting non-financial data is gradually losing the character of an administrative obligation and becoming an integral part of business communication with stakeholders (Kacprzak, Anam, 2015). As of 2023, the Corporate Sustainability Reporting Directive (CSRD) is in force in the European Union, extending the mandatory non-financial reporting to all companies meeting a minimum of two of the following criteria - EUR 40 million net turnovers, EUR 20 million in assets, 250 or more employees. The question that arises here is whether technology companies know their obligations under this regulation and whether they can meet them.

A significant aspect of governance is undoubtedly data security and protection. Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons concerning the processing of personal data and on the free movement of such data (RODO for short) has forced ICT companies to keep a register of processing activities, report breaches to the relevant supervisory authority, and cooperate with the Data Protection Officer (DPO). A source of security and data protection obligations for the sector under study is the Digital Operational Resilience Act (DORA) regulation, adopted by the Council of the European Union on 28 November 2022. This act aims to increase cyber resilience in the financial sector but will apply to financial institutions and qualified providers of ICT products and services.

The inclusion of ethics in the diagnosis of the ICT sector was dictated by the fact that codes of ethics are an essential regulator of economic relations. They are considered one of the tools to improve the effectiveness of corporate governance (Żabski, 2013). They formulate the core values of a company. These values include professionalism, attention to customer interests, reliability, diligence and honesty. Together with legal regulations, they define the boundaries of socially acceptable behaviour and thus prevent companies from shaping relationships arbitrarily that harm stakeholders.

The final element of governance diagnosed was diversity in the composition of governing bodies. The reason for the interest in diversity was the 2020 S&P Global report (Alison et al., 2020), which noted that although the representation of women on boards and director teams in technology companies has increased globally over the past ten years, there is still much to be done. Women occupy less than one-fifth of board seats in technology companies - fewer than in the financial or industrial sectors. At the same time, it has been noted that companies with more women than men in the IT department tend to be more advanced in their digital transformation efforts. The Institute for the Study of Labor research also points out the benefits of women's participation in top management. They show that the participation of women in top management positions tends to positively impact company performance, albeit that their occurrence depends on the women's level of qualification (Smith et al., 2006).

5. Results and findings of the studies

The results of the research carried out were structured according to the four elements of corporate governance examined.

5.1. Performance in the area *Transparency (reporting of non-financial information)*

In the context of transparency, the question was asked about having a position in the organisational structure responsible for coordinating sustainability/CSR/ESG activities and the approach to reporting. The survey shows that 26 companies still need to establish such a position. Four surveyed entities report sustainability issues. In 3 cases, this is done according to the United Nations Global Compact. One company reported under an initiative such as the Neutral Data Centre Pact, the European Coalition for Green Digitisation. None of the companies uses GRI (Global Reporting Initiative), a recognised standard for reporting non-financial information. The actions taken by companies in terms of corporate governance most often served to achieve sustainability development goals (SDGs) such as:

- Goal 9: Industry, innovation and infrastructure,
- Goal 5: Gender Equality,
- Goal 8: Decent work and economic growth.

The second group of objectives with a similar number of indications was such:

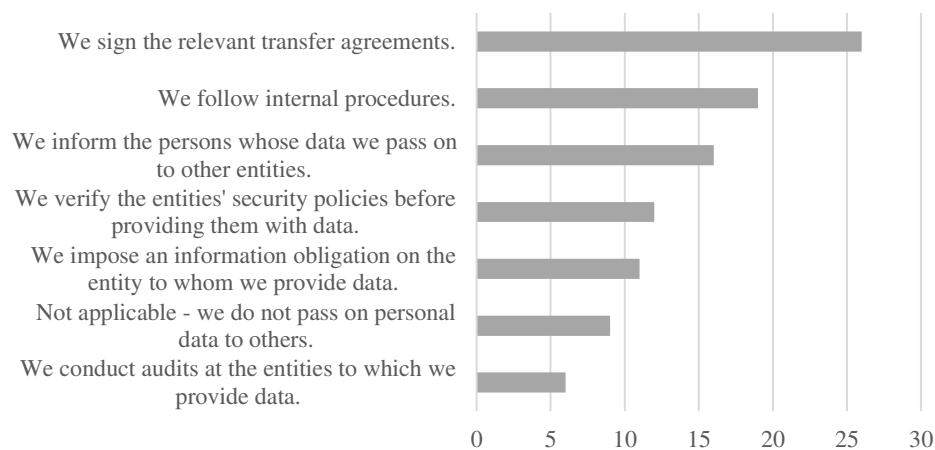
- Goal 13: Climate action,
- Goal 12: Responsible consumption and production,
- Goal 11: Sustainable cities and communities.

The goal that only one respondent indicated was Goal 16: Peace, justice and strong institutions.

5.2. Results in the area of *Data protection*

Among the most common solutions for data processing and use, personal data protection (35 indications), customer data security policy (34), and company website privacy policy (33) were mentioned. In 6 entities it was behavioural advertising measures.

The next question addressed the issue of transferring personal data to third parties. The most popular practices for transferring personal data to third parties were (Figure 2): signing appropriate transfer agreements (26), using internal procedures (19), and informing individuals about the transfer of their data to other entities (16). Auditing the entities where data is transferred is the least common practice (6).

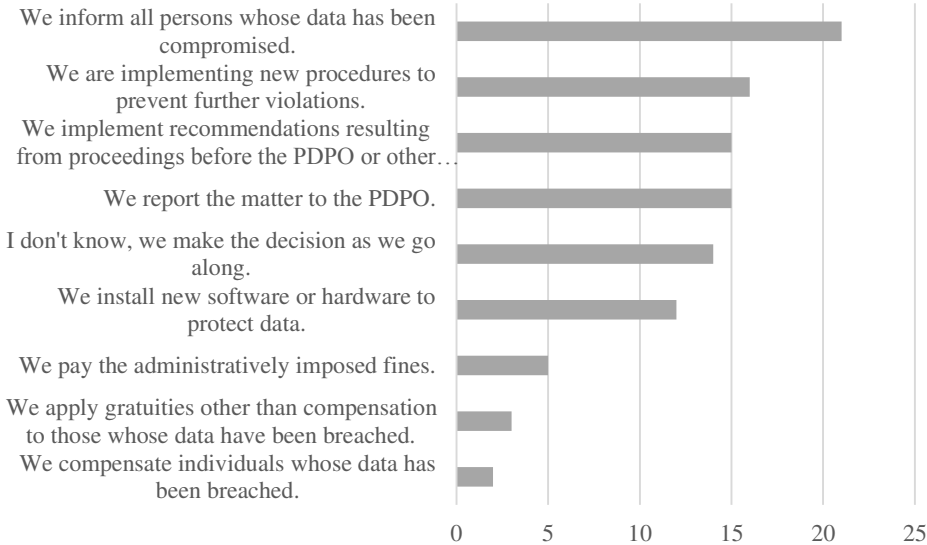


*Respondents could tick all answers corresponding to their companies' practices (if any).

Figure 2. Distribution of responses to the question on how companies regulate the transfer of personal data to third parties*.

Source: own study.

In the event of a personal data breach and 'leakage' of that data, the most common practices were (Figure 3): informing all persons whose data have been breached (21), implementing new procedures to prevent further breaches (16), reporting the matter to the Personal Data Protection Office (PDPO) (15) and then sensing the recommendations resulting from the proceedings before the PDPO (15). Fourteen companies did not know how to proceed in the event of a personal data breach and 'leakage' of this data. Paying compensation to those whose data had been breached was indicated by the fewest respondents (2).



*Respondents could tick all answers corresponding to their companies' practices (if any).

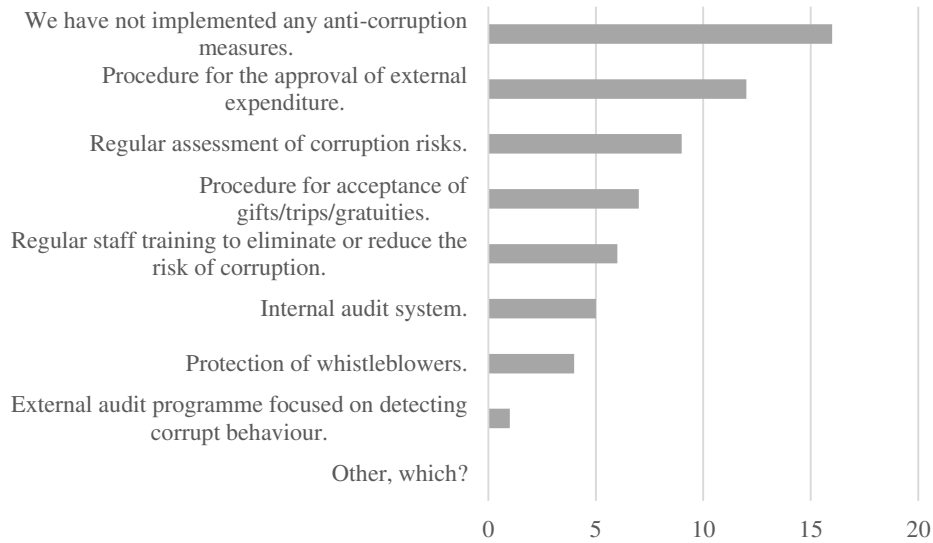
Figure 3. Distribution of responses to the question on procedures to be followed in the event of a personal data breach and ‘leakage of’ this data*.

Source: own study.

5.3. Results in the area of Ethics and anti-corruption

Only one-third of the surveyed entities confirmed having a code of ethics. Respondents of the remaining entities either claimed that their companies did not have such a document or had no knowledge in this regard. Nearly 1/3 of the respondents evaded answering the question on the number of ethics training sessions, and 14 respondents openly admitted that they do not conduct training on the subject. Most companies provide one training course per year. Only two companies registered high training activity in the surveyed area (20 and 30 training per year respectively).

To prevent corruption, the entities surveyed most often used (Figure 4): the procedure for acceptance of external expenses (12), regular assessment of corruption risks (9), and procedure for travel/acceptance of gifts/acceptance of gratuities (7). Nearly 1/3 of the entities still need to implement anti-corruption measures. The lack of institutionalisation of ethics in management does not imply a lack of ethical reflection in the surveyed entities. Half of the respondents stated that their company refrains from commissioning or participating in tenders that raise ethical concerns. Only one respondent indicated the practice of an external audit programme oriented towards detecting corrupt behaviour.



*Respondents could tick all answers corresponding to their companies' practices (if any).

Figure 4. Distribution of responses to the question on the type of anti-corruption measures implemented*.

Source: own study.

5.4. Results in *Diversity in the composition of authorities*

Twenty-three entities did not have a single woman on the board, and six have yet to respond (Figure 5).

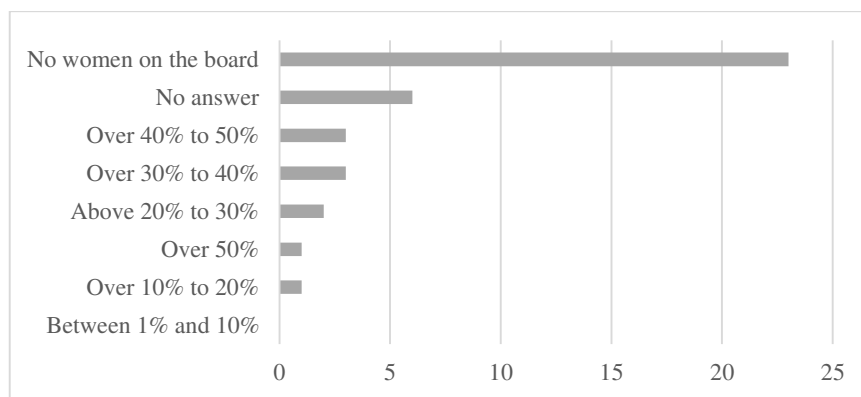


Figure 5. Percentage of female board members.

Source: own study.

The need for more women on the supervisory board was found in 16 entities, and 18 companies evaded answering this question (Figure 6).

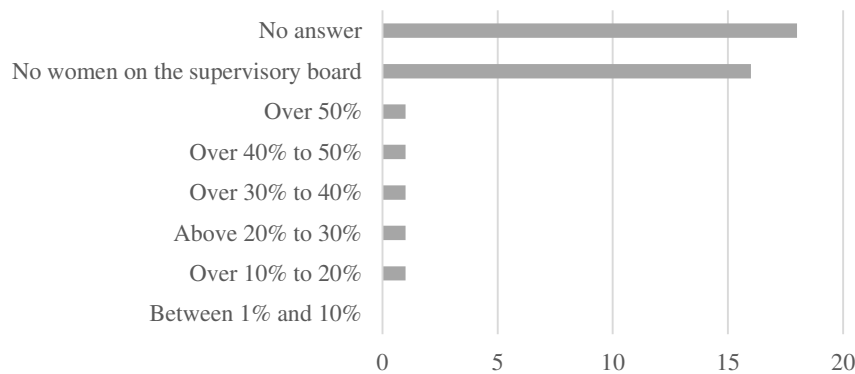


Figure 6. Percentage of women on the supervisory board.

Source: own study.

5.5. Findings

The research exposed the weakness of the corporate governance mechanisms of ICT companies in Poland. The involvement of the surveyed entities in CG can be described as highly unsatisfactory. Insufficient institutionalisation of ethics in management, lack of due diligence in data protection, evident gender disparities in the staffing of top management bodies, or underestimation of the importance of non-financial reporting are just some of the ills plaguing the surveyed sector. Continued disregard for corporate governance may result in a reduced ability to identify, assess and mitigate business risks, loss of stakeholder trust, and an inability to meet reporting obligations.

6. Conclusion

A limitation of the research presented in the study was related to the use of the CAWI technique. A higher return rate for the questionnaires was expected. The high number of non-responses also resulted in a certain number being rejected. Most of the questions in the survey were closed, which prevented the representatives of the enterprises from expressing their opinions in their own words. This construction of the research tool translated into a specific range of information obtained in terms of the topics covered and the scope. At the same time, thanks to this approach, it was not associated with interpretation difficulties.

The research was conducted before adopting the Corporate Sustainability Reporting Directive (CSRD) in 2022. Shortly, following the transposition of this directive into the national legislation of EU member states, including Poland, it can be expected that there will be an increased awareness in companies of the impact of non-financial risks (from ESG areas) on their operations. There will also be an increase in the activities of enterprises aimed at achieving sustainable development goals. Because of the above, repeating the research among small and

medium-sized enterprises, especially those listed on the regulated market, which will be affected by the publication of non-financial reports in 2027 for the financial year beginning 1 January 2026, is a potential direction for future research to assess the impact of the created regulations on changes and the pace of these changes made in enterprises within the framework of sustainable development.

In order to get on the road to sustainability, technology companies should build ESG strategies and define targets and mechanisms to measure and track performance in ESG areas. Creating new structures, teams or positions and implementing new tools to achieve environmental and social goals seems necessary. Corporate governance activities can play a crucial role in the process of change.

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Footnotes

¹ To better understand the different types of ESG rating providers, we can refer to a three-tiered classification (Li, Polychronopoulos, 2020, after D'Amato, D'Ecclesia, Levantesi, 2021): fundamental, comprehensive, and specialist. In the category of the fundamental are included ESG data providers that collect and aggregate publicly available data. Refinitiv (formerly, Thomson Reuters) and Bloomberg are examples of fundamental providers. The comprehensive providers' category can include MSCI, Sustainalytics, Vigeo Eiris, ISS, TruValue Labs, and RepRisk. The category called specialist consists of ESG data providers with specific expertise, that "specialize in a specific ESG issue, such as environmental/carbon scores, corporate governance, human rights, or gender diversity". In this category, for instance, we can insert TruCost (now owned by S&P Global), the nonprofit Carbon Disclosure Project (CDP), and Equileap (gender equality data).

THE IMPACT OF LOGISTICS AND MARKETING CUSTOMER SERVICE ON COURIER SERVICES

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Purpose: The aim of the study was to analyze the importance of logistics and customer service marketing in courier services on the DHL platform. In addition, the scale of influence of the marketing of the courier company in question on consumer decisions is suspicious.

Design/methodology/approach: The choice fell on the survey as a research method that gave the opportunity to analyze the researched problems from different perspectives, dealing with many issues at the same time, and also through the possibility of reaching more people from the research group.

Findings: It has been shown that activities related to logistics and marketing customer service are very important for the functioning of a courier company and achieving success in this industry.

Originality/value: The publication covers the subject of impact of logistics and marketing customer service on courier services. Combining interdisciplinary research in the areas of management and quality science with economics and finance.

Keywords: courier services, logistic customer service, internet marketing.

Category of the paper: case study.

1. Introduction

The market of courier, express and parcel companies is constantly developing and expanding, making them more and more efficient and effective. There is a noticeable increase in courier services provided in Poland in 2012-2017 and an increase in the value of these companies by 53%, which is about 3% of the total share in the European market. The increase in value is considered lower than the increase in quantity, which is 62%, because the average prices of courier services in Poland are almost half lower than the prices on the European market. The dominant factor is lower costs resulting from the employment of employees in Poland (Fachner, Szyszk, 2018). There are several types of companies providing CEP services in Poland. These are (Gulc, 2017):

- companies that operate internationally, with almost all countries in the world and have many branches; they mainly concern the shipment of express and parcel shipments, moreover, the services offered, due to the distance between countries, differ in the time and cost of delivery; both the European and the global market is dominated by large international corporations, e.g. DHL, TNT FedEx, UPS, which offer integrated services based on the guarantee of timely delivery of the shipment, shipment tracking and full implementation of the delivery process, including customs clearance; among international deliveries, and mainly intercontinental, air transport is used most of all, and rail or road transport is rarely used,
- companies operating mainly in Europe, e.g. GLS, DPD, the method of delivery is air and road transport, due to the development and convenient access to road networks in Europe,
- companies that operate only in the country where they thrive thanks to a developed network of national branches, including Opek, Siódemka, are primarily standardized express and parcel shipments,
- regional companies operating in a given region, e.g. in the province are served by smaller operators, which means that both the supplier and the recipient know each other personally, which positively affects urgent and valuable deliveries,
- enterprises operating on the local market, which often cooperate with companies from the previously mentioned groups, e.g. Sprinter; not only vans are used, but also motorcycles, scooters and bicycles for short distances,
- specialized companies that target a specific group of recipients in their activities.

In order to offer the right quality of courier services, there are a number of elements that affect optimization and customer satisfaction. This group includes offering unified services, fast delivery of parcels, individual approach to the client by adapting the services offered to the needs of clients, delivery of parcels on the agreed date and a high level of services provided (Rucińska, 2016; Uvet, 2020).

2. Motivation and purpose

Logistics and marketing management are related by the law of two concepts, i.e. logistics, which is an area of management focusing on flows, and marketing, which refers to the market concept of enterprise management. Both concepts have the same common point, which is the market that determines sales and supplies. The modern market and its development are closely related to the logistics and marketing process. These two areas are of strategic importance in the company and affect the integration of the supply chain and the system of creating value for the customer and enterprises (Majchrzak-Lepczyk, 2014). Thus, marketing and logistics form

a dual concept and subsystem of an integrated enterprise management system. This means that both logistics and marketing are equally included in the concept of enterprise management and are equally important in the functional spheres and integrated processes in the enterprise. At the same time, it allows to define the scope and process of integration and creation of a value system, i.e. in the area of operational, strategic and normative management, as well as the phase of strategic analysis of the situation, development of tactics, implementation of logistics and marketing plans (Blaik et al., 2005).

Customer service is a company-customer relationship based on mutual requirements in the context of the company. This means that the client wants to take advantage of the benefits of this from using a service or product and expects quality for what he paid for (Majchrzak-Lepczyk, 2015). Also, the customer expects that if they are not satisfied enough, the company will fix it. To offer the highest level of service, the company should offer the customer favorable financial and credit terms, deliver the product within the specified period, maintain the level of spare parts stock, provide promotional materials, provide flexible and safe service, collect and fulfill orders and visit customers (Wojciechowski, 2012).

In the context of marketing, customer service refers to the professionalism of sellers, quality assurance and activities that affect sales and customer satisfaction. This action also takes into account the financial aspect, which focuses on the terms of payment, with logistics allowing for an efficient flow of goods, and customer service understood as "the ability of the logistics system to meet the needs of buyers in terms of time, reliability, communication and convenience" (Stawiarska, 2012) or "the manner, place and time of offering the company's products along with detailed rules and forms of order fulfillment" (Kramarz, 2015).

In order to set customer service standards, various activities related to strategic logistics activities are undertaken. In order to improve them, customer service research and analysis are used, such elements as customer expectations as to the level at which the service is to be offered compared to the competition, the relationship between the costs resulting from the change in the level of service and the value of sales and market share, and the compliance of the logistics strategy with the marketing strategy, as well as the forms used to implement the company's global strategy (Rutkowski, 2005).

The relationship between marketing and logistics is strategic for all modern companies, which increases the awareness of enterprises in this area (Szydełko, 2012). An important element of enterprise management is also logistics and related activities. The most effective way to combine these two groups is to develop a logistics strategy that should take into account the concepts of marketing strategy related to the product, price and promotional activities from the perspective of using distribution channels (Łukasik et al., 2016; Ejdyś, Gulc, 2020).

3. Methodology

Logistics and marketing support for a large international company like DHL comes with many challenges. There are several other courier companies on the market that compete with DHL. It is important how DHL works, what are its logistics services and the use of marketing to maintain the level of its services and constantly win new customers. The above considerations prompted the authors to address the topic of the importance of logistics and marketing customer service in courier services, and therefore the following research questions were posed:

1. What determines the respondent's decision to choose courier services?
2. Do the respondents believe that marketing of logistics services is necessary?
3. Do respondents believe that DHL marketing influences the customer and his decision to use the services offered?
4. How are DHL services rated compared to other courier services?
5. What are DHL ads characterized by?
6. In what form do people like to receive advertising?
7. What do respondents say is the reason for DHL's success?

Based on the research questions, the following hypotheses were put forward:

1. The decision to choose courier services depends on the quality of services and price.
2. Respondents believe that marketing of logistics services is needed.
3. The survey participants believe that DHL marketing influences the customer and his decision to use the services offered.
4. Compared to other courier companies, DHL services are rated better.
5. Respondents describe DHL ads as interesting, encouraging and effective.
6. Participants of the study like to deal with advertisements on the Internet.
7. According to the respondents, the low price is the reason for DHL's success.

The survey was conducted in December 2021 only in electronic form. The research tool used to verify the hypotheses was a questionnaire. It was decided to use a survey as a research method, which gave the opportunity to analyze the researched problems from different perspectives, dealing with many issues at the same time, and also thanks to the possibility of reaching a large number of people from the research group. Using Google Forms, a virtual version of the survey was created, which contained 26 questions. The survey is part of a separate study.

The purpose of creating this tool was to prove the presented hypotheses and to present marketing at DHL - a logistics company dealing with courier services. DHL was founded in 1969 by Adrian Dalsey, Larry Hillblom and Robert Lynn. DHL is considered a world leader in the logistics industry. The company employs approximately 400,000 people in over 220 countries. In their work, they help clients grow, cross borders and discover new markets every

day, and send letters to loved ones. Approximately 1,614,000,000 parcels are delivered annually. DHL offers parcel and document shipments domestically and internationally, international air transport and same-day delivery, international sea transport, domestic, pan-European and worldwide road and rail transport within Europe and between Europe and Asia and direct shipments to various companies on an international level (DHL, O nas, 2023).

4. Results

The research sample that took part in the study consisted of 105 people: 65 women and 40 men. This shows that there were more women than men in the study group. Most respondents were aged 26-40 (39%), then 41-55 (26.7%), then 18-25 (18.1%). The penultimate, least numerous group were people under 18 (12.4%), and the smallest group were people over 55 (3.8%). According to the obtained results, the largest group were inhabitants of rural areas (49.5%), followed by inhabitants of cities with more than 100,000 inhabitants. residents. people (23.8%), later in the city up to 50 thousand. inhabitants (16.2%), and the least numerous group were people living in a city with a population of 50,000. - 100 thousand inhabitants (10.5%). In the question about education, most people indicated that they had higher education (45.7%), a slightly smaller group were people with secondary/vocational education (42.9%), then primary (7.6%), and the least numerous group were people with lower secondary education (3.8%). The largest group of respondents declared an average net income in inhabited households above PLN 2,000 (64.4%), a smaller group of people with income in the range of PLN 1,001-1,500 (13.9%) and PLN 1,501-2,000 (9.9%). Next was the group of people with an income of PLN 501-1000 (6.8%), and the smallest group with an income of PLN 500 (5%).

In response to the question "Where did you first encounter the term logistics?" the largest group were people who came across this term at school (56.2%), then former respondents who came across this term at work (20%), then in the press/television (10.5%) and on the Internet (9.5%). Of the smallest groups have never encountered this term (3%), the smallest group of people were people who came across the term "logistics" for the first time in scientific literature (0.8%). The next question concerned obtaining information whether a given person used it from logistics services. Most people (76.2%) answered this question in the affirmative. A smaller part of the answers (23.8%) was the group that had never used logistics services. After the respondents answered the question "What logistics services do you use?" most respondents admitted that from transport services (83.4%). Other services (23.5%) were ranked next. A smaller group were people using forwarding services (20%), and the smallest group were warehousing services.

The next question was: "How often do you use courier services?". The most common answer was several times a month, then several times a year (27.6%). A smaller group consisted of people answering once a month (9.5%), several times a week (8.6%) and once a week (8.6%). The least numerous group were people who answered that they do not use these services (1.9%). In the next question "What determines your decision when choosing courier services?" more than one answer could be selected. A significant proportion of respondents answered that their choice depends on the delivery time (71.4%) and the price of the service (65.7%). It was followed by the quality of services (44.8%), reliability (29.5%) and good opinion among friends and other customers (21.9%). The fewest people admitted that they are guided by the company's marketing when choosing (5.7%).

In the question "For what purpose do you use courier services?" respondents could select several answers. The largest group were people collecting the parcel (82.9%). Almost half of the respondents answered that they regularly shop online (50.5%). A smaller group were people sending parcels in this way (41.9%), and the least numerous group was saving time for self-delivery/collection of the product (31.4%). The next question concerned obtaining an answer to the question of what the respondents think about the quality of courier services in Poland compared to other EU countries. The largest part is the answer that they provide services at a high level (40%). Then the answer was that they were of medium quality (31.4%) and had no opinion on the subject, because the respondent did not know the industry in question (28.6%). None of the respondents indicated that courier services in Poland are of low quality.

The answer to the question "Have you used the DHL courier company?" there was an affirmative answer (84.8%), only a percentage of respondents answered that they had never used DHL services. Another question for people using DHL courier services is why they chose this company. They respond in their responses based on the criteria: Low Price, Random, Fast Delivery, No Specific Option, Company Trust, Trust, Company, and No Service Provider Selection. The question regarding the use of courier services other than DHL indicated that almost all respondents use the services of another company (96.2%), only a small percentage of users used DHL services only (3.8%). The next question also concerns the use of the services of companies, it was related to the question about the use of courier companies other than DHL and asked the respondents to indicate which companies they used and could receive more than one answer. The largest group of people using InPost services (89.2%), including DPD (84.3%), UPS (54.9%), GLS (48%) and FedEx (41.2%). A smaller group of people were customers of Geis (10.8%) and Raben (7.8%). The least frequent answer was MEEEST (2%).

In the next question, the respondents were to answer the question whether marketing of logistics services is needed. The vast majority of people admitted that it is needed (77.1%). A smaller group were people who had no opinion on the importance of marketing in logistics (16.2%). The fewest answers were given to a negative statement on a given topic (6.7%). The next question was: "How do you rate DHL's services overall compared to other courier services?". The vast majority of people answered that it is difficult to say (74.3%). The next

group in terms of the number of answers was "it's better" (18.1%). The lowest percentage was obtained by the answers "it is worse", "it is much worse" and "it is much better". The next question concerned marketing and the form in which the respondents most like to receive (watch, read, listen to) advertisements. Most people said that they like to do it online (29.8%) and in any form (27.9%). Subsequently, the same number of votes was cast for the answer that in any form (15.4%) and television advertising (15.4%). Print advertising was one of the least popular answers (9.6%), and radio advertising was the least popular. The next question concerned the effectiveness of marketing of courier services in Poland according to the respondents. Half of the respondents answered that it was moderately effective (50%), slightly fewer people said that it was effective and influenced the willingness to use the services. The least numerous group were respondents who admitted that marketing is ineffective and does not affect the willingness to use the service (3.8%).

Respondents were then asked if they had ever seen an advertisement for DHL services. Most people said they had seen it (42.3%), slightly fewer people said they were not sure (40.4%). The fewest people answered that they had never seen a DHL advertisement (17.3%). The next question concerned people who had seen DHL ads and those people were asked how they would describe the ads of a given courier company. Respondents could select several answers. Most people admitted that DHL ads are interesting (33.3%), followed by encouraging (31.7%), effective (21.7%), boring (16.7%), pleasant (15%) and ineffective (13.3%). The fewest responses were that they were eye-catching (6.7%), funny (3.3%), discouraging (3.3%), creative (1.7%) and unique (1.7%). None of the people surveyed found DHL's ads emotional or irritating. One of the last questions was whether respondents believe that DHL marketing influences the customer and their decision to use the services offered. The majority of responses were positive (45.2%), followed by abstentions and no opinion on the question (44.2%). The fewest people answered that they disagreed with this statement (10.6%). The next question was to get feedback on why respondents thought DHL was successful. Respondents could select more than one answer. The majority of people answered that the quality of the service affects it (59.8%). The next group consisted of people who believed that good organization in the company (34%), low price (28.9%) and marketing (20.6%) had an impact. The fewest people answered that these are factors other than those mentioned earlier (19.6%). The last question concerned whether the surveyed person would recommend DHL services to another person. More than half of people admitted that they would recommend DHL services (55.8%), a smaller percentage of people who had no opinion (39.4%). The smallest group were people who would not recommend DHL services (4.8%).

After analyzing the data and taking into account the respondents' opinions, it can be concluded that the logistics and marketing of customer service is an important element noticed by current and potential customers. Respondents are aware of what logistics and marketing are and what these areas deal with. The respondents are satisfied with the level of DHL services,

but they also used the services of other logistics companies. Most of the respondents were familiar with DHL's advertisements and rated them as positive and effective.

According to the research results obtained, almost all hypotheses were confirmed, except for the last one, which was not proven.

The first of the hypotheses was that the decision to choose courier services depends on the quality of services and the price. For this purpose, a question was asked in the survey "What determines the respondent's decision in choosing courier services?". The obtained results clearly show that these elements play an important role.

Another research question concerned whether marketing is needed in logistics services. According to the hypothesis, marketing in logistics is important and necessary. For verification, the question "Do you think that marketing of logistics services is necessary?" was asked. Marketing activities in logistics are important and over 3/4 of respondents agree with this statement.

Another research question concerned whether DHL marketing affects the customer and his decision to use the services offered. The hypothesis that DHL marketing influences the customer and his decision to use the services offered has been confirmed.

According to the fourth hypothesis, the services offered by DHL are better than other courier services. For verification, the question "How are DHL services rated compared to other courier services?" The response received directly indicated that DHL and the services offered by this company are better than those that can be obtained from other companies in the logistics industry.

Another hypothesis was that DHL's ads were interesting, enticing and effective. For verification purposes, the question "What are the characteristics of DHL advertisements?" was asked. The results obtained showed that the majority of respondents found DHL's advertisements interesting, encouraging and effective, so the hypothesis was confirmed.

Another hypothesis was that the favorite form and place to receive advertisements is the Internet. For verification, the question "In what form do people like to receive advertising?" was asked. Most of the answers concerned advertising on the Internet, which confirmed another hypothesis.

The latter assumed that the low price was the reason for DHL's success. The question asked "What do respondents think is the reason for DHL's success?" allowed to conclude that not the price, but the quality of services affects the success of the company. The second place among the success factors was good organization in the company, and only the third place was the price of the services offered. The hypothesis was not confirmed, however, the question showed that the price of services also plays an important role, as this answer was in the top three most popular answers.

It has been shown that activities related to logistics and marketing customer service are very important for the functioning of a logistics company and achieving success in this field. The aim of the research was to show the importance of activities related to logistics and

marketing customer service for courier services. Effectiveness achieved through the use of appropriate tools allows you to reach various customer groups, encourage them to use the services, recommend them to others and be a loyal and engaged customer.

5. Conclusions

Logistics and marketing are departments that exist in symbiosis. These departments need to support each other and put the customer first. Employees should remember that the most important resource and element influencing the company is the customer. It is the customer that enables the existence and guarantees the future of the company and the workplace. This approach is related to get information about how employees approach the customer. They should read and evaluate your approach, opinion, and ask a series of questions to help determine your audience and direction. Such questions in the marketing of logistics companies and customer service include: whether high standards of delivery time standards are set and whether they are strictly observed, whether innovative ideas in the area of customer service are collected and actions are taken to implement them, whether competent and kind people are employed for customer service who will quickly, effectively and efficiently answer all questions, consider complaints and solve problems.

Effective and efficient functioning of companies would not be successful without the appropriate quality of services, such as timely deliveries, affordable price, reliability or good opinion among customers. Appropriate effective actions allow you to stand out from the competition, retain customers and acquire new ones.

In order to arouse more interest among recipients of logistics services, logistics companies should use appropriate marketing. Most often, segmentation and positioning of logistics services, marketing communication and, above all, such methods as promotion, advertising, personal selling and public relations are used to achieve this goal. Logistics companies shape their own image and identity.

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OPTIMIZATION OF LOGISTICS PROCESSES IN THE SUSTAINABLE DEVELOPMENT OF MANUFACTURING ENTERPRISES

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Purpose: The aim of the research was to show the importance of optimizing logistics processes in commercial enterprises, the impact of optimizing logistics processes on customer satisfaction was presented.

Design/methodology/approach: A combination of several research methods was used. The method of literature analysis was used as the basic research method. In addition, by using the method of observation and the method of examining documents, it was possible to more accurately determine the phenomena occurring in enterprises and to obtain data, the comparison of which would allow to determine the impact of the applied change and optimization of the implemented processes. The supplementary method in the conducted research was the method of interviews with business owners, which made it possible to fill in the emerging information gaps.

Findings: The key importance of optimizing logistic processes in commercial enterprises for operational efficiency and competitiveness has been demonstrated. It shows the need to optimize processes in enterprises, the benefits that can be achieved by focusing on processes and becoming a process-mature organization to remain a competitive organization on the market. Company owners' understanding of the importance of process optimization, continuous improvement in this area and the use of modern IT systems is the key to surviving in a dynamically changing market, achieving higher indicators and organizational effectiveness in order to gain a competitive advantage over other entities present on the market.

Originality/value: The publication covers the subject of optimization of logistics processes in the sustainable development of manufacturing enterprises in the microeconomic aspect. Combining interdisciplinary research in the areas of management and quality science with economics and finance.

Keywords: logistics processes, manufacturing enterprises, sustainable development.

Category of the paper: research paper.

1. Introduction

Logistics is a very dynamically developing field both in the country and in the world (Murphy, Knemeyer, 2018). Every enterprise or other organization recognizes the importance of logistics in gaining an advantage over the competition. In order to maintain their position in the market, retain existing customers and attract new ones, companies are forced to constantly adapt to changing market conditions in the shortest possible time and with minimal effort and resources. The concept of logistics processes is inseparable from logistics. These, in turn, make up the company's logistics system (Pfohl, 2010). Logistics processes are accompanied by the flow of materials and information, and their management in the company requires diligence, analysis and continuous optimization, because logistics processes are largely interdependent. Organizations that currently operate on the market are trying to adapt to the changing conditions as best as possible, e.g. through the flexibility of operations and optimization of internal processes. It is crucial that the ongoing processes are properly identified, modeled, implemented, controlled and improved so that they bring benefits in the area of profitability, customer satisfaction and achieving competitiveness and even competitive advantage (Bielecki, 2022; Kayikci, 2018).

Process improvement is a consequence of proper controlling, i.e. monitoring and controlling processes. It is an equally important element on the process optimization path (Cherchata et al., 2022). Controlling is also a comprehensive analysis of the functioning of processes in the company and evaluation of these processes (Pisz, 2011). This stage is to give those implementing and managing the process the opportunity to efficiently perform their tasks based on the information collected at this stage. Controlling is also to ensure the achievement of the organization's goals and bring it closer to achieving a competitive advantage thanks to customer orientation. It is supposed to find bottlenecks in order to be able to react appropriately and optimize the process in this respect (Dobroszek, 2010). Thanks to controlling, the achieved goals are to give effects in the form of operational efficiency, operational efficiency, credibility in reports and allow for the implementation of processes in accordance with legal regulations (Bitkowska, 2013).

In process management, it is important to measure the effectiveness of processes in terms of time, quality, cost, flexibility, importance to the company and value to the customer. The consequence of this fact is the introduction of measures, and more specifically Key Performance Indicators (Anand, Grover, 2015). Their task is to measure the achievement of the set goals. The adopted measures are to give a picture of the degree of implemented activities and show the results obtained from the process. Indicators show to what extent the processes have delivered results to give the customer a product that meets his requirements (Grycuk, 2010). The attributes that allow to describe the processes are: process duration, process flexibility, process quality, process cost, timeliness of process implementation, importance for

the organization and importance for the client (Marr, 2012). The duration of the process should be understood as the averaged time of a given process, taking into account all operations and activities included in it. Based on this measure, it can be determined whether employees are sufficiently trained and whether the process is well organized, of course, these may be the reasons, but this is only indirect information and in the case of a decrease in the value of the asset, the reasons should be sought more thoroughly. Flexibility proves whether the process reacts properly to changes in the environment, reacting to changes means, for example, the possibility of improving the process, introducing changes in the process, combining operations. The quality of the process is expressed mainly by the level of customer satisfaction with the results generated during the process. The cost is directly related to the effort put into the process. The timeliness of the process implementation determines whether it falls within the adopted time frame, i.e. it compares the actual time of the process implementation with the planned time. The importance for the organization is related to the revenues achieved, and the importance for the client is related to satisfaction and the difference in the effects obtained as part of the process with the effects of e.g. another organization, which gives a higher level of customer satisfaction (Nowosielski, 2008).

The benefits of implementing and defining indicators include support in the company's decision-making processes and the ability to quickly respond to emerging harmful factors both outside, i.e. in the organization's environment, and inside it (Gozacan, Lafci, 2020). By analyzing the company's activities, you can constantly improve the efficiency of your activities. It is also the basis for comparing the parent organization with the competition, i.e. the basis for benchmarking (Bramham, 2005). Importantly, the use of IT systems is important for the possibility of introducing indicators in the organization. This involves the need to have (collect and store) data in order to be able to analyze it, on the basis of which appropriate levels of indicators can be created and the expected levels of indicators determined. Prepared data should be saved, selected and grouped. Process monitoring is most effective with the use of appropriate IT systems. This allows you to quickly find faults and then react by making adjustments to the process so that it correctly meets the adopted criteria (Jeston, Nelis, 2014).

2. Motivation and purpose

The process method of management is related to the optimization and improvement of processes. In turn, process management is related to the concept of reengineering, lean management, operational management, quality management and others. This is important because elements of process management (identification, modeling, implementation, control,

improvement) appear in various concepts of process management. For example, they show (Glistau, Coello Machado, 2016):

- The Total Quality Management (TQM) method focuses on improving customer service and self-control.
- Business Process Reengineering (BPR) introduces changes by designing processes, focusing on the customer, process improvement, introduces the idea of continuous improvement.
- Active Based Costing (ABC) evaluates the costs of task implementation.
- Active Based Management (ABM) analyzes the activities that make up the process.
- The Strategic Scorecard also focuses on processes that create added value for the customer, sets goals for good process implementation.
- Time Compression Management (TCM) is also customer focused and wants to automate and rebuild processes.
- Just in time (JIT) optimizes production and focuses on offering products at the right time.
- Kaizen is constantly improving processes, introducing small improvements, taking into account the opinion of employees.
- Kanban minimizes the length of the production cycle.
- Benchmarking, improves processes by comparing processes with those of more experienced companies and looking for new opportunities for process implementation.
- A similarly learning organization is supposed to learn by imitating others, but also to constantly improve processes.
- Supply chain management treats decisions, flows and activities in the chain as processes that have allowed their integration.
- Lean Management, streamlining processes by slimming them down.
- Project management based on process management, because projects are a type of processes for which CPM and PERT methods can be used.
- Outsourcing, transferring processes for implementation to external entities, outside the organization in order to better perform them by specialized entities.

Many of the mentioned process management concepts have an approach whose features perfectly or at least partially coincide with the idea and assumptions of the process approach and stages such as improvement or customer focus (Skurpel, 2019).

Process improvement is a stage of process management that must be open to information from customers, employees and management about irregularities in order to be able to react appropriately, often only prepared process models are incorrectly analyzed. Process simulation is also available for process improvement. This allows you to identify weak points in the company and determine the degree of resource utilization. IT tools make it possible to compare several available ways of implementing the process. It is necessary to identify the actual state of processes as accurately as possible in order to create an optimization model that will bring

the assumed benefits and will be susceptible to implementation despite changes in the environment. When reviewing the existing processes in the company, their optimization must bring benefits in the form of increased added value for the customer, but also bring positive changes in terms of efficiency, quality and shortening of time cycles (Dumas et al., 2018; Sgarbossa et al., 2020).

3. Methodology

A combination of several research methods was used. The monographic method was used as the basic research method, where a commercial enterprise is a special case. This made it possible to learn about the specifics of this institution and to learn about the logistic processes taking place and taking place in the area of its activity. Thanks to the use of the observation method and the document examination method, it was possible to more accurately determine the phenomena occurring in the company and to obtain data, the comparison of which allowed to determine the impact of the changes and optimization applied on the current processes. The supplementary method in the conducted research was the method of interviewing the owners of the enterprise, which made it possible to fill in the emerging information gaps.

It is worth noting that the questions arising in the area of the research problem result from the relatively low interest in the processes taking place in commercial enterprises, which is associated with the lack of cyclicity of some activities, which makes it difficult to use process mapping. methods, as is the case with production processes. The consequence of this is the willingness to answer the question:

How do the actions taken to optimize processes in a commercial enterprise affect the company's competitiveness and the level of customer service?

It can be assumed that the optimization of logistics processes has a positive impact on customer relations and increases the efficiency of the company's operations, which brings the company closer to achieving its goals. Hence, the following research hypotheses were adopted:

- Optimization of logistics processes in a commercial enterprise is important for maintaining the company's position on the market and gaining a competitive advantage.
- Optimization of logistics processes positively affects the company's ability to achieve its goals and the ability to provide customer service at a satisfactory level.
- Optimization of logistics processes contributes to development, i.e. to achieving an increase in the efficiency of the organization.

In the course of the research, the method of analysis and criticism of literature, including the literature of the subject, was also used, which allowed to get acquainted with, among others, with the issues of processes, including logistics processes, stages of the management process, which include their optimization, and what logistics processes can be distinguished in

commercial enterprises. Familiarizing with the available literature and then applying the method of literary analysis and criticism made it possible to determine what is already known and what authors need to demonstrate and learn through research.

Therefore, in order to fully explore the subject and obtain the missing knowledge, the monographic method was adopted as the main research method in order to be able to thoroughly analyze the logistics processes taking place within a given commercial enterprise and what is the importance of optimizing these processes. In order to obtain knowledge about the logistics processes in a specific company, the authors conducted research using the observational method, looking at exactly what processes take place in the organization, what actions are taken as part of these processes, what added value they give customers and what consequences bring changes in their structure.

Based on these observations, it was possible to present the currently implemented processes. In addition, the authors used the method of analyzing the documents they had access to. key performance indicators (KPIs) for selected processes in the company available for viewing, allowing you to compare these processes before and after their improvement. In conjunction with the observation method, it was possible to compare the current state of the processes with the state before optimization.

These methods gave rise to the use of comparative methods to compare the state of logistics processes before the introduced changes and the state after the introduced optimization changes (with the current state). In the conducted study, in order to fill in the information gaps that could not be obtained on the basis of observations or documentation of the enterprise, the method of interviews with the owners of the enterprise was used to obtain reliable information, allowing for the completion of all component data needed to obtain a full picture of the examined problem and the subsequent formulation of conclusions. from the conducted research.

4. Results

On the basis of research conducted in a commercial enterprise, it can be concluded that the optimizations introduced in the logistics processes taking place in the enterprise have a significant impact on the quality of activities carried out by the given processes. This is illustrated by the results of KPI measures obtained in the company, which are part of a separate study. Optimization of the selection of suppliers in the purchasing process, using the point method or the implementation of SRM system support, respectively, resulted in shortening the average delivery time from suppliers or manufacturers to the company's warehouse and increasing the indicators of completed deliveries. The quality of services provided by the suppliers of the surveyed company has increased, which is reflected in the growing values of the indicators of handled complaints, reliability of deliveries and flexibility

of deliveries. The average delays in deliveries and the share of defective deliveries also decreased. It can be concluded from this how important it is to introduce new methods and IT tools to support the process, in this case the purchasing process. The obtained benefits are not only a benefit for the company, but also the possibility of better service for own customers in the audited company.

On the example of observations and collected results from the review of the storage process, the most visible is the importance of investing in warehouse infrastructure - reception, storage, picking and release zones - but also devices and an IT system supporting the warehouse management process. The expansion of the warehouse infrastructure with reloading ramps significantly shortened the time of unloading and loading, which brought measurable benefits in the form of the possibility of making more deliveries to customers at a faster pace thanks to the possibility of handling a larger number of reloadings. Streamlining the warehousing process affects (thanks to the synergy effect and systemic approach to logistics) other processes, such as the process of transport to customers. A faster-loaded vehicle performs better in customer deliveries because it leaves the company's warehouse faster after loading.

The same effect can be observed on the basis of optimization through the labeling of load units and increasing the value of the correct release indicators - correct release of load units to the driver also results in the correct release of goods to recipients. In turn, scanners with data collectors improve the level of order picking. This should include improving the picking time, improving the completeness of prepared products and improving the picking accuracy index - these are indicators that together translate into an improvement in the OTIF index for the warehousing process. Similarly, the use of ABC and physicochemical-based storage methods brought benefits. Implementation of the ABC method shortened the time of placing goods in the warehouse and picking time, and the warehouseman was able to distribute more goods at the same time, i.e. his work efficiency increased.

Taking into account the physicochemical properties, which mean savings in the form of lower loss of value of products, the same effect was brought by the use of the FEFO method, which allows for a lower probability of products with a lost shelf life remaining in the warehouse. In the area of sales, the effects of optimization through the use of an extensive IT system and the collection of orders using tablets with access to the functionality of the system at the company's headquarters were presented again. Synchronization of this tool with the company's system allowed to collect more orders, but also to satisfy customers with the efficiency of service by sales representatives. The ability to check the current stock level meant that the customer's needs were fully satisfied by the completeness of the order placed. In the transport process improvement zone, the procedures carried out always had a positive impact on the level of indicators such as delivery readiness. At the same time, they have led to lower delivery costs, optimal fleet management, shorter delays and average delivery times. Even using the machine to convert defective cartons into fillers has improved the customer

experience by reducing complaints and increasing the likelihood that the shipment will reach the customer intact.

All these optimizations implemented on a large or small scale in the presented company resulted in an improvement in the quality of customer service due to the improvement of the indicators of these processes, which confirms the research hypothesis:

Optimization of logistics processes contributes to development, i.e. to achieving an increase in the efficiency of the organization.

It is impossible not to indicate in the conclusions how important the software and IT systems used are in optimization, whether at the stage of purchasing, storage, sales or the transport process. They bring the greatest benefits compared to other improvements, significantly reduce operating costs and increase the company's chances on the market.

The result of these optimizations is the improvement of the company's indicators related to its overall activity and competitiveness. In the subsequent analyzed periods, along with the improvement of process optimization indicators, general company indicators also improved. Sales dynamics increased by 17% compared to the previous year. The indicators of customer satisfaction and loyalty have also improved, and it can be observed that the company has lost fewer customers thanks to the optimization of processes. This results in an increase in the competitiveness of the company, which confirms the truth of the other hypotheses.

5. Conclusions

It has been shown that the optimizations made in the surveyed company in the field of processes increase the possibility of meeting the needs of customers, and thus offering them goods and services that better meet their needs. These optimizations allow for even more effective implementation of the 7W rule by the company, which directly translates into increasing the logistics capabilities of customer service and improving the level of service.

The key importance of optimizing logistic processes in commercial enterprises for operational efficiency and competitiveness has been demonstrated. It shows the need to optimize processes in enterprises, the benefits that can be achieved by focusing on processes and becoming a process-mature organization to remain a competitive organization on the market. Enterprises' understanding of the importance of process optimization, continuous improvement in this area and the use of modern IT systems is the key to the enterprise's survival in a dynamically changing landscape, achieving higher indicators and the effectiveness of the organization's activities in order to gain a competitive advantage over the competition.

As process improvements are made, the company's ability to gain a competitive advantage and increase business efficiency also improves. The need for technological and IT progress is the introduction of optimization in this area, using available, modern IT systems that are necessary for the functioning of current commercial enterprises.

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THE IMPACT OF LOGISTICS AND MARKETING CUSTOMER SERVICE ON E-COMMERCE

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Purpose: The aim of the study is to retain young customers shopping online. The subject of the study concerns the area related to management and optimization of management during online logistics and marketing purchases.

Design/methodology/approach: E-commerce has been steadily gaining more and more supporters in recent years. The Covid-19 pandemic and the restrictions introduced in stationary trade were of particular importance for online shopping. The role of logistic customer service and the impact of online advertising on purchasing decisions were examined. Survey research is the most popular method of social research, therefore, in order to obtain data necessary to achieve the goal of the work, a research tool was used, which is a survey questionnaire.

Findings: A detailed analysis concerned the impact of online advertising on the purchasing decisions of young consumers. It is an inseparable element of using network resources and allows you to reach a very wide audience - Internet users. It is this type of advertising that has the greatest impact on consumers, which is related to the constantly growing number of people using the Internet.

Originality/value: The publication covers the subject of impact of logistics and marketing customer service on e-commerce. Combining interdisciplinary research in the areas of management and quality science with economics and finance.

Keywords: e-commerce, logistic customer service, internet marketing.

Category of the paper: research paper.

1. Introduction

The issue of behavior in conditions of intense competition is becoming increasingly important. Consumer behavior resulting from expectations and needs consists in making a decision to take advantage of an opportunity when financial resources are scarce. Factors determining purchase decisions for customers are subject to research and analysis and form the basis of program decisions, which additionally take into account offers in order to meet

customer expectations and needs, and also allow to increase the level of their efficiency. Thanks to this, the level of acquiring buyers was obtained as an indicator of loyalty, and thus repeatability of purchases and recommendations (Liczmańska, 2015).

Consumer behavior should also be considered from the point of view of processing any information that reaches them. The processing process includes both the reception of stimuli and their retrieval and storage. Before making a purchase, the buyer takes many steps that will help him make the right decision (Maciaszczyk, 2014).

Consumers decisions depend on many factors resulting not only from their environment, but also from the internal conditions of the consumer as an individual. These elements form a set of interacting factors, constantly evolving and constantly changing other aspects. As such, each individual analysis of the elements influencing consumer decisions is a mix of cause and effect. Taking into account the classification proposed by P. Kotler, four groups of factors shaping consumers' purchasing decisions are distinguished, i.e. cultural, social, personal and psychological factors (Kotler, 2012). Getting to know these factors makes it possible to shape consumer behavior and adapt services and products to their needs. Knowledge of the rules of conduct of buyers is a key aspect for the company in the context of the process of preparing action plans. Therefore, the role of the company is to monitor the market and analyze the behavior of current and potential buyers (Nogieć, 2011).

2. Motivation and purpose

Today, there are many different stimuli that directly affect the buyer through the senses. The consumer, however, has the opportunity to choose the information that is important to him from among many simultaneously coming from the environment. For this purpose, it uses attention, which is the selective ability of the senses to focus on specific parts of the perceptual field, while suppressing or ignoring other irrelevant elements. The consumer, using the processes of perception and attention, collects information about the product, and then notices the existence of a consumer problem, looks for all alternatives to solve this problem and evaluates them to make a decision regarding the purchase or resignation from the purchase (Włodarczyk-Śpiewak, 2008).

Culture as the entirety of the material and spiritual achievements of society, patterns of behavior, beliefs and customs passed on to successive generations has a significant impact on the consumption standards of individual consumer groups (Kędzior, Kieźel, 2002). The phenomenon of cultural globalization had a significant impact on the functioning of enterprises, contributing to the emergence of a model of global consumption. In many parts of the world, the same behaviors, symbols, ethical and moral standards are used. Consumers from different cultural districts report similar needs, which they try to satisfy in a similar way.

As a consequence, enterprises are constantly identifying new segments of global consumers to whom global brands target their offers. On the one hand, the unification of consumption patterns on a global scale is the result of consumer mobility, learning from other cultures and adopting new consumption patterns. On the other hand, it is a consequence of the activities of global enterprises, which by directing their unified offer to various cultural groups influence their preferences and shopping experiences (Mirońska, 2010).

Social relationships are one of the rapidly changing life changes in the modern world, and thus an effect that affects consumer behavior. The development of the regulation itself to integrate the blurring of class differences. In this way, consumption became the probability of belonging to groups and accentuating in a social way, as indicated by the norm of a given century. Consumers really feel the effect of the show effect (i.e. imitating the consumption behavior of individual groups to which it aspires), which not only allows you to launch the activity of a specific reference group, but also allows you to emphasize your own functionality and get (Światowy, 2006). This is due to the consumption of products of certain brands, but also purchases in certain circumstances and places (Falkowski, Tyszka, 2009). The very process of making a purchase has acquired a social dimension and is often associated with satisfying needs such as spending free time with friends and family or making interpersonal contacts (Maleszyk, 2004).

The demographic factors determining purchasing behavior and spending structure are the stage of the family life cycle and the age of consumers. The age structure of Polish society is transforming into an "inverted pyramid", in which the number of individual age groups increases with the age of the citizens representing them. The group of buyers at retirement age is constantly growing, which on the one hand means an increase in the purchasing power of this market segment, and on the other hand is associated with a greater diversity of this group, which is why enterprises treat them as uniform from the point of view of needs and ways of satisfying them. Major changes are also taking place in the structure of households. Both the share of single-parent farms and the differentiation of purchasing behaviors of families at different stages of the life cycle are growing (Skawińska, 2009).

Another important factor influencing purchasing behavior is education, because a better educated society is buyers aware of their rights who are able to use the information appearing on the market to purchase goods of the highest value. An educated consumer has high requirements towards suppliers and producers and expects relatively the highest quality at a reasonable price, and at the same time is ready to share his knowledge with other producers and users, bringing a new quality to the process of creating a market offer. Shopping behavior is influenced by both common education and the evolution of content transmitted in the education process, using modern technologies as a carrier, such as the Internet (Adamowicz, Krasuska, 2016). Another element included in the group of personal factors is consumer income. Developed countries are characterized by a long-term trend of increasing prosperity. The structure of household expenditure changes as the number of people with above-average

income increases. The share of expenditure on food is decreasing, and the share of expenditure intended to meet higher needs is increasing. There is an increasing demand for various forms of spending free time, as well as for services and goods related to health and luxury goods (Mruk et al., 2007).

Cultural, social and personal changes are contributing to the evolution of the motivations, values, attitudes and perceptions of today's consumers. Increasingly, traditional values such as family, generosity, willingness to sacrifice and customs are mixed with new values such as health, self-fulfilment, efficiency, individualism and material comfort. In the hierarchy of goals, the family loses its position in favor of professional qualifications, high education and a good financial situation. Lifestyles is a category that includes mental factors and connects them with behaviors in everyday life. The lifestyle of modern consumers is mainly characterized by mobility (business trips, leisure with family), spending free time actively (shopping, going to the cinema or restaurant), as well as using technology: mobile phone, Internet (Kicińska, 2009).

Consumption is one of the basic factors in the development of societies. It is an important economic tool and regulator of life, controlling market mechanisms and directing the economic situation. In addition, it is a symbol of modern societies in highly developed countries. It is also worth adding that in individual countries, global trends in consumption occur with heterogeneous intensity. They influence both the behavior of buyers in a mature market economy and in developing countries (Żelazny, 2009; Choi, 2019).

Constantly changing living conditions and trends prevailing in the buyer's environment contribute to the formation of new consumer characteristics, such as (Dybka, 2017):

- greater awareness of their rights and a more rational approach to the commercial offer;
- the need for social bonds leading to the use of products and services that connect these;
- increase in skills of strategic management of one's own budget;
- "multiculturalism" - both thanks to global strategies for the functioning of enterprises and the pursuit of maintaining cultural specificity and identity. The global increase in the standard of living contributes to the possibility of buying international branded products by a larger group of people, who are sometimes guided by national heritage when purchasing local branded products;
- increasing mobility, integration with others in many areas and striving to protect the natural environment, consumption of ecological products, as well as the use of biodegradable packaging.

Trends relating primarily to the behavior of buyers and distinguishing entire customer segments can be an inspiration for companies and the basis for creating new strategies, products or ideas. Some companies use these strategies to decide on their offer, others will confirm the validity of the strategies implemented so far, still others will continue to operate despite the detected changes in customer expectations, and the gap between market requirements and their offer will increase. This situation does not mean, however, that these companies will not

survive, because they can successfully operate in a niche, due to the fact that not all consumers follow global trends, and moreover, some trends are also niche (Pleśniak, 2004; Rajendran et al., 2018)

3. Methodology

Consumer behavior is the subject of many market studies, not only in the economic context, but also in the psychological, ergonomic, biological and sociological context. There are many definitions of consumer behavior in the literature, covering their various aspects. The first one is the entirety of activities aimed at obtaining and using services and products as well as disposing of them, together with decisions conditioning and preceding these activities (Burlita, 2014). Therefore, consumer behavior consists of two types of reactions, purchase and consumption. The second definition indicates the general actions and perceptions of the consumer that make up the preparation of decisions regarding product selection, its selection and consumption (Wolny, 2016). Thus, in this case, the consumer's behavior consists of three types of reactions: communication, purchase and consumption. Another defines consumer behavior as feeling needs and assessing them, as well as determining a subjective hierarchy of one's needs, choosing ways to satisfy more important needs and ways to obtain and service them. Particularly important in consumer behavior are economic criteria, including a comparison of the consumer's income with the prices of these funds. Consumer behavior is a concept that assumes that behavior is directed towards a specific way of satisfying a need. Therefore, the buyer wants to achieve a specific desired state, defined by the level of aspirations, expressed by the needs that must be satisfied with the purchased products. Consumer behavior in accordance with this concept can be explained by the description of the internal reactions of the buyer to the stimuli acting on him. This behavior depends on the consumer's perception and interpretation of the stimuli and how he or she interprets the information obtained (Rybowska, 2010).

The aim of the research was to learn and present the behavior of young consumers participating in the process of purchasing goods and services. The study was conducted in April 2021, during the Covid-19 pandemic. The study involved 140 people, 103 women and 37 men. Women accounted for over 73%.

Surveys are the most popular method of social research, therefore, in order to obtain the necessary data, a research tool was used, which is a survey questionnaire, which is part of a separate study. It was developed by the authors and consisted of 22 questions and a metric. The survey was fully anonymous. The study covered Internet users aged 16 to 26 - born after 1995, representing the "Z" generation (Kieźel, 2010). The sample was selected using the non-

random technique, "random" selection. The study was conducted using an interactive form available on the online platform to be completed.

The analysis of the socio-demographic characteristics of the surveyed population will allow to determine the shopping preferences of consumers and their online behavior and to compare them by gender, place of residence, income or marital status.

4. Results

Online shopping brings various benefits to consumers, which is why it is gaining more and more popularity. Depending on the needs of customers, various factors determine whether they will make purchases online or convince them to choose an online store instead of a brick-and-mortar store. In addition, through the prism of various fears, as well as their own experiences, they assess the factors discouraging online shopping. The study focused on the analysis of positive and negative factors determining online shopping. Each respondent indicated a maximum of 3 positive and negative factors.

According to the respondents, the factor that most influenced their online shopping was the lower price than in traditional stores (52.9%). The same percentage of respondents - 47.9% - indicated convenience and time saving as a factor determining online shopping. The conclusions of the conducted study coincide with the conclusions of the PwC and Digital Experts Club report "Strategies that win", developed on the basis of interviews with e-commerce leaders. According to her, the key factor when choosing an online store is the price (68%), and for young consumers also the speed of delivery (Polacy nie porzucają zakupów online, 2021). The least frequently chosen factor influencing online purchases was accurate product information (5%).

The research shows that in 60.7% of cases online shopping is discouraged by the lack of opportunity to familiarize yourself with the goods. An equally high percentage of indications (60%) indicated the risk of receiving defective goods as a factor discouraging online purchases. Nearly 43% of respondents see additional delivery costs as a disincentive to online shopping. According to the ExpertSender report "Online shopping in Poland 2020", based on research conducted in August 2020, the most disincentives to online shopping are pop-up advertising and the lack of free delivery or its unpredictable date. It can be seen that some factors negatively affecting the assessment of online shopping according to the research data are convergent (The ExpertSender report..., 2020).

A multitude of factors determining the choice of an online store is an element that significantly affects purchasing decisions. Consumers in their shopping choices are often guided by other people - close friends or strangers from the Internet. People making purchases are not free from the opinions of celebrities or messages carried by advertisements. Individual

factors contribute to making the final decision and choosing the right product. The last analyzed aspect concerning online purchases made by the respondents were the factors influencing the choice of an online store.

Analyzing the results of the conducted research, it can be concluded that the choice of an online store by the surveyed women and men was equally affected by individual factors. The same average (4.38) respondents of both sexes indicated the importance of knowing the online store when shopping online. This means that it often or very often determines the choice of where to shop online by the respondents. In turn, advertising was the factor with the lowest average value - 2.57 for men and 2.99 for women, so it rarely influenced the decision to buy in a given online store.

Taking into account the place of residence of the respondents, it can be seen that respondents living in cities rarely or neither often nor rarely chose an online store based on advertising (average in cities of all sizes below 3), while people living in rural regions did so more often (average 3.14). In addition, advertising as a determinant of the choice of an online store for online shopping reached the lowest average in all surveyed places of residence, which means that it had the least impact on this choice. In addition, it can be stated that the factor that often or very often determines the choice of an online store is the knowledge of the store for each type of place of residence under study. The average values in all analyzed variants ranged from 4 to 4.6.

When examining the factors influencing the choice of an online store by respondents, it is worth focusing on the level of their income. The way in which the consumer makes purchasing decisions will depend on the financial capacity of the consumer. Analyzing the level of income of the surveyed people, it can be concluded that for each income range, as well as for people who do not have it at all, the most important factor influencing the choice of an online store is its familiarity. The average ranged from 4.24 to 4.50. In the case of people with a monthly income of PLN 2,001-2,500, the lowest average - 3.05 - was obtained by the result in the search engine as a determinant of the choice of an online store. In turn, the opinion of friends often determines this choice in the case of people with an income below PLN 1,000 (average 4). Consumers believe in the recommendations of people they trust and only check recommended online retailers.

The value of the online advertising market in Poland amounted to over PLN 5 billion in 2020 (IAB Polska/PwCAdEx, 2020). The level of these expenses increases year by year and shows how important advertising plays a role in the consumption process. Another analyzed aspect of the study were the forms of advertising that the respondents encounter on the Internet. The impact of place of residence and gender on the frequency of occurrence of six selected forms of advertising was analysed.

Respondents encountered all the analyzed forms of advertising on the web sporadically or often, both in the case of women and men, because their average value in each case was from 3 to 4. Women most often encountered advertisements in the form of pop-up windows on the

web. / pop-under (average 3.70) and male search engine keywords with a score of 3.76. In cities over 401,000 inhabitants, each of the surveyed forms of advertising occurred with a similar frequency - the average was about 3.5. Mailing is often or the most common form of online advertising among respondents. Respondents living in cities with up to 30,000 inhabitants residents often come into contact with mailings, sponsored links and advertising buttons, because their average is 4. The least frequently indicated forms of advertising found on the web were billboards, which in the city of 101-400 thousand. inhabitants reached an average of only 2.79.

The next stage of the study was the analysis of the frequency of purchase of eight selected types of products by respondents thanks to online advertising. A scale from 1 to 6 was used, where 1 - difficult to say, and 6 - always. The results obtained are presented in Table 1 broken down by the marital status and place of residence of the respondents and in the table taking into account the income of the respondents and the assessment of their financial situation.

Table 1.

Frequency of purchase of particular types of products, broken down by marital status and place of residence of respondents

Category	Mean							
	Food products	Cleaning products	Cosmetics	Household appliances/electronics	Furniture	Clothing	Footwear	Jewelery
Marital status								
single/single	3.35	2.96	4.19	3.85	2.81	4.56	4.26	3.32
married	3.25	3.35	4.30	4.15	4.00	5.00	4.75	3.95
widow/widower	2.00	4.00	6.00	5.00	4.00	4.00	5.00	3.00
in an informal relationship	2.97	2.77	4.31	3.86	3.31	4.80	4.54	3.63
Place of permanent residence								
village	3.43	3.03	4.29	3.69	3.14	4.72	4.50	3.59
city up to 30,000 inhabitants	3.45	3.18	4.55	4.18	3.18	4.91	4.45	3.36
city 31-100 thousand inhabitants	2.92	2.92	4.16	4.36	3.12	4.56	4.40	3.36
city 101-400 thousand inhabitants	2.95	3.11	4.21	3.95	3.11	4.84	4.63	3.47
city of 401,000 residents and more	3.19	2.74	4.15	3.78	3.04	4.48	4.04	3.44

Rating on a scale of 1 to 6, where 1: don't know, 2: never, 3: rarely, 4: occasionally, 5: often, 6: always.

Source: own study based on research results.

On the basis of online advertisements, single and unmarried men never or rarely decide to buy cleaning products, while they occasionally or often buy clothes and shoes. It is similar in the case of the surveyed people living in informal relationships. Respondents who are married often buy clothes encouraged by online advertising, and sporadically - furniture. The surveyed people from all the analyzed marital statuses rarely or sporadically buy jewelry on the basis of online advertising. There are no big differences between the average frequency of purchase of the discussed products by the respondents depending on the place of residence.

Both respondents living in the countryside and in the city, encouraged by online advertising, buy cosmetics occasionally or often, and furniture rarely or sporadically. Respondents never or rarely buy food based on online advertising.

Table 2.

Frequency of purchase of particular types of products, taking into account the division into the assessment of the financial situation and the level of the respondents income

Category	Mean							
	Food products	Cleaning products	Cosmetics	Household appliances/electronics	Furniture	Clothing	Footwear	Jewelery
Assessment of the financial situation								
very angry	5.00	4.00	5.00	5.00	3.00	5.00	3.00	5.00
bad	3.00	3.50	5.00	4.50	3.25	4.25	3.50	2.75
average	3.37	2.83	4.17	3.92	3.00	4.37	4.25	3.13
all right	3.20	3.11	4.42	3.88	3.27	4.91	4.59	3.83
very good	2.89	2.79	3.68	3.74	2.89	4.84	4.47	3.37
Revenue level								
no income	3.20	3.20	4.50	3.10	3.30	4.30	4.40	3.10
up to 1000 PLN	3.75	2.58	3.92	4.25	3.50	4.42	3.83	3.08
1001-1500 PLN	3.14	2.90	4.45	4.00	2.97	4.66	4.55	3.66
1501-2000 PLN	3.15	3.25	4.35	3.95	2.90	4.65	4.35	3.20
2001-2500 PLN	3.33	2.86	4.14	4.05	3.05	4.71	4.43	3.38
2501-3000 PLN	3.44	3.44	4.44	4.25	3.19	4.75	4.56	3.88
over 3001 PLN	3.00	2.81	4.03	3.63	3.19	4.88	4.44	3.66

Rating on a scale of 1 to 6, where 1: don't know, 2: never, 3: rarely, 4: occasionally, 5: often, 6: always.

Source: own study based on research results.

The research results indicate that the surveyed people who described their financial path as very good, never buy, relying on advertising on the Internet, cleaning products and furniture, or they rarely do it. Most often, thanks to online advertising, respondents buy clothes - suddenly or often. Respondents with an average financial situation, based on advertising, rarely or suddenly buy cosmetics, clothes and shoes. On the other hand, respondents with a very bad financial situation often buy food, aid or household appliances through advertising on the Internet. If this has an impact on revenue from buying source data based on online advertising, then respondents from all income sectors analyzed rarely or suddenly gain influence and benefits. Respondents without income suddenly or often buy clothes encouraged by advertising in the network of cosmetics, clothing and footwear, as well as people with an income above 1000 PLN.

5. Conclusions

A detailed analysis concerns the impact of corporate and marketing customer service on the purchasing decisions of young customers. This is an inherent use of network resources and allows you to reach a very versatile recipient - Internet users. To the top industry by type of activity, which is associated with an ever-growing branch of network entities. Apart from

a small part of the time spent on Internet activities. The products purchased by respondents whose products have an impact on the logistics and marketing of customer service are cosmetics, clothing and footwear. It attaches itself to teenagers because young consumers rarely run their own household and do not use it to buy household appliances or cleaning products, but focus on ordinary needs in the form of clothing or maintenance.

Logistics and customer service marketing influence the purchase of various goods among the surveyed people to some extent, but it is not a decisive influence. Due to the intrusive form of presenting some advertisements on the Internet, consumers have a negative attitude towards them. This causes ads not to open and even pop-up blockers to be used. An overly aggressive advertising campaign, instead of encouraging consumers to buy, may have the opposite effect. Young online consumers mainly use messengers and social networking sites. They spend the same amount of time studying online. The pandemic had a big impact on this, because students were obliged to learn remotely, and they rebuilt lost contact with their peers using the Internet.

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AN ECONOMETRIC MODEL OF HOUSEHOLD ELECTRICITY CONSUMPTION. A CASE STUDY OF POLAND

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Purpose: Electrical energy is in this day and age fundamental to the functioning of every household. The use of gas, heating oil or solid fuels for home heating also involves the supply of electricity. Today, electric power is the most environmentally friendly source of energy. Experience has shown that substitution of an oil heating system with a heat pump resulted in significant financial savings for the household.

Design/methodology/approach: The purpose of this paper shall entail the construction of a multi-equation econometric model describing the mechanisms of electricity consumption in a specified household. The model takes the nature of a system of interdependent equations. Described shall be the monthly volume of electricity consumption, payment amount of for this energy (in PLN), and price per 1 MWh in a given month. Monthly time series from September 2015 to November 2022 have been used, which resulted in a time series with a count of 87 statistical observations.

Findings: The econometric model of household electricity consumption presented in this paper confirms both the hypothesis about feedback between the variables USAGE and PRICE as well as the recursive effect of electricity consumption volume on its value in monetary units. In addition to the cognitive value of the econometric modeling results obtained, the empirical tool constructed makes enables forecast estimation of the energy consumption volume, its value and unit price in subsequent months, for at least 12 consecutive months.

Practical implications: This type of research has great practical utility. They make it easier for rational interaction between electricity sellers and specific consumers.

Social implications: Knowledge about the mechanisms of electricity consumption on the farm home may influence the rationalization of consumption and spending. This type of rationalization should have a positive impact on the environment natural, contributing to the reduction of greenhouse gas emissions.

Originality/value: The novelty and originality of the work are the identification of the mechanism behavior of a single household consuming energy electric. Feedback between magnitudes revealed electricity consumption and its price on a specific farm home. The recipients of the work will be electricity sellers, consumers, and researchers of household market behavior.

Keywords: econometric model, electricity consumption, interdependent equations.

Category of the paper: Research paper. Case study.

1. Introduction

The use of energy sources underpins human life. Currently, by far the most important of household energy sources is electricity. In fact, there are households where electricity constitutes the only source of power. It is worth paying attention to the ongoing energy transformation. There is a shift away from fossil energy sources such as: oil, gas, or coal. Renewable energy sources play an increasingly important role. The presented household is in line with this trend.

The decarbonization of the Polish economy will cause increased household demand for electricity. At the same time, rising energy prices will correct demand, which will result in a negative feedback between the price and its consumption.

The purpose of this paper entails the construction of a multi-equation microeconomic model describing the mechanisms of electricity consumption in a specified household. The model takes the nature of a system of interdependent equations. Described shall be the monthly volume of electricity consumption, payment amount for this energy (in PLN), and 1 MWh rate in a given month. Monthly time series from September 2015 to November 2022 have been used. The resulting time series has a count of 87 statistical observations.

The work has an original character, presenting the case of a specific household. In this household, electricity is the only source of energy. There is a lack of such research in the literature due to unavailability of statistical data regarding the consumption of electricity in specific households.

2. Literature Review

Household electricity consumption has been the subject of many scientific papers. The period from 2016 onward is marked by articles addressing the issues of household electricity consumption analysis by means of ordered logit models, i.e., the example of Turkey (Ari, Aydin, Karacan, Saracli, 2016). One of the articles worth noting deals with the analysis of electricity consumption behavior, based on a case study of a non-business household in Malang (Karisma, Maski, Noor, 2016). The impact of geodemographic factors on electricity consumption and forecasting models has also been addressed in the subject literature (Singh, Alam, Yassine, 2016). Another paper discusses the econometric modeling of household electricity consumption as a tool in calculating the social norm of consumption (Zaitseva, Yu, 2016). Case study investigation of the energy savings resulting from fan coil speed control based on the number of persons (Hernández-Tabares, 2017) represents an important focus as well. Yet another noteworthy paper entitled *Disentangling household and individual actors in*

explaining private electricity consumption concerns individual electricity consumption (Seebauer, Wolf, 2017). Hidalgo J., Coello S., Mg., González Y. (2018), in turn, have addressed the subject of electricity demand factors in Marginal Ecuador, through a case study of Monte Sinai. M.J. Kim (2018), in contrast, presents the characteristics and determinants of household electricity consumption in Korea. A paper by Ali S.S.S., Razman M.R., Awang A. (2020) tackles the topic of estimating household electricity consumption and appliance ownership in a Malaysian intermediate city. *Determinants of household electrical energy consumption: Evidences and suggestions with application to Montenegro* constituted the subject of research by Đurišić V., Rogić S., Smolović J.C., Radonjić M. (2020). In Greece, a study of the sociodemographic determinants of household electricity consumption was conducted using quantile regression analysis (Kostakis, 2020). A Nigerian example can be found in a paper (Mamudu, Ochei, 2020), in which an empirical analysis of electricity consumption, in relation to the economic growth in Nigeria, was undertaken. Non-linear analysis of the effect of electricity price on household electricity consumption constituted the subject of research in an article by Zhang L., Wen X. (2021). Finally, a comparison was made of energy consumption in American households, in distribution by climate region (Debs, Metzinger, 2022).

As the above literature review shows, researchers have taken a significant interest in various aspects of household electricity consumption. Nevertheless, further research into the topic so essential to the operation of each household, regardless of its location, is still needed.

3. Methodology and Data

The paper shall attempt to describe the mechanism of household electricity consumption volatility in monthly terms, from September 2015 to November 2022. The household is located in Toruń (Poland). It covers a land area of roughly 6000 m², with a house of approx. 300 m², a 60 m² detached garage, and an outbuilding of circa 450 m². The only energy source used in this household is electricity, obtained exclusively from the power grid. There is no use of gas. Up until March 2021, the house had been heated with fuel oil. In April 2021, the oil furnace was replaced with a heat pump. Electricity is thereby used for the heating and lighting of the residential dwelling and the garage, for cooling, as well as for utility and land-irrigation ground water intake.

The paper shall describe the mechanism of electricity consumption, described by a system of interdependent equations. The volatility thereof shall be considered both quantitatively as well as in value, including analysis of the 1 MWh unit price dispersion, i.e.:

$$\text{USAGE} \begin{cases} \rightarrow \text{VALUE} \\ \rightarrow \text{PRICE} \end{cases} \quad (1)$$

where USAGE represents the volume of monthly electricity consumption, VALUE is the monthly cost of electricity consumption in PLN, and PRICE indicates the unit price per 1 MWh, in PLN. Formula (1) shows that the volume of electricity consumption directly affects its cost to the household and the unit price. Simultaneously, the unit price of energy exerts impact on the volume of energy consumption. This means that the variables USAGE and PRICE form a feedback loop, i.e.:

$$\text{USAGE} \longleftrightarrow \text{PRICE} \quad (2)$$

Negative feedback of the above pair of variables can be expected. An increase in energy consumption results in a unit price decrease, while an increase in the unit price induces a decrease in electricity consumption.

The process of household electricity consumption shall be described by three stochastic equations. Each equation's parameters shall be estimated using the ordinary least squares method. The reasons for this estimation approach have been described in the work of Wisniewski J.W. (2022). Autoregressions, lags of endogenous variables, a trend and monthly periodic fluctuations are taken into account in the model equations. A model such as this can be used to forecast endogenous variables using an iterative method, as described in the work of Wisniewski J.W. (2021, 2016, subsection 2.5, 2023, subsection 2.4).

4. Results and Discussion

In the period from 2015 to 2020, seasonal oscillations occurred in the volume of electricity consumption and the amount of its value in the household under consideration. After the abandonment of the oil-fired heating system for the house and domestic water supply, and the installation of a heat pump, a sharp increase in the magnitude of the variables USAGE and VALUE occurred. This is illustrated in Figures 1 and 2. In the period from 2015 to 2019, a stabilization of the energy unit price is also observed. A price spike occurred in March 2000. The unit price fluctuated since then, with a slight tendency to rise steadily. This process is illustrated in Figure 3, showing the fluctuations in the variable PRICE. Unit prices for household electricity ranged from PLN 607.89 to PLN 740.90 per MWh.

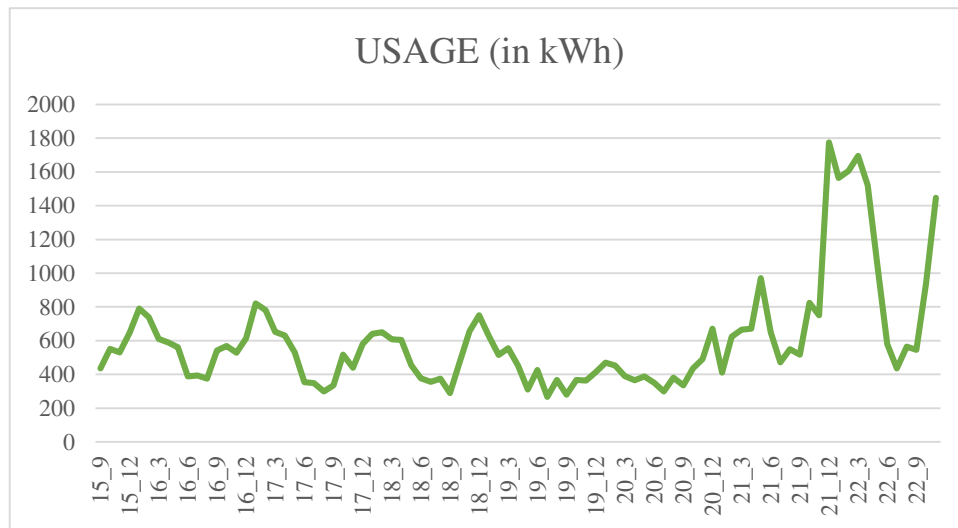


Figure 1. Monthly household electricity consumption in the period 2015.09 – 2022.11.

Source: ENERGA invoices.

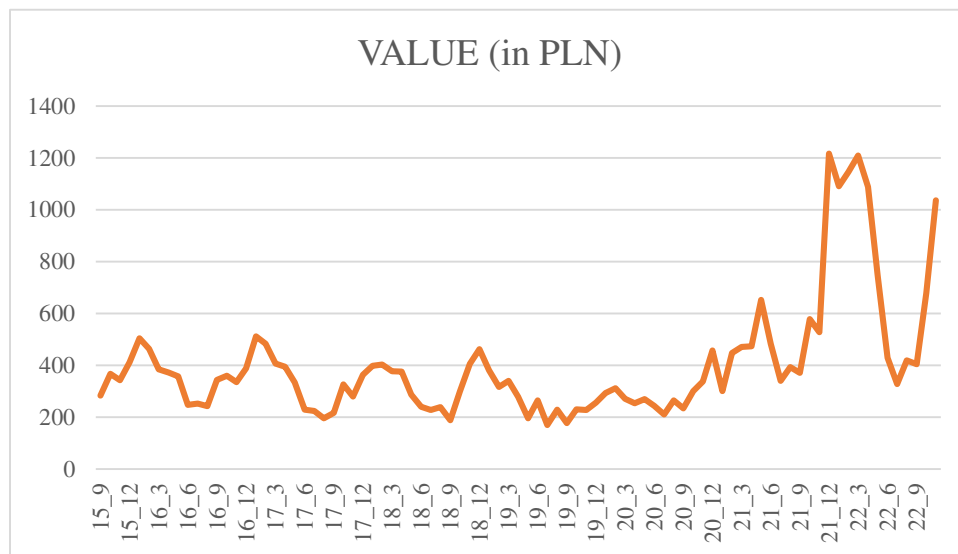


Figure 2. Value of monthly household electricity consumption in the period 2015.09 – 2022.11 (in PLN).

Source: ENERGA invoices.

Parameters of three stochastic equations forming the household electricity consumption system were estimated (Table 1). The first of the empirical equations presents the mechanism of electricity consumption. The unit price of electricity plays an important role in this equation. An increase in the concurrent price of electricity reduces the volume of energy consumption. As such, the classic mechanism of a decrease in demand under the influence of a unit price increment is at work here. The impacts of the price lagged by 1, 6 and 7 months are statistically significant as well. They are corrective in nature for electricity consumption, with lags of 1 and 6 months adjusting consumption positively, and a lag of 7 months triggering a negative adjustment of consumption under the influence of the unit price increment.

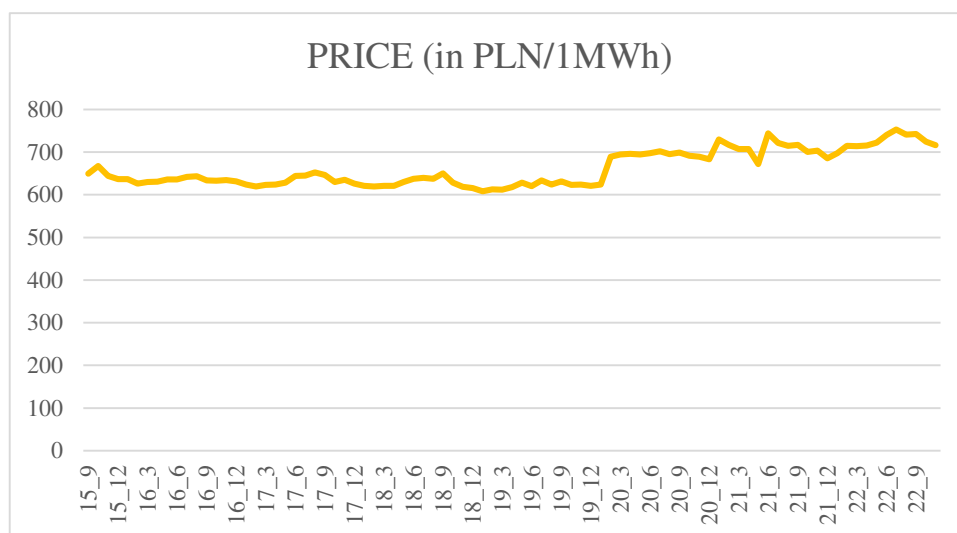


Figure 3. Prices per 1 MWh of household electricity in the period 2015.09 – 2022.11 (in PLN/1MWh).

Source: own calculation.

Table 1.

Dependent variable: USAGE, observations used 2016.05-2022.11 (N = 79)

Variable	Coefficient	Std. Error	t-Statistic	Prob. p	Significance
const	-197.952	281.559	-0.7031	0.4844	
PRICE	-4.51717	0.855759	-5.279	<0.0001	***
PRICE_1	3.67887	0.984763	3.736	0.0004	***
PRICE_6	3.78387	0.933031	4.055	0.0001	***
PRICE_7	-2.36990	0.913559	-2.594	0.0116	**
PUMP	366.607	61.0021	6.010	<0.0001	***
USAGE_1	0.670004	0.0666205	10.06	<0.0001	***
USAGE_4	0.205710	0.0889041	2.314	0.0237	**
USAGE_5	-0.330384	0.0852801	-3.874	0.0002	***
USAGE_8	0.124633	0.0555391	2.244	0.0280	**
Mean dependent var.		598.5063	S.D. dependent var.		332.7467
Sum squared resid.		770585.7	S.E. of regression		105.6783
R-squared		0.910772	Adjusted R-squared		0.899134
F(9, 69)		78.25599	Prob(F-statistic)		1.17e-32
Log likelihood		-474.9217	Akaike info criterion		969.8435
Schwarz criterion		993.5380	Hannan-Quinn criterion		979.3362
Autocorrel. coeff. (rho1)		-0.126826	Durbin h-statistic		-1.398861

Source: Own calculations using the GRETL package.

A dummy variable (PUMP) occurs in the equation of electricity consumption, taking the value of 1 in the months after the heat pump had been installed and 0 in the entire preceding period. This means that the use of the heat pump increased the household's electricity consumption by an average of 366.6 kWh per month. It is evident from this that the heat pump triggered an increase in the household electricity consumption by nearly 4400 kWh per year. The replacement of the oil-fired furnaces and boilers with a heat pump resulted in a significant cost reduction. The empirical equation in question shows autoregressive correlations: positive of 1, 2 and 8 months, and corrective negative of 5 months. The actual electricity consumption and the theoretical values obtained from the empirical model are graphically illustrated in Figure 4.

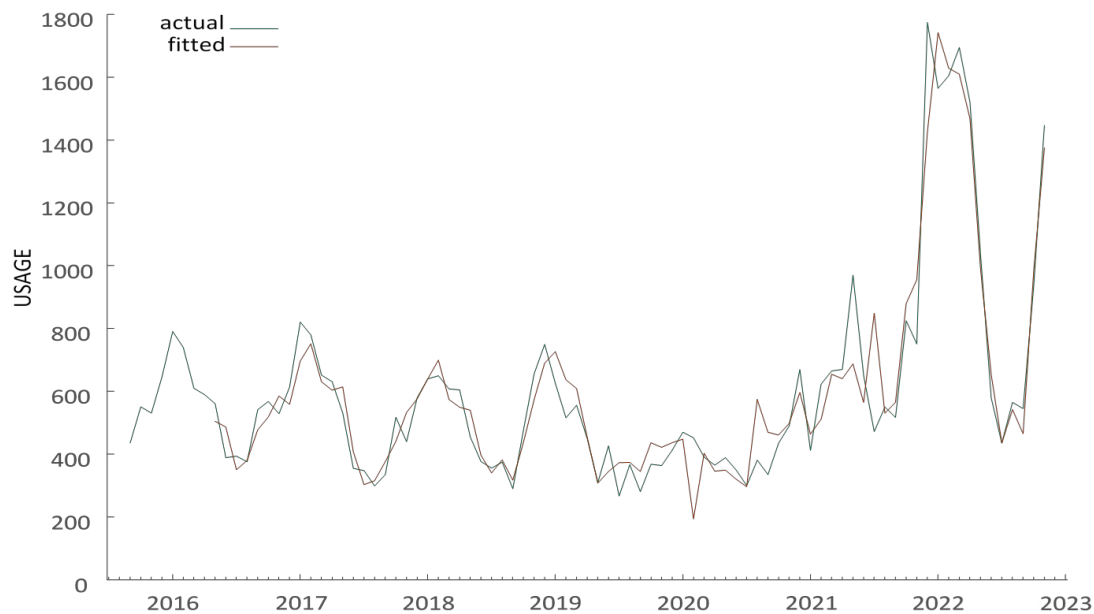


Figure 4. Actual and fitted values of variable: USAGE.

Source: Own calculations using the GRETl package and Table 1.

Table 2 shows the empirical equation describing the volatility of monthly electricity consumption value. Recursive effect of the energy consumption volume on its value comes into play here. A concurrent unit increase in energy consumption causes an increase in its value by approx. 652 PLN per 1 MWh. Negative adjustments with lags of 1 and 8 months simultaneously arise. The equation also shows a positive autoregression with periods of 1 and 8 months. The sequential reference from the 1-month period is of particular significance. It means that more than 74% of the previous month's value is revealed in the current value of household electricity consumption. Slight negative autoregressive adjustments of the variable VALUE, with lags of 5 and 12 months, likewise occur. The equation's explanatory variables explain the volatility of nearly 99.9% of the variable's (VALUE) formation mechanism. Graphical illustration of the actual electricity consumption values and the theoretical values obtained from the empirical model is presented in Figure 5.

Table 2.

Dependent variable: VALUE, observations used 2016.09-2022.11 (N = 75)

Variable	Coefficient	Std. Error	t-Statistic	Prob. p	Significance
const	10.8832	4.37675	2.487	0.0154	**
USAGE	0.652252	0.00672407	97.00	<0.0001	***
USAGE_1	-0.468964	0.0416847	-11.25	<0.0001	***
USAGE_8	-0.224058	0.0454904	-4.925	<0.0001	***
VALUE_1	0.743339	0.0610527	12.18	<0.0001	***
VALUE_5	-0.0205559	0.00711779	-2.888	0.0052	***
VALUE_8	0.355201	0.0673714	5.272	<0.0001	***
VALUE_12	-0.0420434	0.0132410	-3.175	0.0023	***

Cont. table 2.

Mean dependent var.	408.3923	S.D. dependent var.	244.3413
Sum squared resid.	4567.269	S.E. of regression	8.256403
R-squared	0.998966	Adjusted R-squared	0.998858
F(7, 67)	9249.036	Prob(F-statistic)	2.13e-97
Log likelihood	-260.5147	Akaike info criterion	537.0295
Schwarz criterion	555.5694	Hannan-Quinn criterion	544.4323
Autocorrel. coeff. (rho1)	-0.185294	Durbin h-statistic	-1.890566

Source: Own calculations using the GRETl package.

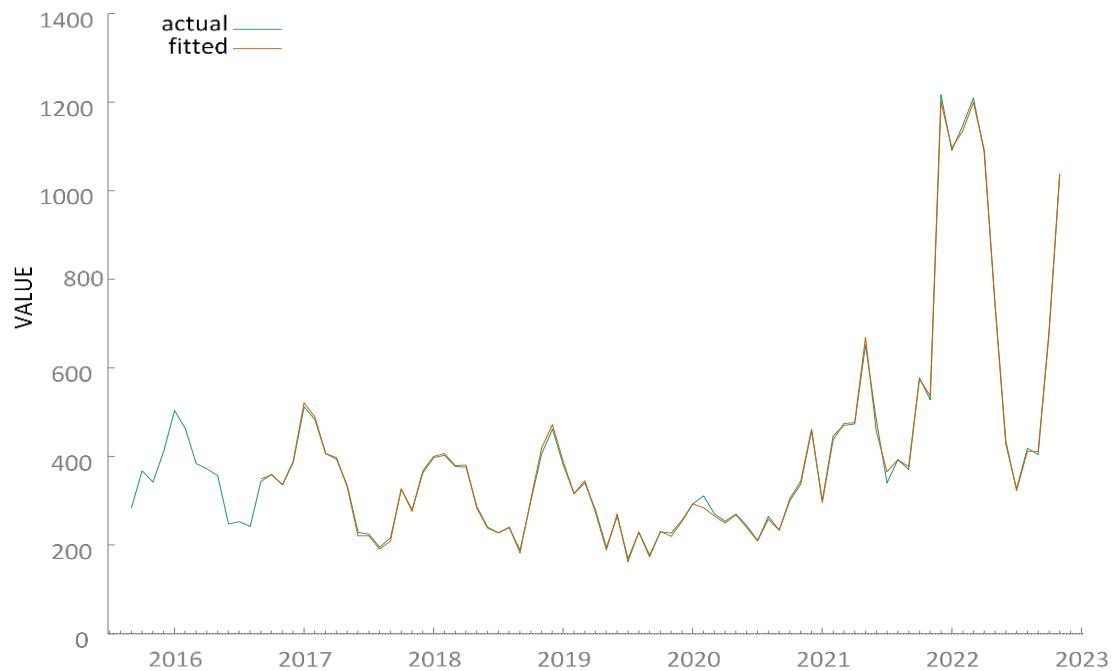


Figure 5. Actual and fitted values of variable: VALUE.

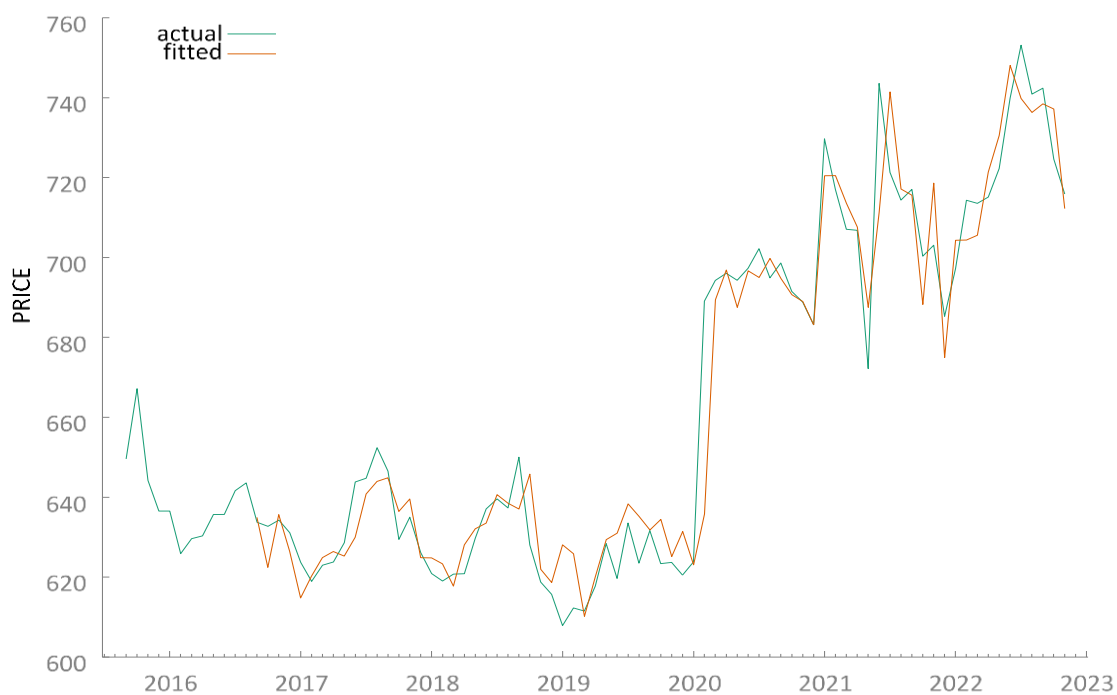
Source: Own calculations using the GRETl package and Table 2.

Table 3 illustrates the empirical equation of monthly electricity unit price in the household under analysis. The hypothesis about a feedback loop between the variables PRICE and USAGE has been confirmed. An increase in electricity consumption results in a simultaneous decrease in the price per 1 MWh. The relatively high fixed costs in the unit price are distributed over a greater number of units of energy consumed. This results in a decrease in the unit price per 1 MWh. The equation also shows positive adjustments to the unit price every 1 and 6 months and a negative adjustment with a lag of 5 months.

Table 3.Dependent variable: *PRICE*, observations used 2016.09-2022.11 ($N = 75$)

Variable	Coefficient	t-Statistic	Prob. p	Significance
const	55.7383	1.199	0.2349	
USAGE	-0.0550942	-7.052	<0.0001	***
USAGE_1	0.0585181	6.798	<0.0001	***
USAGE_5	-0.0409556	-4.245	<0.0001	***
USAGE_6	0.0340014	3.560	0.0007	***
TIME	0.276738	2.400	0.0192	**
PRICE_1	0.842834	12.60	<0.0001	***
PRICE_11	0.353386	3.348	0.0013	***
PRICE_12	-0.294481	-2.660	0.0098	***
Mean dependent var.	664.9519	S.D. dependent var.		43.65533
Sum squared resid.	8434.964	S.E. of regression		11.30498
R-squared	0.940190	Adjusted R-squared		0.932940
F(8, 66)	129.6858	Prob(F-statistic)		2.57e-37
Log likelihood	-283.5199	Akaike info criterion		585.0397
Schwarz criterion	605.8971	Hannan-Quinn criterion		593.3679
Autocorrel. coeff. (rho1)	-0.102156	Durbin h-statistic		-1.085335

Source: Own calculations using the GRETl package.

**Figure 6.** Actual and fitted values of variable: *PRICE*.

Source: Own calculations using the GRETl package and Table 2.

During the period under consideration, an increasing trend in the unit price occurred. An average monthly increase of nearly PLN 28/100 in the price per 1 MWh followed. What is more, a positive autoregression of the unit price has occurred. The current unit price results in more than 84% of the previous month's price. Additionally, autoregressive adjustments of the variable *PRICE* emerge, i.e., positive adjustment by more than PLN 35/100 every 11 months and negative by more than PLN 29/100 every 12 months. The empirical equation given

in Table 3 describes the volatility mechanism of electricity unit price with great accuracy. More than 94% of the unit price volatility is explained. Figure 6 illustrates the price volatility, showing the actual and theoretical magnitudes of the variable PRICE.

5. Conclusions

Electrical energy is in this day and age fundamental to the functioning of every household. The use of gas, heating oil or solid fuels in home heating systems also involves the powering thereof with electrical energy. Today, electricity is the most environmentally friendly energy source. As experience has shown, the substitution of an oil-fired heating system with a heat pump resulted in significant financial savings for the household. What is more, the living comfort has improved due to the elimination of the need to purchase heating oil twice a year at minimum.

The econometric model of household electricity consumption presented in this paper confirms both the hypothesis about the feedback between the variables USAGE and PRICE as well as the recursive effect of the amount of electricity consumption on its value in monetary units. In addition to the cognitive value of the econometric modeling results obtained, the empirical tool constructed enables forecast estimation of energy consumption volume, its value and unit price in subsequent months, for at least 12 consecutive months. One significant unknown arises, however. Due to the energy crisis, it is difficult to determine - even in the short term - what the unit price for electricity supplied from the external environment will be. Yet, even with this unknown, a relatively accurate prediction of the future size of the variable USAGE is possible.

The analysis shows that the next investment in household should be a photovoltaic installation. It will bring great benefits in terms of greenhouses' gas reduction. It will also dramatically reduce current electric energy expenditures. An increase in the consumption of electricity in the household is observed after installing the heat pump. In addition, there is a negative feedback between the consumption of electricity in the household and its unit price.

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SMART BIKING AND TRADITIONAL BIKING

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Purpose: The purpose of this publication is to present the most important features with which the smart biking is characterized.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: Smart biking is a transformative approach that integrates modern technology and innovative solutions into urban transportation, revolutionizing cycling as a mode of travel in smart cities. By merging traditional cycling with cutting-edge advancements, smart biking enhances the overall cycling experience, focusing on safety, connectivity, and community engagement. This concept aligns seamlessly with the core principles of smart cities, emphasizing data-driven planning, environmental sustainability, and seamless integration with public transportation to create a bike-friendly urban environment. The development of dedicated bike lanes, cycle tracks, and bike-sharing systems showcases the smart city's commitment to improving cycling infrastructure and encouraging its adoption as a preferred mode of transportation. By providing real-time information and mobile apps, smart biking empowers cyclists to efficiently plan their routes, while advanced safety features and IoT technology enhance cyclist safety on the roads. Furthermore, smart biking fosters a sense of community among cyclists through social platforms, promoting an active and engaged cycling community.

Originality/value: Detailed analysis of all subjects related to the problems connected with the smart biking in smart city.

Keywords: smart biking, smart city, quality of life, biking, smart mobility.

Category of the paper: literature review.

1. Introduction

The smart city concept aims to utilize modern technologies and innovative solutions to enhance the quality of life in urban areas, improving their efficiency and sustainability (Herdiyah, 2023). Smart city initiatives encompass various domains, one of which is smart

mobility (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021, Orzeł, Wolniak, 2021, 2022, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021). Smart mobility holds particular importance in modern cities, as it facilitates the organization of transportation systems in a contemporary manner.

Smart biking exemplifies smart mobility in a smart city, showcasing how technology and innovative solutions are applied to transform urban transportation and make it more efficient, sustainable, and accessible. Smart biking is seamlessly integrated into the city's overall transportation ecosystem. It complements existing public transportation systems, providing first and last-mile connectivity solutions. Cyclists can easily combine biking with buses, trains, and other transit options, promoting a multi-modal approach to commuting.

The purpose of this publication is to present the most important features with which the smart biking approach is characterized.

2. Smart biking

Cycling has always been a popular mode of transportation, a great form of exercise, and an environmentally-friendly way to get around. In recent years, the world has witnessed a technological revolution that has impacted every aspect of our lives, and cycling is no exception. The emergence of the "Smart Biking" concept has brought together the traditional joys of cycling with cutting-edge technology, creating a new and exciting experience for cyclists.

The heart of the smart biking concept lies in the development of smart bikes. These bicycles are equipped with advanced sensors, microprocessors, and connectivity features that make them much more than just two-wheeled vehicles. Smart bikes are designed to gather and analyze data, communicate with other devices, and provide enhanced functionalities to both the rider and the environment. Smart bikes come with built-in navigation systems and GPS trackers. Riders can set their destinations through a mobile app or directly on the bike's interface. The bike's GPS provides real-time navigation, suggesting the best routes, avoiding traffic, and even indicating points of interest like bike-friendly cafes or parks. This feature is particularly useful for urban commuters and long-distance cyclists who want to explore new routes (Rahman, Dura, 2022).

Safety is a primary concern for cyclists, especially when sharing the road with motor vehicles. Smart bikes incorporate various safety features like proximity sensors, collision detection, and automatic brake systems. Proximity sensors warn the rider of nearby vehicles or obstacles, while collision detection can automatically apply the brakes in emergency situations. These technologies significantly reduce the risk of accidents and enhance the overall safety of

cycling (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021). Smart biking encourages a healthy lifestyle by integrating fitness tracking functionalities. Built-in sensors can monitor the rider's heart rate, calorie expenditure, distance covered, and other vital health metrics. This data is then synced to the rider's smartphone or fitness app, allowing them to keep track of their progress, set goals, and make improvements in their fitness routine (Prajeesh, Pillai, 2022).

Electric bikes, or e-bikes, are becoming increasingly popular, and smart biking takes e-bikes to the next level. Smart e-bikes offer various modes of power assistance that can be adjusted based on the rider's preference or the terrain. For instance, the bike can automatically increase assistance when climbing a hill and reduce it on flat roads to conserve battery power. This efficient energy management maximizes the bike's range and minimizes environmental impact.

Smart biking fosters a sense of community among cyclists. Dedicated mobile apps and social platforms allow riders to connect with each other, share experiences, plan group rides, and even compete in virtual cycling events. This social aspect of smart biking not only makes the experience more enjoyable but also motivates cyclists to stay active and engaged. Smart bikes can be equipped with environmental sensors to collect data on air quality, temperature, humidity, and more. By crowdsourcing this data from a fleet of smart bikes, city planners and environmental agencies can gain valuable insights to improve urban planning, optimize cycling infrastructure, and make cities more sustainable and bike-friendly (Boichuk, 2020).

Smart bikes are equipped with self-diagnostic systems that monitor the bike's performance and condition. They can detect potential issues such as tire pressure, chain wear, or brake problems and notify the rider in real-time. This proactive approach to maintenance ensures that the bike is always in top shape and minimizes the risk of breakdowns during rides (Ku et al., 2022).

The smart biking concept represents an exciting fusion of technology and traditional cycling, enhancing the overall experience for riders and promoting cycling as a viable transportation option (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023; Wolniak, 2013, 2016; Hys, Wolniak, 2018). With the integration of navigation, safety features, fitness tracking, and environmental data collection, smart bikes are transforming the way we ride, making it safer, more enjoyable, and environmentally responsible. As technology continues to advance, the future of smart biking holds even more promising possibilities for cyclists worldwide (Benevolo et al., 2016).

Smart biking leverages technology to offer real-time information to cyclists. Dedicated mobile apps and smart devices provide access to updated route information, weather conditions, traffic updates, and even available bike-sharing options. This real-time data empowers cyclists to make informed decisions and plan their rides efficiently. Also smart biking promotes

eco-friendly transportation within the smart city. By encouraging cycling as a preferred mode of transport, it reduces carbon emissions, traffic congestion, and the overall environmental impact of commuting. This aligns with the smart city's goals of promoting sustainable practices and reducing its carbon footprint (Kunyska et al., 2023).

It can be said, that smart biking prioritizes cyclist safety through the integration of advanced technologies. Smart bikes can be equipped with collision detection systems, proximity sensors, and automatic braking features, enhancing the safety of riders. Additionally, smart biking infrastructure may include well-lit bike lanes and smart traffic signals that respond to cyclists' presence, further improving safety on the roads. Also those initiatives collect valuable data on cycling patterns, usage, and demand. This data is used for data-driven planning and decision-making. City authorities can analyze the data to identify popular cycling routes, areas with high demand for bike-sharing, and opportunities for improving cycling infrastructure to better serve the community (Orlowski, Romanowska, 2019).

Smart biking fosters community engagement among cyclists. Dedicated social platforms and apps allow riders to connect, share experiences, plan group rides, and participate in cycling events. This sense of community helps promote smart biking and encourages more people to adopt cycling as a mode of transportation. The concept of smart biking contributes to improved public health within the smart city. By encouraging more people to bike, it promotes an active lifestyle and helps combat sedentary behaviors. This, in turn, can lead to reduced healthcare costs and improved overall well-being for residents.

Bike-sharing systems are an integral part of smart mobility in a smart city. These systems are integrated with other transportation options and are equipped with technology for easy access, payment, and tracking. Smart bike-sharing enables convenient, affordable, and flexible transportation for residents and visitors alike.

Smart bike-sharing systems are innovative and technology-driven solutions that provide convenient and flexible access to bicycles for short-term use. These systems are designed to enhance urban mobility, reduce traffic congestion, promote sustainability, and offer an alternative mode of transportation in smart cities and urban areas. Smart bike-sharing systems typically involve the following key features and components: Smart bike-sharing systems consist of automated bike stations strategically located throughout the city. These stations are equipped with docking points that securely hold the bikes when they are not in use. Users can easily rent and return bikes at these stations.

Users can access the bike-sharing system through mobile apps or interactive kiosks placed at the bike stations. The mobile app provides information about station locations, bike availability, and real-time data on nearby bikes. Smart bike-sharing systems offer a contactless rental process. Users can unlock a bike by scanning a QR code or using a mobile app. This allows for quick and easy access to the bikes without the need for physical keys or cards.

Each bike in a smart bike-sharing system is equipped with GPS tracking and connectivity features. This enables operators to monitor the location of bikes in real-time, manage bike distribution, and collect valuable data on bike usage patterns. Smart bikes have built-in smart locking mechanisms. Once a user completes their ride, they can securely lock the bike at any available docking point within a designated station. Smart bike-sharing systems offer integrated payment systems that allow users to pay for their bike rentals through the mobile app using credit/debit cards or digital wallets. The mobile app and kiosks have user-friendly interfaces that provide clear instructions for renting and returning bikes. Users can also view their rental history and track their riding statistics. The mobile app provides real-time information about bike availability at each station, helping users find nearby bikes and plan their rides efficiently.

Smart bike-sharing systems are often integrated with public transit networks, providing a seamless and convenient option for users to combine cycling with other transportation modes, such as buses and trains. By encouraging cycling and reducing the reliance on motorized vehicles, smart bike-sharing systems contribute to a greener and more sustainable urban environment, promoting cleaner air and reduced carbon emissions.

3. Smart city and smart biking

The smart city concept and smart biking are interrelated in numerous ways, as both aim to utilize technology to improve urban living and transportation. The integration of smart city infrastructure and initiatives has a significant impact on the development and promotion of smart biking. Smart cities prioritize the creation of cycling-friendly infrastructure, including dedicated bike lanes, cycle tracks, and bike-sharing systems. These infrastructure developments encourage more people to choose biking as a viable mode of transportation. Smart biking initiatives benefit from the smart city's commitment to expanding and enhancing cycling infrastructure, making it safer and more convenient for cyclists to navigate through urban areas.

Also smart cities offer real-time information to residents, including cyclists, through various channels like mobile apps, digital displays, and smart kiosks. Smart biking takes advantage of this connectivity by providing cyclists with up-to-date information on bike lane availability, road closures, weather conditions, and potential hazards. Having access to such information enables cyclists to plan their routes more efficiently and stay informed about any changes in the city's infrastructure (Tahmasseby, 2022).

Smart cities often implement bike-sharing programs, where commuters can easily rent bikes for short trips. These bike-sharing systems are integrated into the city's overall transportation network, offering a seamless connection between various modes of transport like buses, trains, and even ride-sharing services. Smart biking benefits from this interconnectedness, making it easier for people to incorporate cycling into their daily commutes and travel.

The Internet of Things (IoT) plays a crucial role in smart biking. Smart city infrastructure can be equipped with sensors and connected devices that enhance cyclist safety. For instance, IoT-enabled traffic signals can detect approaching cyclists and adjust signal timings accordingly, reducing the risk of accidents. Additionally, smart streetlights can illuminate bike lanes and paths as cyclists pass by, improving visibility and safety during nighttime rides.

Smart cities leverage data analytics to make informed decisions about urban planning and transportation. This data-driven approach extends to smart biking, where information collected from bike-sharing systems, cycling patterns, and traffic flow can inform the expansion of bike lanes, the placement of bike racks, and the optimization of cycling routes. This data-driven planning ensures that smart biking initiatives align with the actual needs and preferences of cyclists (Dudycz, Piatkowski, 2018).

Smart biking aligns with the smart city's focus on environmental sustainability. By promoting cycling as a green and eco-friendly mode of transportation, smart cities aim to reduce traffic congestion and lower carbon emissions. As a result, cities invest in smart biking initiatives to incentivize residents to choose cycling over traditional motorized vehicles, contributing to a cleaner and greener urban environment. Smart cities encourage multi-modal transportation, where different modes of transit seamlessly connect and complement each other. Smart biking fits perfectly into this framework, offering a convenient first and last-mile solution for public transportation users. Cyclists can easily combine biking with buses, trains, or subways, reducing the reliance on private cars and contributing to a more efficient urban transportation ecosystem (Wawre et al., 2022)

Smart cities create an environment that fosters and supports the growth of smart biking initiatives, while smart biking contributes to the overall goals of a sustainable, efficient, and interconnected urban landscape. By embracing the smart biking concept, cities can promote healthier lifestyles, reduce traffic congestion, and improve the overall quality of life for their residents.

Table 1 highlights the relationship between smart cities and smart biking, showcasing how various factors associated with smart cities positively impact and promote the concept of smart biking.

Table 1.
Relationship between smart city and smart biking

Smart City factors	Smart Biking
Cycling Infrastructure	Development of dedicated bike lanes, cycle tracks, and bike-sharing systems to promote cycling as a preferred mode of transport.
Real-time Information	Provision of up-to-date data on bike lane availability, road closures, weather conditions, and potential hazards to aid cyclists in route planning.
Bike-sharing and Connectivity	Integration of bike-sharing programs with other transportation modes, offering a seamless connection between cycling and public transit options.
IoT for Safer Riding	Utilization of IoT-enabled sensors and devices to enhance cyclist safety, such as smart traffic signals and illuminated bike lanes.

Cont. table 1.

Data-Driven Planning	Data analytics to inform urban planning decisions related to cycling infrastructure expansion, bike rack placement, and route optimization.
Environmental Sustainability	Promotion of cycling as an eco-friendly and sustainable transportation option to reduce traffic congestion and carbon emissions.
Integration with Public Transportation	Encouragement of multi-modal transportation, where cycling complements public transit, providing a first and last-mile solution.

Source: (Ploeger, Oldenziel, 2020; Tahmasseby, 2022; Rahman, Dura, 2022; Prajeesh, Pillai, 2022; Boichuk, 2020; Benevolo et al., 2016; Kunytska et al., 2023; Christensen, 2020; Langer et al., 2021).

4. Smart biking and traditional biking

Traditional biking planning typically focuses on providing basic bike lanes and paths, which may lack proper connectivity and safety measures. Cyclists often rely on paper maps or limited online resources for route selection, without access to real-time data and mobile apps for updated route information and weather conditions. Safety measures in traditional biking planning might be limited, and cyclists often have to adhere to general road rules without the support of advanced safety features (Simonofski et al., 2023).

Regarding environmental impact, traditional biking does contribute to reduced emissions, but planning may not prioritize environmental benefits as a core objective. Data utilization in traditional biking planning is limited, with minimal use of data analytics and Internet of Things (IoT) technology for urban planning and optimizing biking routes. Integration with public transportation is often not well-developed in traditional biking planning, with limited connections and lack of seamless integration between biking and other transportation modes.

On the other hand, smart biking takes a more technologically advanced and environmentally conscious approach. It focuses on creating dedicated and connected bike lanes with smart technology integration for enhanced safety, including features like illuminated lanes and smart traffic signals. Smart biking planning utilizes real-time data and mobile apps to provide cyclists with updated route information, weather conditions, and road closures, making route planning more efficient and convenient. Safety in smart biking is improved through advanced features such as collision detection, proximity sensors, and automatic brakes, all designed to protect cyclists. Smart biking actively promotes environmental consciousness, encouraging cycling as a key component of green and sustainable urban transportation (Christensen, 2020).

Data-driven planning is a hallmark of smart biking, utilizing data analytics and IoT to optimize biking routes, identify high-demand areas, and make informed decisions for urban planning. Smart biking seamlessly integrates with public transportation, providing first and last-mile solutions for commuters and integrating bike-sharing systems (Kim, Hall, 2023).

Technological integration is a significant aspect of smart biking, where smart bikes with built-in GPS, fitness tracking, and connectivity features enhance the overall biking experience. The smart biking concept also fosters community engagement through social platforms, cycling

events, and crowdsourcing data to continuously improve biking initiatives (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022). Lastly, smart biking incorporates self-diagnostic systems that monitor bike performance and notify riders of maintenance needs in real-time, ensuring that bikes are always in top condition for safe and enjoyable rides (Langer et al., 2021; Sen, 2022).

In table 2 there is a comparison between traditional biking planning and smart biking.

Table 2.
Comparison between traditional biking and smart biking

Aspect	Traditional Biking Planning	Smart Biking
Infrastructure	Focus on basic bike lanes and paths, often lacking connectivity and safety measures.	Emphasis on dedicated and connected bike lanes, incorporating smart technology for enhanced safety (e.g., illuminated lanes, smart traffic signals).
Route Planning	Relies on paper maps or limited online resources for route selection.	Utilizes real-time data and mobile apps to access updated route information, weather conditions, and road closures.
Safety Measures	May lack specific safety measures, and cyclists rely on general road rules.	Equipped with advanced safety features like collision detection, proximity sensors, and automatic brakes for enhanced rider protection.
Environmental Impact	Traditional biking contributes to reduced emissions, but planning may not prioritize environmental benefits.	Encourages cycling as a key component of green and sustainable urban transportation, actively promoting environmental consciousness.
Data Utilization	Limited use of data for planning and decision-making.	Utilizes data analytics and IoT for data-driven urban planning, optimizing biking routes, and identifying high-demand areas.
Public Transportation Integration	Limited integration with public transit systems, may not be well-connected.	Seamlessly integrates with public transportation, providing first and last-mile solutions for commuters, and integrated bike-sharing systems.
Technological Integration	Relies on traditional biking equipment without much technology integration.	Incorporates smart bikes with built-in GPS, fitness tracking, and connectivity features for a more enhanced biking experience.
Community Engagement	May have limited community involvement in planning and infrastructure development.	Encourages community engagement through social platforms, cycling events, and crowdsourcing data to improve biking initiatives.
Maintenance and Monitoring	Relies on periodic maintenance without real-time monitoring capabilities.	Equipped with self-diagnostic systems that monitor bike performance and notify riders of maintenance needs in real-time.

Source: (Ploeger, Oldenziel, 2020; Tahmasseby, 2022; Rahman, Dura, 2022; Prajeesh, Pillai, 2022; Boichuk, 2020; Benevolo et al., 2016; Kuniytska et al., 2023; Christensen, 2020; Langer et al., 2021).

5. Conclusion

The concept of smart biking exemplifies the integration of modern technology and innovative solutions into urban transportation, making cycling a more efficient, sustainable, and accessible mode of travel in smart cities. By combining traditional cycling with cutting-edge advancements, smart biking enhances the overall experience for cyclists, promoting

safety, connectivity, and community engagement. Smart biking benefits from the core principles of smart cities, where data-driven planning, environmental sustainability, and seamless integration with public transportation play crucial roles in shaping a bike-friendly urban environment. The development of dedicated bike lanes, cycle tracks, and bike-sharing systems reflects the smart city's commitment to improving cycling infrastructure and encouraging its use as a preferred mode of transportation.

The use of real-time information and mobile apps in smart biking empowers cyclists to plan their routes more efficiently, while advanced safety features and IoT technology enhance cyclist safety on the roads. Moreover, smart biking fosters a sense of community among cyclists through social platforms, promoting an active and engaged cycling community. In contrast, traditional biking planning may lack the technological advancements and data-driven approach that smart biking embodies. Basic bike lanes and limited integration with public transit might hinder the convenience and appeal of traditional biking.

The smart biking concept represents a remarkable fusion of technology and traditional cycling, presenting an exciting future for urban transportation. As smart cities continue to prioritize sustainability and technological advancements, smart biking will play an increasingly significant role in promoting healthier lifestyles, reducing traffic congestion, and contributing to a greener and more efficient urban landscape. By embracing smart biking initiatives, cities can build a brighter, more sustainable future for cyclists and urban residents alike.

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THE FIVE STAGES OF BUSINESS ANALYTICS

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Purpose: The goal of the paper is to analyze the main features, benefits and problems with the business analytics usage.

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 paper explores the main concepts of business analytics, including descriptive, real-time, diagnostic, predictive, and prescriptive analytics. Each stage of development builds upon the previous one, addressing specific needs in data analysis and decision-making. The paper also presents a detailed comparison of the five types of business analytics, showcasing their unique characteristics, techniques, and applications. Understanding these differences helps organizations select the appropriate analytics type to suit their requirements and drive success. As technology and data processing capabilities advance, business analytics continues to evolve. Embracing the power of data and analytics grants organizations a competitive advantage, unlocking opportunities and driving innovation. Integrating analytics into decision-making processes is essential for thriving in a data-driven world, ensuring sustained growth and success in an ever-changing marketplace.

Originality/value: Detailed analysis of all subjects related to the problems connected with the prospective analytics.

Keywords: Industry 4.0; diagnostic analytics, business analytics, data analysis.

Category of the paper: literature review.

1. Introduction

Business analytics is the practice of utilizing data analysis and statistical methods to gain valuable insights and make informed business decisions. It involves the exploration, examination, interpretation, and visualization of data from various sources to identify trends, patterns, and correlations that can drive strategic planning and operational improvements

(Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021).

The main objective of business analytics is to extract meaningful and actionable information from data, enabling organizations to make data-driven decisions, optimize processes, enhance efficiency, and gain a competitive edge. By leveraging historical and real-time data, businesses can better understand their operations, customer behavior, market trends, and other critical factors that influence their performance.

The goal of the paper is to analyze the main features, benefits and problems with the business analytics usage.

2. Business analytics – main concepts

Business analytics is the systematic application of statistical and quantitative methods to explore and interpret data, providing valuable insights that aid in making data-driven decisions to improve business performance and achieve strategic goals (Hurwitz et al., 2015). Business analytics also refers to the process of analyzing data from various sources using statistical and computational techniques to uncover patterns, trends, and correlations (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023; Wolniak, 2013, 2016; Hys, Wolniak, 2018). The insights gained from this analysis help organizations make informed decisions and optimize their operations for greater efficiency and competitiveness.

Business analytics empowers organizations to transform raw data into valuable knowledge, enabling them to make data-driven decisions that positively impact their overall performance and success.

Business analytics plays a crucial role in aiding decision-makers to (Cam et al., 2021):

- Identify opportunities for growth and improvement.
- Optimize operational efficiency and resource allocation.
- Understand customer behavior and preferences.
- Mitigate risks and identify potential threats.
- Monitor and evaluate the performance of various initiatives and strategies.

We can divide business analytics into five following stages (Hwang et al.; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023):

- Descriptive analytics involves the examination and interpretation of historical data to gain insights into past performance and understand what has happened in a business. This type of analytics focuses on summarizing and presenting data in a meaningful way, often using data visualization tools like charts, graphs, and dashboards to provide a clear and concise overview of key performance indicators (KPIs) and trends.
- Real-time analytics, also known as streaming analytics or instant analytics, is the process of analyzing data as it is generated or received, without any delay. It enables organizations to monitor and respond to events, transactions, and data streams in real time. This type of analytics is especially useful in dynamic and time-sensitive environments, such as financial markets, supply chain management, and online customer interactions.
- Diagnostic analytics goes beyond descriptive analytics by seeking to understand why certain events or patterns occurred in the data. It involves analyzing historical data to identify the root causes of specific outcomes or anomalies. By investigating past performance and understanding contributing factors, businesses can gain insights into how to improve processes and avoid potential issues in the future.
- Predictive analytics involves the use of historical data and statistical algorithms to make predictions about future events or outcomes. By identifying patterns and relationships in the data, predictive analytics helps organizations anticipate potential scenarios and trends. This enables them to proactively plan and make more informed decisions, such as predicting customer behavior, demand for products, or financial performance.
- Prescriptive analytics takes data analysis to the next level by recommending specific actions to optimize outcomes based on the insights gained from descriptive, diagnostic, and predictive analytics. It uses advanced algorithms and decision models to determine the best course of action under different circumstances. Prescriptive analytics provides actionable recommendations that guide decision-makers in maximizing efficiency, minimizing risks, and achieving strategic objectives.

3. Evolution of business analytics

Descriptive analytics, as the initial stage of business analytics, focused on examining historical data to summarize past performance and identify trends. Organizations relied on batch processing and traditional data analysis methods to gain insights from historical datasets. However, as the pace of business and the need for faster decision-making increased, a new demand emerged for real-time insights.

The evolution to real-time analytics was driven by advancements in technology and data processing capabilities. Organizations began to adopt technologies like stream processing and complex event processing (CEP) to analyze data as it was generated or received in real-time. This shift allowed them to monitor events, transactions, and data streams as they happened, enabling immediate responses to emerging trends or critical situations.

Real-time analytics became essential in industries where timeliness and quick reactions were critical, such as financial markets, online retail, and fraud detection. With the ability to process and analyze data in real-time, organizations gained a competitive advantage, as they could identify opportunities and respond to threats faster than their competitors (Sharma et al., 2020).

The transition from descriptive analytics to real-time analytics was driven by the recognition that historical insights alone were insufficient to keep up with the rapidly changing business landscape. Organizations realized the need to leverage the power of real-time data to make more informed and agile decisions, ultimately leading to the evolution of business analytics to the next stage of development (Hwang et al., 2017; Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023; Scappini, 2016; Peter et al., 2023).

As organizations began leveraging real-time analytics to gain immediate insights, they recognized the need to go beyond simply reacting to events and delved deeper into understanding the underlying causes of specific outcomes. This realization led to the evolution from real-time analytics to diagnostic analytics (Peter et al., 2023).

With real-time analytics in place, organizations could quickly identify anomalies and emerging trends. However, the next logical step was to investigate the reasons behind these patterns. Diagnostic analytics emerged as the stage where historical data was thoroughly analyzed to identify root causes, contributing factors, and correlations. By performing drill-down analyses, root cause analysis, and other investigative techniques, organizations could pinpoint the factors that led to specific events or performance outcomes. Diagnostic analytics provided a deeper understanding of the relationships between different variables and helped identify potential bottlenecks or inefficiencies in processes.

The evolution to diagnostic analytics represented a shift from reactive decision-making to a more proactive approach. By understanding the underlying causes of both positive and negative outcomes, organizations could take corrective actions, optimize processes, and make data-driven improvements to their operations (Hurwitz et al., 2015).

Building on the insights gained from diagnostic analytics, organizations sought to move from understanding past events to anticipating future scenarios. The evolution from diagnostic analytics to predictive analytics was driven by the desire to leverage historical data and patterns to make informed predictions. With the historical data already analyzed during the diagnostic stage, organizations had the groundwork to develop predictive models. Advanced statistical algorithms, machine learning techniques, and time series forecasting were employed to identify patterns and relationships in the data that could be used to forecast future trends.

Predictive analytics enabled organizations to anticipate potential outcomes, market trends, customer behavior, and demand for products or services. This forward-looking approach allowed businesses to proactively plan and allocate resources, optimize inventory management, and strategize marketing campaigns based on anticipated changes in the market. The shift to predictive analytics empowered organizations to move beyond reactive and proactive decision-making to predictive decision-making. Armed with data-driven predictions, they could be better prepared for the future and adapt their strategies to potential changes, thereby gaining a competitive edge in their respective industries.

The transition from predictive analytics to prescriptive analytics marks the final and most advanced stage in the evolution of business analytics. While predictive analytics focused on forecasting future outcomes, organizations recognized the need to take it a step further and move from predicting what might happen to determining the best course of action to achieve desired outcomes. This shift led to the development of prescriptive analytics (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021; Orzeł, Wolniak, 2021, 2022, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021).

Prescriptive analytics builds upon the insights gained from descriptive, real-time, diagnostic, and predictive analytics to recommend specific actions or decisions to optimize results. By using optimization models, decision trees, simulation techniques, and machine learning algorithms, organizations could evaluate various scenarios and potential outcomes (Hwang et al., 2017).

Prescriptive analytics considers multiple variables, constraints, and objectives to arrive at the best possible course of action. It enables decision-makers to weigh the potential risks and rewards of different strategies and make well-informed choices based on data-driven insights. With prescriptive analytics, organizations can answer questions such as "What should we do?" and "How can we achieve our goals most effectively?" It empowers businesses to optimize their resources, streamline processes, maximize profitability, and make strategic decisions that align with their long-term objectives (Greasley, 2019).

In practice, prescriptive analytics finds applications in complex decision-making processes, such as supply chain optimization, resource allocation, pricing strategies, and personalized recommendations in e-commerce. For instance, prescriptive analytics can recommend the most cost-efficient distribution routes for a logistics company or suggest personalized product offers based on individual customer preferences. Prescriptive analytics represents the pinnacle of data-driven decision-making, enabling organizations to gain a competitive advantage by making precise, well-informed choices in a dynamic and rapidly changing business landscape. By fully embracing prescriptive analytics, businesses can optimize their operations, enhance customer experiences, and position themselves for sustained success in the ever-evolving marketplace (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022).

4. Comparison of business analytics types

In table 3, we compare five types of business analytics: Descriptive Analytics, Real-time Analytics, Diagnostic Analytics, Predictive Analytics, and Prescriptive Analytics. Each type is described based on its definition, focus, time perspective, purpose, techniques/models used, and application examples.

Descriptive Analytics involves the examination and interpretation of historical data to gain valuable insights into past performance and understand what has happened in a business or operational context. By summarizing data, identifying patterns, and presenting key performance indicators and trends, descriptive analytics offers a clear and concise overview of historical events, enabling stakeholders to comprehend past outcomes and assess the effectiveness of their strategies and initiatives.

In contrast, Real-time Analytics focuses on the analysis of data as it is generated or received, without any delay. This dynamic approach allows organizations to monitor and respond to events, transactions, and data streams in real-time. By leveraging complex event processing and stream processing techniques, real-time analytics empowers decision-makers to promptly detect emerging trends, identify anomalies, and react swiftly to changing market conditions or critical situations.

Table 1.
Comparison of five types of business analytics

Factor	Descriptive Analytics	Real-time Analytics	Diagnostic Analytics	Predictive Analytics	Prescriptive Analytics
Definition	Examination and interpretation of historical data.	Analysis of data as it is generated or received, without delay.	Understanding the reasons behind past events or patterns.	Using historical data and statistical algorithms to predict future outcomes.	Recommending specific actions to optimize outcomes.
Focus	Past performance and trends.	Immediate events and streams.	Root causes of outcomes.	Future trends and possibilities.	Best course of action.
Time Perspective	Historical data.	Real-time data.	Historical data.	Future predictions.	Future predictions.
Purpose	Summarize data, identify patterns, and provide a clear overview of key performance indicators and trends.	Monitor and respond to events in real-time, enabling quick decision-making in dynamic and time-sensitive contexts.	Investigate past performance to identify the factors that contributed to specific outcomes or anomalies.	Anticipate potential scenarios and trends, allowing proactive planning and decision-making.	Provide actionable advice based on insights gained from other types of analytics to achieve desired objectives.

Cont. table 1.

Techniques/ Models	Data visualization, reporting, descriptive statistics.	Stream processing, complex event processing (CEP).	Drill-down analysis, root cause analysis.	Regression analysis, time series forecasting, machine learning models.	Optimization models, decision trees, simulation models.
Application Examples	Monthly sales reports, customer segmentation, website traffic analysis.	Fraud detection, stock market analysis, real-time website monitoring.	Customer churn analysis, identifying reasons for a decrease in sales.	Demand forecasting, predictive maintenance, stock price prediction.	Supply chain optimization, resource allocation, dynamic pricing strategies.
Data Sources	Structured and unstructured data from various sources.	Diverse data streams, sensors, social media, etc.	Structured and unstructured historical data.	Historical data from various sources.	Data from various sources, integrated and processed for analysis.
Decision-Making Impact	Informative insights for informed decision-making.	Immediate insights for real-time decision-making.	Identifying areas for improvement and optimization.	Anticipate risks and opportunities for better strategic planning.	Guiding optimal decisions to achieve desired outcomes.
Data Volume and Velocity	Handling larger historical datasets.	Handling real-time data streams, fast processing.	Working with historical data with varying volume.	Managing large datasets for future predictions.	Handling data to recommend decisions for future outcomes.
Industry Applications	Applicable across various industries.	Various industries and sectors.	Widely used in diverse business sectors.	Commonly used across industries for predictive insights.	Applied in various industries for decision optimization.
Data Integration	Data integrated from multiple sources for analysis.	Real-time data integration for immediate insights.	Data integration for analyzing historical performance.	Data integration for historical data analysis.	Integration of data to derive actionable recommendations.
Time Horizon	Historical view of performance over a specific period.	Immediate view of ongoing events and their impact.	Historical view to understand past performance.	Future-oriented view for forecasting long-term outcomes.	Future-oriented view for determining optimal actions.
Data Exploration	Understanding past trends and performance patterns.	Identifying emerging trends and anomalies in real-time.	Exploring historical data for potential insights.	Uncovering hidden patterns and relationships in data.	Evaluating potential scenarios for decision-making.
Implementation Complexity	Typically less complex due to historical data analysis.	May require sophisticated real-time data processing.	Can be complex, depending on the factors being analyzed.	Requires advanced statistical modeling and machine learning.	Involves complex optimization algorithms and simulations.

Cont. table 1.

Data Storage	Can be stored in databases, data warehouses, or spreadsheets.	Real-time data may be stored in memory or temporary storage.	Stored in databases or data warehouses for historical analysis.	Stored in databases or data warehouses for modeling.	Utilizes databases or specialized models to store recommended actions.
Data Visualization	Charts, graphs, and reports to summarize historical data.	Real-time dashboards and visualizations for ongoing events.	Visual representations to explain past performance patterns.	Visualizations to display predictive outcomes and trends.	Visualizations to present recommended actions and their impacts.

Source: Authors own work on the basis of: (Hurwitz et al., 2015; Lawton, 2019; Charles et al., 2023, Scappini, 2016, Peter et al., 2023).

Diagnostic Analytics goes beyond descriptive analytics by seeking to understand why certain events or patterns occurred in the data. It involves in-depth analysis of historical data to identify the root causes of specific outcomes or issues. By investigating past performance and uncovering contributing factors, diagnostic analytics provides crucial insights that enable organizations to gain a deeper understanding of their operations and identify areas for improvement or optimization.

Predictive Analytics harnesses historical data and applies statistical algorithms, machine learning models, and data mining techniques to predict future outcomes and trends. By identifying patterns and relationships in the data, predictive analytics allows organizations to anticipate potential scenarios and make data-driven decisions for better planning and resource allocation. This forward-looking approach empowers businesses to proactively address challenges and seize opportunities.

Prescriptive Analytics represents the pinnacle of data-driven decision-making. Building upon descriptive, diagnostic, and predictive analytics, prescriptive analytics provides actionable recommendations and guidance on the best course of action under different circumstances. By utilizing optimization models, decision trees, and simulation techniques, prescriptive analytics assists decision-makers in optimizing resources, mitigating risks, and achieving strategic objectives with precision and effectiveness.

By analyzing and understanding the distinct characteristics of each type of business analytics, organizations can effectively leverage data to gain actionable insights, improve operational efficiency, enhance customer experiences, and stay ahead in an increasingly data-driven and competitive landscape. The wide range of analytical techniques and approaches available empowers businesses to unlock the full potential of their data and make more informed, strategic decisions that drive success and growth.

5. Conclusion

Throughout this paper, we have explored the main concepts of business analytics, including descriptive, real-time, diagnostic, predictive, and prescriptive analytics. Each stage of development builds upon the previous one, addressing specific needs and challenges in data analysis and decision-making.

Descriptive analytics serves as the foundation, offering a historical perspective on performance and trends. As the need for real-time insights emerged, organizations transitioned to real-time analytics, enabling swift responses to dynamic events. Recognizing the importance of understanding the underlying reasons behind outcomes, the evolution continued to diagnostic analytics, providing deeper insights into root causes.

Predictive analytics emerged as a response to the demand for future-oriented decision-making. By leveraging historical data and advanced algorithms, organizations could anticipate trends and scenarios, thereby enabling proactive planning and strategic decision-making. The ultimate stage of prescriptive analytics recommends specific actions to optimize outcomes, synthesizing insights from previous analytics stages. Prescriptive analytics empowers decision-makers to make precise, well-informed choices, driving efficiency and achieving strategic objectives.

In this paper, we also presented a detailed comparison of the five types of business analytics across various factors. Each type possesses unique characteristics, techniques, and applications that cater to diverse business needs. By understanding these differences, organizations can select the appropriate analytics type to suit their specific requirements and drive success in their respective industries.

Business analytics continues to evolve with advancements in technology and data processing capabilities. As organizations harness the power of data and analytics, they gain a competitive advantage, unlock hidden opportunities, and drive innovation. The integration of business analytics into decision-making processes is crucial for organizations seeking to thrive in a data-driven world, paving the way for sustained growth and success in an ever-evolving marketplace.

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THE IMPLEMENTATION OF INDUSTRY 4.0 CONCEPT IN SMART CITY

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Purpose: The purpose of this publication is to present relations between Industry 4.0 and Smart City.

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 study highlights the positive effects of Industry 4.0 on Smart Cities, including efficient infrastructure, connected transportation, data-driven decision-making, improved public services, and enhanced safety and security. Furthermore, Industry 4.0 supports sustainability, economic growth, and resilience in Smart Cities. However, implementing Industry 4.0 in Smart Cities poses challenges such as high costs, data security and privacy concerns, digital divide issues, workforce displacement, and technological complexity. Interoperability, energy consumption, lack of standardization, overreliance on technology, and resistance to change are also potential hurdles to be addressed.

Originality/value: Detailed analysis of all subjects related to the problems connected with the smart city in Industry 4.0.

Keywords: smart city, Industry 4.0, digitalization, sustainability, economy, public services.

Category of the paper: literature review.

1. Introduction

A smart city is a visionary urban concept that harnesses cutting-edge technology and data to enhance the quality of life for its residents and optimize resource management. It seeks to create a more efficient, sustainable, and interconnected urban environment.

In a smart city, various devices, sensors, and systems are integrated into the urban infrastructure to collect real-time data on various aspects such as traffic flow, energy consumption, waste management, and air quality. This data is then analyzed and used to make informed decisions to improve city services and solve challenges (Jonek-Kowalska, Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021; Orzeł, Wolniak, 2021, 2022, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecula, Wolniak, 2022; Olkiewicz et al., 2021).

Industry 4.0, also known as the Fourth Industrial Revolution, is a transformative concept that represents the integration of advanced technologies into the manufacturing and industrial sectors. It leverages cutting-edge technologies like the Internet of Things (IoT), artificial intelligence (AI), big data, cloud computing, and robotics to create smart, connected, and automated production systems (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021).

The core idea of Industry 4.0 is to create a highly efficient, flexible, and autonomous manufacturing ecosystem. Machines and equipment in factories are equipped with sensors that gather real-time data on their performance and processes. This data is then analyzed and used to optimize production, predict maintenance needs, and improve overall productivity (Sułkowski, Wolniak, 2015, 2016, 2018; Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023; Wolniak, 2013, 2016; Hys, Wolniak, 2018).

Industry 4.0 empowers smart cities with advanced technologies and data-driven approaches, leading to increased efficiency, sustainability, and citizen satisfaction. The integration of Industry 4.0 concepts into urban planning and governance is pivotal in shaping the cities of the future, where technology and innovation work harmoniously to create a better living environment for all.

The purpose of this publication is to present relations between Industry 4.0 and Smart City.

2. Smart city

Citizens in a smart city benefit from advanced transportation systems that promote seamless mobility, such as intelligent traffic management and public transportation options. Additionally, the concept promotes smart grids and renewable energy sources to ensure efficient energy distribution and reduce environmental impact. Smart city initiatives often involve digital platforms and applications that engage citizens in governance, making it easier for them to access services and participate in decision-making processes. These platforms can include apps

for reporting issues, accessing public services, or staying informed about city events and developments (Herdiansyah, 2023).

Safety and security are also key components of a smart city, with the integration of surveillance technologies and emergency response systems to ensure quick and effective responses to incidents. Ultimately, a smart city aims to create a more sustainable and connected urban landscape that enhances the well-being of its residents while minimizing environmental impact and optimizing resource utilization.

In a smart city, technology acts as a backbone that connects various aspects of urban life, allowing for real-time monitoring, data analysis, and predictive modeling. Smart cities emphasize the development of robust digital and physical infrastructure. This includes high-speed internet access, a network of sensors and actuators, and the installation of smart grids to efficiently manage utilities like electricity, water, and gas (Embarak, 2022).

Environmental sustainability is a core principle of smart cities. The integration of renewable energy sources like solar and wind power, energy-efficient buildings, and optimized waste management systems help reduce carbon footprints and ensure a cleaner environment. Smart cities aim to improve transportation efficiency and reduce traffic congestion. This involves implementing intelligent traffic management systems, promoting the use of electric vehicles, and providing better public transportation options. Additionally, bike-sharing and pedestrian-friendly infrastructure contribute to a greener and healthier urban environment (Samarakkody et al., 2022).

The heart of a smart city lies in the data it collects and analyzes. Data is gathered from sensors, IoT devices, and various digital platforms. Advanced data analytics and machine learning algorithms help city officials make informed decisions, optimize resource allocation, and respond proactively to changing urban needs. Smart cities encourage active citizen participation and engagement. Digital platforms and mobile apps enable residents to access government services, report issues, provide feedback, and participate in civic activities. This creates a more inclusive and transparent governance structure (Albino et al., 2015).

Smart cities integrate technology into healthcare and public service delivery. Telemedicine, remote health monitoring, and smart clinics improve healthcare accessibility and reduce the burden on healthcare facilities. Additionally, smart public services like waste management and street lighting ensure more efficient resource utilization. Utilizing advanced surveillance systems, smart cities can enhance safety and security. Integrated networks of cameras and sensors enable real-time monitoring of public spaces, improving emergency response times and aiding law enforcement efforts (Lara et al., 2016).

The smart city concept fosters an environment for innovation and entrepreneurship. It attracts businesses and investment by offering a tech-savvy ecosystem, encouraging startups, and supporting research and development initiatives. Smart cities are better equipped to handle disasters and emergencies. Through data analysis and modeling, they can predict potential risks and plan mitigation strategies, ensuring a more resilient urban infrastructure. Also the smart

city concept is designed to enhance the overall quality of life for its inhabitants. By creating efficient, sustainable, and interconnected urban spaces, smart cities aim to provide a better standard of living, improved accessibility to resources, and greater opportunities for growth and development (Dameri, 2016).

3. Industry 4.0

The concept emphasizes the interconnectivity of devices and systems, creating a "smart factory" where machines can communicate with each other, make decentralized decisions, and adapt to changing conditions without human intervention. This connectivity allows for seamless information flow throughout the production process, facilitating better coordination and resource allocation (Adel, 2022).

Industry 4.0 also focuses on customization and personalization of products. With the integration of advanced technologies, manufacturers can efficiently produce small batches of customized goods at costs comparable to mass production. This enables businesses to meet the individual needs and preferences of customers, fostering customer satisfaction and loyalty (Wolniak, Sułkowski, 2015, 2016; Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020; Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022).

Moreover, the concept drives innovation and new business models. By harnessing the power of data analytics, companies can gain insights into market trends, consumer behavior, and product performance, leading to better-informed strategic decisions and opportunities for new revenue streams. However, as Industry 4.0 involves extensive automation and digitization, there are challenges to address, including cybersecurity risks, data privacy concerns, and the need to reskill the workforce for jobs that require a higher level of technical expertise (Akundi et al., 2022).

Industry 4.0 represents a significant shift in the manufacturing landscape, offering increased efficiency, agility, and competitiveness to businesses while shaping a new era of intelligent and technology-driven industries (Olsen, 2023).

Industry 4.0 relies on the integration of physical machines and digital systems, creating cyber-physical systems. These systems are equipped with sensors, actuators, and communication devices that enable them to collect and exchange data in real-time. As a result, manufacturing processes become more adaptive, responsive, and self-optimizing. The IoT plays a crucial role in Industry 4.0 by enabling the seamless connection and communication of various devices and assets. Machines, products, and even individual components can be equipped with IoT sensors, facilitating continuous data exchange and enabling remote monitoring and control (Aslam et al., 2020).

The massive amounts of data generated by cyber-physical systems and IoT devices are processed and analyzed through advanced data analytics techniques. This data-driven approach empowers manufacturers to make data-informed decisions, optimize processes, detect anomalies, and predict maintenance needs, leading to higher efficiency and reduced downtime. AI algorithms are used in Industry 4.0 to extract meaningful insights from data, identify patterns, and make autonomous decisions. Machine learning models can analyze historical data to predict future events, optimize production schedules, and improve quality control (Bakir, Dahlan, 2022).

Cloud-based platforms provide the infrastructure needed to store and process the vast amounts of data generated by Industry 4.0 technologies. Cloud computing offers scalability, accessibility, and cost-effectiveness, enabling businesses of all sizes to adopt and benefit from advanced technologies. Industry 4.0 encourages the adoption of additive manufacturing techniques, like 3D printing, to enable rapid prototyping, on-demand production, and greater design flexibility. This can lead to reduced waste, lower inventory costs, and faster product development cycles (Cillo et al., 2022).

While Industry 4.0 emphasizes automation, it also recognizes the importance of human involvement in the manufacturing process. Humans and machines collaborate to complement each other's strengths, with workers focusing on complex problem-solving, creativity, and decision-making, while robots handle repetitive and dangerous tasks. Industry 4.0 extends its benefits beyond individual factories by integrating the entire supply chain. Real-time data sharing and transparency allow for better coordination among suppliers, manufacturers, and distributors, leading to a more agile and responsive supply chain ecosystem. The concept of Industry 4.0 promotes sustainable practices in manufacturing, such as energy efficiency, waste reduction, and eco-friendly materials. Smart monitoring and optimization tools help reduce the environmental impact of industrial processes. Industry 4.0 has far-reaching implications on a global scale. Countries and companies that embrace these technologies gain a competitive edge in the global market. It fosters innovation, enhances productivity, and opens up new business opportunities (Di Marino et al., 2023).

Industry 4.0 represents a paradigm shift in manufacturing, revolutionizing traditional industries and paving the way for a new era of intelligent, interconnected, and data-driven manufacturing processes. Its potential to improve efficiency, innovation, and sustainability makes it a transformative force across various sectors worldwide. However, it also requires careful consideration of ethical, security, and social aspects to ensure its responsible implementation and maximize its positive impact (Ghibakholl et al., 2022).

4. Smart city and Industry 4.0

Industry 4.0, with its focus on advanced technologies and data-driven processes, has a significant impact on smart cities, transforming the way urban environments are managed and improving the quality of life for residents. Smart cities leverage Industry 4.0 technologies to create more efficient infrastructure. Intelligent sensors and IoT devices are integrated into urban systems such as transportation, energy grids, and waste management, enabling real-time data collection and analysis. This data-driven approach allows for optimized resource allocation, reduced energy consumption, and better management of city services (Javaid, Haleem, 2020).

Industry 4.0 enhances transportation in smart cities. Smart traffic management systems use real-time data to optimize traffic flow, reduce congestion, and minimize travel time. Connected vehicles, equipped with IoT devices, can communicate with each other and with infrastructure, enabling safer and more efficient transportation. Also Industry 4.0 enables smart cities to implement advanced energy management systems. Smart grids and energy distribution networks use data analytics to balance energy supply and demand efficiently. This leads to reduced energy wastage, lower emissions, and increased use of renewable energy sources, contributing to a greener and more sustainable city (Javaid et al., 2020).

Smart cities benefit from the data-driven decision-making capabilities of Industry 4.0. Real-time data on various aspects of the city's functioning, such as air quality, waste generation, and public services utilization, help city authorities make informed decisions and respond proactively to emerging challenges and opportunities. Industry 4.0 enables the development of smart public services in smart cities. Citizens can access government services through digital platforms, report issues through mobile apps, and stay informed about city developments through connected devices. This seamless integration improves service delivery and enhances the overall citizen experience (Johri et al., 2021).

Describe concept contribute to improved safety and security in smart cities. Advanced surveillance systems, including AI-based video analytics, can monitor public spaces and detect potential security threats. Emergency response systems are also enhanced, enabling faster and more effective responses to incidents. By optimizing resource utilization and reducing energy consumption, Industry 4.0 supports sustainable urban living in smart cities. The concept promotes eco-friendly practices, waste reduction, and green infrastructure development, ensuring a healthier environment for residents.

The integration of Industry 4.0 technologies attracts businesses and investors to smart cities. The tech-savvy environment encourages innovation, entrepreneurship, and the development of new business models. This, in turn, boosts economic growth and creates job opportunities for the local workforce. Smart cities equipped with Industry 4.0 capabilities are more resilient to disasters and emergencies. Predictive analytics and modeling can help anticipate potential risks

and plan effective mitigation strategies, enhancing the city's ability to withstand and recover from adverse events.

In table 1 there is an comparison of Smart City and Industry 4.0.

Table 1.
Comparison between Smart city and Industry 4.0

Aspect	Smart City	Industry 4.0
Focus	Urban development and city management	Manufacturing and industrial transformation
Technology Emphasis	IoT, AI, big data, connectivity, digital platforms	IoT, AI, big data, cloud computing, automation
Objective	Enhance urban living, sustainability, efficiency	Optimize manufacturing processes, increase productivity
Data Utilization	Real-time data for city services and decision-making	Real-time data for production optimization and decision-making
Infrastructure	Smart grids, connected transportation, public services	Cyber-physical systems, smart factories, connected machinery
Citizen Engagement	Digital platforms for access to services and participation	Human-machine collaboration in manufacturing
Impact Areas	Transportation, energy, waste management, safety	Production efficiency, quality, supply chain
Scalability	Applicable to cities of various sizes and contexts	Applicable to diverse manufacturing industries
Resilience	Disaster management, emergency response	Predictive maintenance, adaptive manufacturing
Economic Implications	Attracting businesses, boosting local economy	Fostering innovation, creating new business models

Source: (Adel, 2022; Akundi et al., 2022; Olsen, 2023; Cillo et al., 2022; Di Marino et al., 2023; Javaid et al., 2020; Johri et al., 2021; Herdiansyah, 2023; Embarak, 2023; Albino et al., 2015; Lara et al., 2016; Dameri, 2016).

In the table 2 there is an analysis of potential positive impact of Industry 4.0 on various smart city activities. Industry 4.0 brings numerous benefits to Smart Cities by making them more efficient, connected, and sustainable while improving the lives of their residents through better services and safety measures.

Table 2.
Factors of positive impact of Industry 4.0 on Smart City concept

Factor	Description
Efficient Infrastructure	Industry 4.0 technologies optimize urban systems, such as transportation, energy grids, and waste management, leading to better resource allocation and reduced energy consumption.
Connected Transportation	Smart cities benefit from Industry 4.0 advancements in transportation, such as intelligent traffic management, connected vehicles, and data-driven decision-making, resulting in reduced congestion and improved mobility.
Data-Driven Decision Making	Industry 4.0 enables smart cities to make data-informed decisions based on real-time data collected from various urban services and processes, leading to better planning and resource management.
Improved Public Services	The integration of Industry 4.0 technologies improves public service delivery in smart cities, offering citizens seamless access to government services through digital platforms and mobile apps.

Cont. table 2.

Enhanced Safety and Security	Industry 4.0 contributes to better safety and security in smart cities through advanced surveillance systems, AI-based video analytics, and improved emergency response capabilities.
Sustainable Urban Living	With Industry 4.0 optimizing resource utilization and reducing energy consumption, smart cities can achieve greater sustainability and foster eco-friendly practices and green infrastructure development.
Economic Growth and Innovation	Industry 4.0 attracts businesses and investors to smart cities, creating an innovative environment that fosters entrepreneurship, economic growth, and new business models.
Resilience and Disaster Management	Smart cities with Industry 4.0 capabilities are more resilient to disasters and emergencies, thanks to predictive analytics and modeling, which aid in effective risk mitigation and recovery strategies.

Source: (Adel, 2022; Akundi et al., 2022; Olsen, 2023; Cillo et al., 2022; Di Marino et al., 2023; Javaid et al., 2020; Johri et al., 2021; Herdiansyah, 2023; Embarak, 2023; Albino et al., 2015; Lara et al., 2016; Dameri, 2016).

The table 3 outlines the potential problems that may arise when implementing Industry 4.0 technologies in a Smart City.

Table 3.*Problems of implementing Industry 4.0 on Smart City*

Problem	Description
High Implementation Costs	Integrating Industry 4.0 technologies can be expensive, requiring significant upfront investments in infrastructure, training, and technology upgrades.
Data Security and Privacy Concerns	Industry 4.0 relies heavily on data collection and sharing, raising concerns about data security, privacy breaches, and unauthorized access to sensitive information.
Digital Divide and Accessibility	Not all residents may have equal access to digital technology, creating a digital divide that could leave certain segments of the population underserved or excluded.
Workforce Displacement	Automation and AI in Industry 4.0 could lead to job displacement for certain workers, particularly in traditional manufacturing and service sectors.
Technological Complexity	Implementing and managing complex Industry 4.0 systems may require a highly skilled workforce, leading to challenges in finding and retaining qualified personnel.
Interoperability Issues	Different Industry 4.0 technologies may not always be fully compatible with each other, causing challenges in achieving seamless integration and communication.
Energy Consumption and Environmental Impact	The increased use of advanced technologies in Industry 4.0 could lead to higher energy consumption and potentially increase the carbon footprint of the city.
Overreliance on Technology	Relying heavily on technology could lead to vulnerabilities, as a single point of failure or cyberattack could disrupt critical services and infrastructure.
Lack of Standardization	A lack of standardized protocols and practices in Industry 4.0 could hinder interoperability and create complexities in the development and deployment of smart city solutions.
Resistance to Change	Resistance from various stakeholders, including government agencies, businesses, and citizens, may slow down the adoption of Industry 4.0 solutions in the smart city context.

Source: (Adel, 2022; Akundi et al., 2022; Olsen, 2023; Cillo et al., 2022; Di Marino et al., 2023; Javaid et al., 2020; Johri et al., 2021; Herdiansyah, 2023; Embarak, 2023; Albino et al., 2015; Lara et al., 2016; Dameri, 2016).

5. Conclusion

The paper discusses the concept of a Smart City and the transformative influence of Industry 4.0 on urban development. A Smart City aims to enhance residents' quality of life and resource management by utilizing cutting-edge technology and real-time data. It integrates various devices, sensors, and systems to monitor and analyze aspects such as traffic flow, energy consumption, waste management, and air quality. Industry 4.0, known as the Fourth Industrial Revolution, revolutionizes manufacturing by integrating advanced technologies like IoT, AI, big data, and robotics. It aims to create efficient, flexible, and autonomous manufacturing systems, optimizing production and predictive maintenance through data analysis.

The paper highlights the positive impacts of Industry 4.0 on Smart Cities, such as efficient infrastructure, connected transportation, data-driven decision-making, improved public services, and enhanced safety and security. Industry 4.0 also promotes sustainability, economic growth, and resilience in Smart Cities. However, the implementation of Industry 4.0 in Smart Cities also poses challenges, including high costs, data security and privacy concerns, digital divide and accessibility issues, workforce displacement, and technological complexity. Interoperability, energy consumption, lack of standardization, overreliance on technology, and resistance to change are also potential problems that need to be addressed. The integration of Industry 4.0 technologies in Smart Cities offers numerous benefits, but it requires careful planning and management to overcome potential challenges and ensure responsible and effective implementation for the betterment of urban living.

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IMPLEMENTING FULL-TIME REMOTE WORK IN THE IT SECTOR: CONSEQUENCES AND SOLUTIONS

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Purpose: The COVID-19 pandemic allowed companies to test the full-time remote work performed by the majority of employees. So far, such a workplace model has been rarely used in companies. Partial remote or full-time remote work dominated but carried out by a relatively small proportion of employees. The aim of the study was to identify the key consequences that appeared in IT companies during the implementation of full-time remote work and actions that were or may be taken in response to them.

Design/methodology/approach: Comparative case studies method – seven companies representing different segments of IT sector. Case studies were prepared with the use of interviews and documents analysis.

Findings: The assessment of the effects of full-time remote work has changed over time, from surprisingly positive in the first period to a more nuanced and complex one, including both positive and negative side effects. Over time, the approach of study participants to remote work began to change. Most of them began to gradually reduce its scale, encouraging or obliging employees to partially return to their offices.

Research limitations/implications: The subject of research is extremely dynamic due to social and technological changes. For example, the development of communication tools may have a significant impact on some of the identified effects of remote work.

Practical implications: The contribution of the study is indication of critical areas that require addressing by companies when implementing this form of work. The pandemic will bring a permanent change in the workplace organization, and the effective implementation of new hybrid models requires deep understanding of the full-time remote work consequences. This study supports the creation of such models and the selection of tools that will allow to use full potential of remote work.

Originality/value: The novelty of the research is recognizing the dynamics of the full-time remote work effects. Although the study was conducted among IT companies, its results may also be useful in other sectors.

Keywords: remote work, distant work, telework, work from home, COVID-19.

Category of the paper: research paper.

1. Introduction

Although the IT sector was particularly predisposed to use full-time remote work, until recently this form of work organization was not often used by IT companies in Poland. In a study of Polish IT specialists conducted just before the outbreak of the COVID-19 pandemic (Bulldogjob, 2020), only 8% of the respondents performed all work remotely. The survey shows that most of the respondents primarily worked in an office, and work at home accounted for a relatively small part of their professional activity (partial remote work). The situation changed with the outbreak of the pandemic. Companies had to implement such solutions overnight. In next study of Polish IT specialists (Bulldogjob, 2021) carried out almost a year after the outbreak of the pandemic, 73% of respondents still used full-time remote work. However, the end of the pandemic brought a partial return to offices in the IT sector. More and more companies (e.g. Amazon, Google, Zoom) have started to switch from full remote work to hybrid work.

The introduction of full-time remote work on a large scale is a revolution leading to a number of organizational and social consequences. There is a large body of research on potential consequences of implementing remote work (Bloom et al., 2015; Grenny, Maxfield, 2017; Nilles, 1998), but most studies refer to partial remote work, which so far occurred much more often than full-time remote work. In turn, research on virtual teams refer to organizations where remote workers are a minority (Gibson, Gibbs, 2006; Lepsinger, DeRosa, 2010). Meanwhile, full-time remote work performed by most employees in organization can lead to effects that are not observed in partial remote work or full-time remote work used by a small proportion of employees. More studies on full-time remote work used by most employees in companies have emerged during the COVID-19 pandemic. Many of them are employee opinion polls (Barrero et al., 2020; Wong et al., 2021; Maghlaperidze et al., 2021; Sami, Roychowdhury, 2021; Wrycza, Maślankowski, 2020), but relatively little illustrates the employers' perspective (e.g. Atkin et al., 2023; Gibbs et al., 2022; Jung, Silva, 2021; Yang et al., 2021). In addition, it is worth emphasizing that a large part of these studies was carried out in the first months of the pandemic, hence they may not include the effects that appear in the long term. Therefore, we can identify a research gap – lack of knowledge about the long-term effects of implementing full-time remote work used by the majority of employees in the organization.

The aim of the study is to identify the key consequences that appeared in IT companies during the implementation of full-time remote work and actions that were or may be taken in response to them. The article contributes to research on remote work by taking the employer's perspective. Furthermore, as the analysis focused on the first two years of the pandemic (2020-2022), it was possible to observe the effects from a longer perspective. The relationship between positive and negative outcomes is important for the future use of remote work after the pandemic. The author used comparative case studies method (7 companies operating in Poland).

The choice of the analyzed sector resulted from the above-average frequency of remote work in comparison to the entire Polish economy during the pandemic (GUS, 2020).

In the article, full-time remote work refers to work performed 5 days a week at any distance from the place where its effects are expected or where it would be performed within the traditional employment system, using available ICT techniques (Zalega, 2009, p. 39). So far, the term telework has been used more often in research, however, remote work, telework and telecommuting may be treated as the same.

2. Literature review

The introduction of full-time remote work is a revolution in organizations using traditional office workplace. As a result, there is a number of consequences of such a change in organizations, both for the employer, the employees affected by this change and their co-workers or clients. The literature and research most often examine the effects of remote work, without distinguishing certain types of it. Meanwhile, it is a heterogeneous phenomenon. Due to the frequency of its use, it is possible to distinguish full-time, partial and occasional remote work. This section presents the effects of implementing full-time remote work, most often indicated in the research, or universal effects identified in various types of remote work, including full-time remote work.

2.1. Employee productivity

In the past, many researchers indicated that remote work could contribute to an increase in employee productivity. The reasons for this effect were seen in several sources. On the one hand, the average working time of remote employees is longer than the working time of employees performing tasks in the office (Lasfargue, Fauconnier, 2015; Madden, Jones, 2008; Noonan, Glass, 2012; Tipping et al., 2012). The productivity of remote employees is influenced not only by the extension of working time, but also the ability to work in concentration. Many researchers (e.g. Golden, 2006) emphasize that working remotely from home can eliminate many sources of disruption in the office (e.g. telephones, colleagues, noise, meetings) in the employee's environment and thus increase their productivity. However, this does not apply to everyone, for example employees who live with young children or do not have a separate room to work at home.

In practice, measuring the performance of remote workers is difficult. Many studies are based on the subjective opinion of employees or their superiors. For example, in the study by FlexJobs and WorldatWork (2015), managers asked to evaluate the productivity of remote workers compared to office workers in almost half of the cases (39%) avoided the answer, indicating that it was difficult to assess. Other managers most often indicated that the level of

productivity was similar in both groups (48%), and only 12% saw a difference in productivity: 8% in favor of remote workers, 5% in favor of office workers. At the same time, as many as 97% of surveyed managers admitted that the impact of projects promoting flexibility among employees, e.g. on productivity, customer satisfaction, and product quality, is not assessed.

A different approach to assessing the impact of remote work on productivity was chosen by (Bloom et al., 2015). During the implementation of remote work in the Chinese company Ctrip, a pilot project was conducted in which the performance of remote call center employees was compared with the performance of office workers performing the same duties (control group). The productivity of the group of remote employees compared to control group increased by 13%. The increase was due to: 9% increase in effective working time (fewer breaks and sick leaves) and 4% increase in the number of calls per minute of work (quieter and more comfortable working conditions). After the end of the experiment, about half of the employees decided to continue working remotely - the increase in the productivity of this group was even higher and amounted to 22%. Employees whose work performance decreased during the experiment resigned from further remote work. This means that some of the employees using remote work recorded a reduction in efficiency.

The pandemic period has provided new opportunities to study the performance of remote workers. The obtained results are less optimistic than those previously described. Jung and Silva (2021) in a study of companies that used full-time remote work during the COVID-19 pandemic point out that high productivity was the result of increased working hours and a disruption in work-life balance. They concluded it was positive in the short-term, but unsustainable in the long-term. Atkin, Schoar and Shinde (2023) analyzed remote work in the data entry sector in India that exogenously allocates workers to the home or office. They found that the productivity of workers randomly assigned to working from home was 18% lower than those in the office. Gibbs, Mengel and Siemroth (2022) compared employee productivity in a large Indian IT services company before and during the working from home period of the Covid-19 pandemic. They found employees spent 18% more time at work, but the employee productivity (output per hour worked) fell 8-19%. An important source was higher communication costs - time spent on coordination activities and meetings increased, while uninterrupted work hours shrank considerably.

2.2. Cost savings

One of the most measurable effects of full-time remote work is cost optimization by reducing the need for office space. As a result, the costs of renting or purchasing space, office maintenance, utilities, taxes, and car park rental are reduced. On the other hand, the use of remote work requires specific expenditure related to arranging offices in employees' homes, although it is most often a one-time expense.

The research shows the different scale of savings. The analysts of Global Workplace Analytics and Flexjobs (2017) estimated that the decrease in office maintenance costs amounted to approx. 2 thousand dollars per year for one remote employee. In the aforementioned study by the Chinese company Ctrip (Bloom et al., 2015), savings related to the reduction of office space (Shanghai) and IT costs amounted to 1.4 thousand dollars per year for one remote employee.

2.3. Human Capital Management

Researchers find a number of limitations of remote work in the context of selected HR processes. These restrictions apply with on-boarding of new members. Employees deployed remotely in many cases need more time to learn tacit knowledge, develop understanding of the organization and build relationships with other team members (Ahuja, Galvin, 2003). Lowered social capital can result in weaker work identity (Gruman, Saks, 2018). For this reason, some companies use hybrid approach introducing an obligation for new employees to work the first period at the company's headquarter before they can work remotely (Matos, 2015).

The challenge for managers of teams consisting of remote employees is to develop their competences. Researchers found during the COVID-19 pandemic that remote workers received less coaching and 1:1 meetings with supervisors (Emanuel, Harrington, 2023; Gibbs et al., 2022). This may lead to lower job satisfaction and greater propensity to quit in this group.

Next challenge in distant work is to transfer the culture of the organization, which should be the bond of teams. In a traditional workplace, organizational culture is passed on in many ways, e.g. through material artifacts, relationships with superiors and colleagues, rituals, and formal tools. Meanwhile, full-time remote work limits these possibilities. The number of direct personal interactions is small and the observation of mutual behavior is limited. Gainey et al. (1999) even emphasize that remote work may weaken existing organizational cultures. The challenge of transmitting culture concerns, above all, people who have not previously worked at the office of the organization and do not know it. As a result, the transfer of culture to such people takes longer and is less effective. The result may be weaker identification of the employee with the organization, a lack of a sense of community with the team, less involvement in work or the emergence of subcultures. Kostner (1999) points out a similar problem, claiming that many remote employees, due to the virtual nature of the relationship, do not feel a significant emotional connection with the organization (low loyalty to the employer). For this reason, it is easier to build the loyalty of remote employees towards the manager and the team. This phenomenon can lead to increased staff turnover which was observed in research on distributed software teams (Smite, Solingen, 2015).

2.4. Relationships in teams

Full-time remote work may hinder team building due to constraint or elimination of face-to-face contacts between employees. Many researchers emphasize the importance of F2F contacts as a catalyst for the process of increasing social cohesion in teams (Lu, 2015). In particular, the importance of a face-to-face meeting at the beginning of the team's work is emphasized. Research shows that new teams that start cooperation from such a meeting and then work remotely achieve similar results as teams that are physically in the same place all the time (Coenen, Kok, 2014). Lepsinger and DeRosa (2010) comparing the functioning of 48 virtual teams operating in various organizations and industries concluded that the teams that met face to face at the beginning of the project were more effective than those that did not have such a meeting.

Loss of relationships was identified among companies implementing full-time remote work during the pandemic as one of most common challenges (Jung, Silva, 2021). Despite the effort put in staying connected virtually employee relationships became more limited to their departments and teams.

The other consequence was loss of in-person innovation and collaboration (Jung, Silva, 2021). The replacement of white boarding sessions and other in-person meetings with virtual meetings was limited and oftentimes frustrating substitute. Employees lost a chance to interact with colleagues outside of one's regular teams. Meanwhile, these types of interactions with new people – the power of “loose ties” – are conducive to innovation (Davis, 2008).

Research conducted during the pandemic at Microsoft illustrates the impact of full-time remote work on teamwork and communication (Yang et al., 2021). Researchers concluded that firm-wide remote work caused the collaboration network of workers to become more static and siloed, with fewer bridges between disparate parts. Furthermore, there was a decrease in synchronous communication and an increase in asynchronous communication. Together, these effects may make it harder for employees to acquire and share new information across the network.

3. Methodology

The aim of the study was to identify the key consequences that appeared in IT companies during the implementation of full-time remote work and actions that were or may be taken in response to them. The effects were analyzed from the employer's perspective.

The research questions (RQ) were:

RQ1: What were the short and long-term effects of the full-time remote work implementation for IT companies?

RQ2: What actions have employers taken to adapt their organizations to the challenges arising from full-time remote work?

RQ3: Which remote work challenges require additional action?

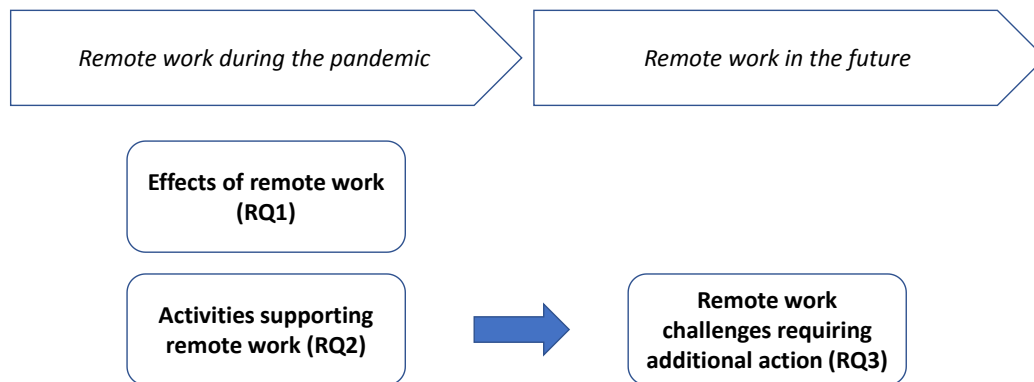


Figure 1. Research framework.

Source: own elaboration.

Most studies so far focused on partial remote work, which occurred much more often than full-time remote work. Only the pandemic became a stimulus for the massive implementation of remote work performed five days a week. We lack knowledge about the long-term effects of implementing full-time remote work used by most employees in the organization. Meanwhile, increasing the effectiveness of this form of work requires a better understanding of its mechanisms. The comparative case studies method allows for a more in-depth understanding of the phenomenon than quantitative research.

The research sample of 7 companies was chosen using the following criteria:

- organizations operating in Poland in the IT sector or IT departments of large enterprises;
- companies employing at least 20 IT staff members;
- organizations using full-time remote work in their activities during the COVID-19 pandemic.

The IT sector consists of companies with a very different profile of activity. The strength of the research sample is its diversity, from e-commerce company through software houses, companies implementing ERP systems based on third-party software, to companies providing IT services for international holdings.

The study was carried out in two stages:

- about a year after the pandemic began in Poland (2021);
- two years after the start of the pandemic (2022).

In each stage, at least one semi-structured in-depth interview was conducted with representatives of each surveyed organizations (company management or HR units). Interviews were conducted by phone or by videoconference.

Surveyed organizations were asked to provide three categories of internal documents: remote work regulations, existing analysis of the use of remote work during a pandemic, employee opinion surveys on the use of remote work. Not all companies had these documents, and those that did not always decided to share them. Eventually three companies made their documents available (A, D and F). For this reason, this source of information was rather complementary.

Table 1.

Description of the research sample

Code	Type of activity	Number of IT employees	Respondents
A	E-commerce company operating in Poland	30	CEO
B	IT subsidiary that supports global production holding	300	CEO
C	IT department in a production company operating worldwide	20	Head of programmers
D	Software house operating worldwide	200	Project Manager
E	IT company implementing ERP systems under license in Poland	50	Head of the implementation department
F	Software house operating in Europe	400	HR Director
G	IT subsidiary that supports global conglomerate	> 1000	Team leader

Source: own elaboration.

4. Results

4.1. The use of remote work in the surveyed companies

The analysis and drawing of conclusions from case study method requires knowledge of the context of the studied phenomenon. Before the outbreak of the pandemic, analyzed companies had a very different approach to remote work. Among the participants there is a company (C), which did not use this possibility at all, as well as two companies (D and G) for which it was already the dominant form of workplace organization. The remaining four companies used partial remote work to a small extent.

In March 2020, the beginning of pandemic triggered lockdown, all surveyed companies introduced remote work as the basic form of workplace organization and used it intensively until the day of the study (two years after the outbreak of the pandemic). So it was a revolution for five of the seven companies. Employees mainly used remote work from home. In the first period of the pandemic, companies introduced full-time remote work. Over time, the approach to remote work began to diversify between study participants. Some of them maintained full-time remote work (A, D, G), and some began to gradually reduce its scale, encouraging (B, F) or obliging (C, E) employees to partially return to their offices. In most companies, the phenomenon is quite heterogeneous: some workers do all duties at home, while others work partly from home and partly from the office.

4.2. The effects of the full-time remote work implementation for IT companies

The introduction of full-time remote work on a large scale contributed to several consequences, some of them were positive, but there were also negative side effects. Some of the effects were seen in the first weeks, others only after a long time.

Table 2.

Selected effects of full-time remote work implementation observed in the surveyed companies

The effect	Type of effect (positive, neutral, negative; immediate, postponed)	Company						
		A	B	C	D	E	F	G
Maintaining business continuity	Positive, immediate							
No drop in employee productivity	Neutral, immediate							
Increasing the efficiency of office space use	Positive, postponed							
Loosening of interpersonal ties and erosion of organizational culture	Negative, postponed							
Departure of employees	Negative, postponed							
Acquiring employees from new labor markets	Positive, postponed							
Difficulties in onboarding new employees	Negative, postponed							

Source: own elaboration.

Maintaining business continuity

Remote work has long been indicated as a solution enabling organizations to maintain business continuity in the event of natural disasters, extraordinary situations. However, so far this factor has played a minor role, for short periods in a limited territory, e.g., during the crisis at the Fukushima nuclear power plant. The outbreak of the COVID-19 pandemic and the introduction of lockdown restrictions forced organizations to implement full-time remote work. Despite the relatively low popularity of full-time remote work in the IT sector before the pandemic¹, these companies were nevertheless technologically very well prepared for such organizational innovation and in most cases had experience of partial remote work. As a result, the surveyed entities, despite the lack of formal Business Continuity Plans, continued their activities without major disturbances.

No drop in employee productivity

The surveyed companies did not conduct comprehensive and systematic analyzes of the performance of remote employees. Performance assessments were based primarily on the opinions of managers who formulated them, most often analyzing the time and quality of executed tasks. After two years of using full-time remote work, management feedback has been positive. The most common opinion was that the change in workplace organization did not contribute to the decline in productivity at the level of the organization as a whole.

¹ Only 8% of IT employees in Poland before the outbreak of the COVID-19 pandemic (November 2019 - January 2020) used remote work 5 days per week (Bulldogjob, 2020).

Some survey participants (company A) emphasized that in the case of individual employees such a decrease took place. It turned out that due to the lack of self-discipline and independence, not every employee was able to effectively work remotely, such people were dismissed.

The tasks performed in the surveyed companies are of a very diverse nature and this has a significant impact on the efficiency of remote work. According to the survey participants, most of the work of employees was relatively easy to transfer to a new form of work organization. However, there were tasks where it was more difficult or even impossible:

- tasks requiring access to resources located in the office, e.g. maintenance of IT infrastructure [companies B, C];
- tasks that require a large group of people to work together to solve unique, non-routine problems, e.g. strategic workshops [company A], workshops initiating the project with the participation of customer representatives [companies D, F], internal workshops as part of Scrum Day [company F], creating innovation [company G];
- tasks that require a lot of interpersonal contacts in order to understand the context of the work being carried out, e.g. the work of a developer or analyst who should understand the business processes and expectations of software users [companies B, D];
- tasks requiring deep interpersonal contact, e.g. interviews as part of the performance appraisal system [company A];
- tasks that are difficult to measure, which makes it difficult to monitor the work [company A];
- recruitment meetings due to the much smaller possibilities than before to make a good impression on the candidate for work (no possibility of presenting the office and future colleagues) [company F];
- integration activities, mainly concerning new employees [companies F, G].

Several respondents [companies A, B, C] additionally indicated that cooperation is troublesome when some people work in the office, and some remotely. It is especially noticeable during meetings, when the discussion takes place mainly among office workers, and the activity of remote participants of the meeting is much lower.

On the other hand, there were tasks in which a clear increase in productivity was visible as a result of the remote work use. During the removal of system failures, communication and cooperation in a large group of employees from different locations was more efficient than before (company B). Thanks to technology, these workers were more accessible without having to meet in the same place.

Increasing the efficiency of office space use

The introduction of full-time remote work enables organizations to reduce office maintenance costs. Among the surveyed companies, despite the fact that two years have passed since the outbreak of the pandemic, only one (company E) has renegotiated the office lease agreement, reducing the used office space by approximately a half. The second company (A) is

preparing to reduce the existing space by approx. 75%. The third company (B) will increase employment without increasing the existing office space. One of the companies (F) even took the opposite action - while at the stage of rapidly increasing the scale of its operations, it decided to open another office in a new location, but relatively small one. Three other companies are refraining from taking any action in this area, keeping the existing office space. It may indicate that they treat remote work as a temporary solution assuming that employees would return to offices.

Loosening of interpersonal ties and erosion of organizational culture

The result of remote work is the replacement of face-to-face contacts in the office by exchanging e-mails, chatting on IM and during videoconferences. The intensity of communication in teams is declining - instead of a constant conversation with a wide group of colleagues in a common space, communication is shifted to periodic virtual meetings and to a narrower group through instant messaging. Additionally, employees miss opportunities for random conversations in the hallway or a break area, especially with people outside of their team. The chance for an exchange of ideas, mutual spontaneous inspiration, and building team spirit decreases. As a result, managers of all surveyed companies see the problem of loosening interpersonal ties in their teams. This is particularly evident in teams where new people have already appeared during the pandemic. In such teams, internal divisions sometimes appear - old vs. new employees [company E].

An even greater problem of loosening interpersonal ties arises if a broader perspective of analysis is adopted, going beyond a single team. While employees maintain constant contact with colleagues within their team, contacts with people from other teams are much less frequent than before the pandemic [companies A, E, F, G]. While we can talk about maintaining employees' attachment to their team, the level of identification with the company decreases [companies A, C, F, G].

Traditionally, many cultural artifacts are tangible (e.g. office design and furnishings) or held in offices (e.g. some rituals). Reducing majority of contacts to electronic communication limits the possibilities of shaping and transmitting organizational culture. It is particularly troublesome in the case of new employees, the possibilities of shaping their behavior are shrinking. Additionally, there is the challenge of maintaining the coherence of the culture within the entire company. The much smaller number of contacts with colleagues from other teams than before makes it difficult to use top-down approach in shaping the culture and may lead to the formation of subcultures in teams. As a result, there is a risk of a gradual erosion of organizational cultures.

Acquiring employees from new labor markets

In the first months of the pandemic, the recruitment of new employees was suspended in all surveyed companies. Returning to the recruitment, companies faced the challenge of finding talents. The labor market of IT specialists in Poland has been an employee's market for a long time. In such a situation, the possibility of going beyond the current local labor markets thanks

to the implementation of full-time remote work was attractive for employers. Among the respondents, four companies [A, B, F, G] extended the geographical scope of recruitment to other local labor markets in Poland, and one [D] is looking for employees also in other countries, including non-European countries. The motivations behind entering new labor markets include the lack of candidates in the existing markets and sometimes also the desire to reduce personnel costs (e.g. recruiting cheaper employees in Romania or in small towns in Poland). New employees recruited in such markets will also work remotely after the pandemic, which means that expanding the scope of recruitment will make full-time remote work permanent in these organizations.

Departure of employees

The competitors of the surveyed companies also take advantage of the possibility of recruiting employees on new labor markets. For some employees, full-time remote work performed for Polish or foreign organizations does not differ much, apart from salaries. Among some companies it was observed that their employees received job offers, in particular from Western European companies [companies B, F]. As a result, some employees have already left. This is dangerous because, according to some respondents, working remotely 5 days a week causes the previously mentioned problems of loosening interpersonal ties, weakening organizational cultures and, as a result, a decrease in employee loyalty to the company [companies A, C, F, G]. Additionally, this phenomenon is overlapped with the reduced need to identify with the company among the youngest employees [B, E]. As a result, this leads to a situation where when comparing job offers, employees focus primarily on the amount of remuneration. Moreover, it is more difficult for managers of remote employees to notice red flags that may indicate an intention to leave a given employee.

Difficulties in onboarding new employees

During the pandemic, all surveyed companies employed new workers. The onboarding of new remote employees was a challenge primarily for line managers. The vast majority of these activities in the first year of pandemic took place remotely. Despite the great effort put by the organization to introduce a new employee, this process was much slower than before. It was also difficult to integrate such a person into the team in this way. Moreover, some of the new employees felt uncomfortable with this way of entering the new organization. Getting to know your duties, colleagues and the company itself was much more difficult than before [company E, G]. Among the surveyed organizations, there were cases of resignation of new employees for this reason during the first weeks of employment [company C, G].

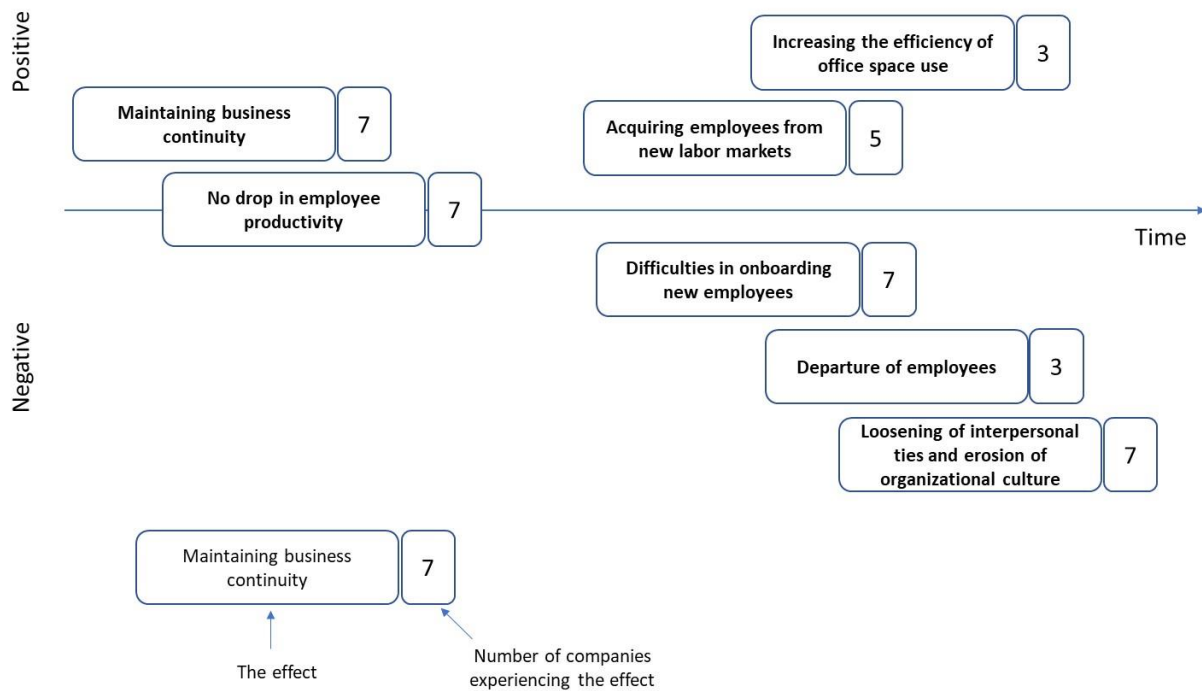


Figure 2. The order of appearance of remote work results.

Source: own elaboration.

At the beginning of the pandemic, there were positive effects of implementing full-time remote work related to maintaining business continuity in the new work organization model without negative effects on productivity. Therefore, the first evaluations were positive and optimistic. As time passed, however, some negative side effects of a social and organizational nature began to be noticed in all companies. New opportunities also began to emerge (access to new labor markets, the possibility of reducing office costs), but only a part of the surveyed companies took advantage of them.

4.3. Response of the surveyed companies to the challenges arising from remote work

The implementation of remote work required the adoption of several technical tools as well as making organizational changes. In the first place, solutions aimed at ensuring the efficient performance of the main tasks of employees were implemented. Over time, managers observed the side effects of remote work and looked for solutions that prevented them or minimized their consequences.

In order to maintain the continuity of processes and projects and to ensure employee productivity, IT tools were implemented, where they had not existed before, to facilitate cooperation between remote employees and help managers to supervise the team [company A]. In some companies, the rules of conducting electronic communication have been specified in detail [company B]. The limitations of this form of communication were noticed in the surveyed companies and in the case of tasks in which electronic communication does not fully work, face-to-face meetings were used. All the surveyed companies tracked work performance

primarily using the existing measures, e.g. resulting from the applied project management methodologies. Their design depended on the specificity of the team's work. In some cases (e.g. secretary), the work was not measurable enough to use such solutions.

The respondents often pointed out that work productivity is an important problem for management and is subject to monitoring. In two cases [companies B, C] it was found that the challenge for IT managers was to convince top management that the effectiveness of remote work was not lower than before the COVID-19 pandemic. In several interviews, opinions appeared that top management returned to stationary work after the initial period of the pandemic and was suspicious of remote work [companies C, E]. In one of the surveyed companies [company C], the top management expected the introduction of software for monitoring computers of remote employees. In another [company E], reporting on work was introduced more detailed than before. After some time, when it turned out that the productivity did not decrease, the scope of reporting was limited.

The problem of loosening interpersonal ties was noticed after a few months of full-time remote work in practically all the surveyed companies. In larger entities [companies B, F, G], not only managers but also HR departments monitored employees' morale. Two of the surveyed companies [A, G] conducted a survey of employees in order to find out their opinions on the organization of remote work.

Actions aimed at reducing the problem of loosening interpersonal ties were of various nature, both top-down and bottom-up, which means that the problem was noticed by both the managers and the employees themselves. Top-down actions sometimes led to forcing certain behaviors by, for example, introducing the obligation to work in the office on certain days [companies C, E]. In other cases, the actions were less restrictive and were intended to encourage employees to visit the office periodically [companies B, F, G]. Typically, there were more top-down activities in larger companies that have HR departments. These were both initiatives inspired by company top management and line managers who reported such needs to HR units. On the other hand, bottom-up activities were undertaken more often in a small groups of people, e.g. a project teams or narrow groups of people who had close relationships with each other. They involve organizing social meetings (on-line and traditional) or spending time together playing online games.

The risk of organizational culture erosion and the problem of limited possibilities of transferring it were less noticed among the surveyed companies. This challenge was considered key by one of the surveyed companies [B]. One of the actions taken was to change the scope of tasks of the current HR Partner positions and rename these positions to Culture manager. In the remaining companies, no activities related to this threat were identified.

Each of the surveyed organizations developed new rules for onboarding process. The process in some companies [A, B, C, E] began with a visit to the office and getting to know the supervisor (but no co-workers who worked at home) in a traditional way. In the remaining companies, even the first contacts were only virtual. A new employee in the first period - usually

a few weeks - was supported by a manager or designated employee (buddy system) or internal trainers [all surveyed companies]. During this time, the newly hired person carried out tasks that introduce him or her to new duties. This stage of cooperation was usually remote. Introducing a new employee to work was focused on formal and legal issues and substantive preparation for work, little attention was paid to soft issues, so that the employee felt part of the team. Only two companies [F, G] used some virtual social activities. What's more, the interviewees emphasized that new people did not have a chance to watch other employees, listen to their conversations, and so far it had been an important factor in the development of new employees. Knowledge diffusion often occurred unplanned when working together in one room. As a result, the period of reaching the desired level of professional maturity took much longer than before.

One of the companies [A] was planning to record tutorials on how to perform selected tasks. In this way, the people looking after new employees would be partially relieved, and they, in turn, would be able to use the hints at any time without involving other employees.

A serious problem for some of the surveyed companies was the loss of employees to employers from other countries offering higher wages. The pandemic made foreign competitors implement remote work and as a result they started to hire workers all over Europe. This is a challenge that is difficult to deal with directly. The surveyed companies declared that they used indirect solutions, trying to create non-material benefits for employees. Unfortunately, the possibilities of creating a friendly atmosphere and close relationships are limited in the realities of remote work. While long-term employees stick to the company because of existing strong ties, new people have very limited opportunities to create them, so the risk of their departure is greater than those who started working in a traditional office.

5. Discussion

5.1. The effects of the full-time remote work implementation for IT companies

The study highlights changing nature of full-time remote work effects over time. In the short term, the assessment of the remote work implementation was very positive. This change in workplace organization allowed companies to maintain business continuity in a pandemic without adversely affecting work performance. With a few tasks, the limitations of remote work became apparent, which, however, does not undermine the claim that work performance has been maintained. Some researchers (e.g. Atkin et al., 2023; Gibbs et al., 2022) indicate that remote work during the COVID-19 pandemic led to a decline in labor productivity. Meanwhile, in the case of most tasks, the respondents did not notice a significant change in productivity, although there was also a small part of the tasks where this negative effect was clearly noticed.

The new workplace organization created some new opportunities for companies: reduction of the costs of maintaining the office, recruitment of employees on new labor markets. The latter has become more popular than the first. Both these chances resulting from remote work were highlighted in previous research (e.g. Bloom et al., 2015; Mueller-Langer, Gómez-Herrera, 2021; Oshri et al., 2015).

In the long-term perspective, the assessment of the introduced change in the workplace organization was not so clear. Remote work influenced the existing organizational culture and the possibilities of its shaping. Some researchers (e.g. Jung, Silva, 2021) highlights positive cultural changes: increase in trust and flattened hierarchy. The others show remote work makes collaboration in large organizations more siloed (Yang et al., 2021). As researched companies gradually observed the weakening of interpersonal ties, transmitting values became more and more difficult which confirms the conclusions of other researchers (Gainey et al., 1999). This process may lead to organizational culture erosion in the future.

As a further consequence, there was a decline in employee loyalty and attachment to companies, which may lead into increased employee turnover. These results are similar to those of Kostner (1999) who found that many remote workers, due to the virtual nature of the relationship, do not feel a significant emotional connection with the organization. It was observed during the pandemic, e.g. in global study of more than 30,000 people 46% of workforce was planning to leave their employer because they could work remotely (Microsoft, 2021).

What's more, researchers (Bell, Kozlowski, 2002) indicate that remote work on a significant amount of time causes the remote worker to become "invisible" to the group of people with whom he or she does not cooperate closely and has less contact with superiors and colleagues. As a consequence, this may have a negative impact on individual position in the organization, as well as the chances of promotion (Emanuel, Harrington, 2023) and an increase in earnings. It can also lead to higher employee turnover.

This study shows that full-time remote work may lead to disintegration of the organization if efforts are not made to build and maintain interpersonal relationships in teams and beyond teams to strengthen the organizational culture.

The other challenge remote work brought was onboarding process. All researched companies found onboarding new employees slower and less effective comparing to pre-pandemic. It was much more difficult for new hires to build relationships with colleagues, and this may also result in increased staff turnover.

Taking a broader perspective, it can be expected that the implementation of remote work on a large scale will have a significant impact on the functioning of the labor market of IT specialists. On the one hand, it enables the acquisition of employees in new labor markets, but at the same time it means a greater risk of losing own employees to employers from other countries. As a result, competition for IT workers will increase and labor markets will lose their local character.

5.2. Previous and future activities of companies supporting the remote work

The surveyed organizations first focused on activities aimed at maintaining the continuity of processes and projects and sustaining employee productivity. These were both technical and organizational solutions, enabling employees to cooperate efficiently and supporting managers to control employees and provide them with support.

As time passed, managers began to notice negative side effects of working remotely and introduced solutions that can minimize them. This applies in particular to the problem of loosening interpersonal ties in teams and more broadly in entire organizations. After the initial period of the pandemic, some of the surveyed companies introduced the obligation to work in the office on certain days. Work has also been undertaken to integrate employees. The impulse for such actions came from both the managerial staff and the employees themselves. So far, however, the frequency of integration activities has been quite modest. It seems that if companies decide to maintain a large amount of remote work at home (4-5 days a week) in the future, it will require integration activities on a much larger scale than before. This will be especially important for companies with above-average employee turnover. It will also be necessary to search for a new formula of integration activities combining traditional and virtual methods. Sources of inspiration can be found among companies that have long used virtual, global teams (e.g. Moe, 2020).

Organizational culture plays an important role in employees' integration. Only one of the seven researched companies appreciated the risk of organizational culture erosion creating the position of Culture manager. The others did not undertake any specific actions in this regard. In the short term, this threat is less tangible, but has a number of serious consequences in the future, ranging from lower identification with values, declining employees' loyalty to the disintegration of the entire company. According to the research this was the most serious consequence of full-time remote work. Undoubtedly, the popularization of this form of work will have to be accompanied by the development of methods of virtual transmission of organizational culture. Some of them may involve Mixed Reality, where physical and digital objects co-exist and interact in real time (Shao, 2021).

At the beginning of the pandemic, recruitment processes were suspended, but after a few months the researched companies started hiring new employees. In each of the surveyed companies, measures were also taken to virtualize the on-boarding process of new people, but the assessment of its effectiveness is quite critical. Of the four building blocks of successful onboarding (Jones, 1986), organizations focused on only two – compliance and clarification, not addressing two others: culture and connection. It seems that further use of full-time remote work will require a far-reaching redefinition of this process. The on-boarding experience of companies using virtual teams might be helpful. It points out that the virtual process must be very well thought out and organized, involving many employees (Gruman, Saks, 2018; Elset, 2018).

Prystupa-Rządca (2018) suggests that dispersed teams are a complicated social construct that requires appropriate managerial support. Meanwhile, no training for managers in managing dispersed teams was conducted in any of the surveyed companies. Also research done before the pandemic showed that the use of training in companies implementing remote work was quite modest (WorldatWork, 2011). It seems that the respondents underestimated the complexity of managing dispersed teams. Employing without direct contact with the candidate, building task and social cohesion of teams, or introducing solutions monitoring distant work, but not leading to negative social effects, requires specific knowledge and a lot of managers energy. Meanwhile, a small proportion of the organizations surveyed had experience with full-time remote work prior to the outbreak of the pandemic. This attitude seems to be due to the fact that most of the surveyed companies used partial remote work prior to the pandemic. At the same time, this study shows full-time remote work contributes to a different dynamics of effects and leads to problems that were not visible before.

6. Summary

The results of the study may lead to reflection on the future of remote work and the role of offices in the IT sector. Two years of experience from the pandemic period shows that it is easier to transfer to full-time remote work repetitive tasks which require only digital resources and are carried out by employee teams that have had the opportunity to get to know and learn to cooperate in a traditional office. Difficulties arise when it is necessary to solve complex problems by people who have not had the opportunity to get to know each other better. Tasks requiring deep interpersonal contact may also suffer. An in-depth discussion leading to getting to know the broad context of the analyzed problem becomes a challenge in virtual surrounding.

Will offices survive the current revolution? It seems that it will result in a much wider use of remote work than before the pandemic. However, full-time remote work has several negative side effects that companies find difficult to deal with. For this reason, the dominant model in the coming years will be a hybrid model combining work in the office with remote work, and not full-time remote work. Similar conclusions are reached by (Yang et al., 2021). This is confirmed by the activities of the surveyed companies that gradually transitioned from full-time remote work to a hybrid model over the two years of the pandemic. As a result, the role of offices will change, becoming places where new employees are adapted and where intensive, deep teamwork is carried out. Relationships will be built and cemented in offices, they will become key places for fostering organizational culture. In this way offices will reduce side effects of remote work. However, in the distant future as Mixed Reality develops it may turn out that offices will start to disappear.

It can be concluded that the use of remote work will increase importance of HR departments. The tasks of these units will include, in particular, supporting the process of adapting new remote employees, monitoring morale, supporting distant managers in problematic situations, conducting integration activities and managing organizational culture.

The limitations of the study have a twofold character. Firstly, the subject of research is extremely dynamic due to social and technological changes. Secondly, the pandemic affected social behavior in an unprecedented way. The beginning of the pandemic was a period of great mobilization of employees, but later, the morale began to worsen. Moreover, the intensity of the pandemic has been changing influencing the scale of remote work use in researched companies.

Although the scope of the study was limited to the IT sector, it seems that at least some of the identified effects of remote work are universal and may occur in other sectors employing office workers. Future research should delve deeper into effectiveness of different solutions taken by companies to prevent side effects of remote work. This will make hybrid workplace models more sustainable.

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ASSUMPTIONS OF THE CONCEPT OF A PHASE MODEL OF AN INFRASTRUCTURAL PROJECT IMPLEMENTED ON THIS BASIS OF YELLOW FIDIC CONDITIONS OF CONTRACT

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Purpose: The aim of the article is to develop theoretical and practical assumptions of the phase model concept for infrastructural projects implemented from the perspective of design offices on the FIDIC rules.

Design/methodology/approach: In the article, the author develops and presents the assumptions of the phase model concept based on the available literature in the field of project management and the assumptions of the FIDIC Contract Conditions. The research problem is as follows: What elements does the course of an infrastructural project based on the assumptions of the Yellow FIDIC Conditions of Contract consist of? In the article, the author deepens the analysis of the research problem by pointing out specific questions. In her research, the author will use the method of modeling business processes, which allows for a detailed analysis of the studied phenomenon.

Findings: As a result of the conducted research, the author developed a concept of a phased model for infrastructural projects implemented from the perspective of the design office on the basis of the Yellow FIDIC Conditions of Contract. The presented concept integrates the project phase model typical for project management with the Yellow FIDIC Conditions of Contract model.

Research limitations/implications: The issues discussed in the literature require further development in the form of qualitative and model research. In the literature on the subject, the author identified insufficient knowledge resources in the field of integration of the project management phase model with the Yellow FIDIC Conditions of Contract model.

Practical implications: The conducted research will be an added value for the company, as it will help to systematize project management in a design and engineering company. They can be used as a starting point for developing a dedicated project management model in the researched industry.

Originality/value: The innovation in the conducted research is the integration of the project management phase model with the FIDIC Conditions of Contract model.

Keywords: project management, project phase model, infrastructure project, design office, FIDIC Conditions of Contract.

Category of the paper: Research paper.

1. Introduction

Project management is an independent field of management science. The rapid development of knowledge in this field is noticeable both in theory and in practice. This is visible both at universities and among associations associating project management enthusiasts. Awareness is increasing both in terms of the tools used for project management and in the issue of system modeling of project management for projects implemented in a specific environment. Among the many different types of projects, one can distinguish infrastructure projects that are implemented in the sphere of infrastructure, and their primary goal is to improve the quality of infrastructure services provided (Węgrzyn, 2014). From the point of view of the success of the infrastructure project, one of the key elements is effective management, regardless of the stage of project implementation (Zamojska, Susmarski, 2017). An inseparable element of project management is the project phase model, which is the basic planning tool for the implementation of a specific project. A properly built phase model already in the initial phase of the project allows you to get answers to bothering questions about the legitimacy of the implementation of a specific project.

The aim of the article is to develop theoretical and practical assumptions of the phase model concept for infrastructural projects implemented from the perspective of design offices on the FIDIC rules. The research problem consists in identifying what elements make up the course of an infrastructural project implemented under the Yellow FIDIC Conditions of Contract.

The article lists five parts, of which the first two parts are literature research in the field of the project phase model and the foundations of the FIDIC Conditions of Contract. The article contains the results of research in the form of a conceptualization of a phase model of an infrastructural project created on the basis of literature research and model analysis of business processes.

2. Project phase model

The implementation of projects requires a skillful selection of management methods and techniques for specific conditions. According to the definition of M. Trotsky, a project is an organizationally separate, unique and complex undertaking, which includes an organized sequence of activities carried out over a specific period of time, with limited resources and is aimed at achieving a specific result (Trotsky, 2012). Proper implementation of projects requires the use of a methodological approach, adapted to the specifics of the organization (Strojny, 2019). In order to increase control (Willems, Vanhoucke, 2015) and coordinate activities, the project is divided into several phases. One of the most important features of the project is

its duration, which is individual for each project. The project duration can be defined as the project life cycle, covering the period from the beginning of work on defining the problem to obtaining the expected result, output, i.e. until the end of the project duration (Rokoszewski, 2014). In the literature, the project life cycle is often referred to as a "phase model", "stage concepts", or "stage models". According to the PMI definition, the project life cycle is defined as "the successive phases through which a project passes from its initiation to its closing" (PMI, 2017). The project phase model is one of the key tools necessary for efficient project management. It plays a key role in the project approach, as it is a standardized presentation of the course of project tasks divided into finite time intervals, each of which is uniquely identified and generates significant sub-objectives of the project (IPMA, 2014). The phase model results from good operating practices and is a kind of division of the project into stages, with each stage containing standardized information on the implementation of the project. The definition of the project life cycle, by defining specific activities, supports the link between the project and the operational activities of the organization that implements it (PM Book Guide, 2003). A well-developed phase model is the backbone of the project, which sets the direction and purpose of action. According to the definition of the Government Project Monitoring Office, the project life cycle includes four phases: preparation, planning, implementation, closing (Szyborska, Charchuła, Duma, Janka, Karpińska, Kwiatek, Nocoń, 2021), this model presents a cascade approach that is adapted to linear value creation. Traditional project management methodologies, based on the project life cycle, in which the sequence of steps that must be taken for the implementation of a given project is identified (Strojny, Szmigiel, 2015). According to traditional project management methodologies, project objectives, methods of achieving it and a detailed schedule are fully defined, and the probability of changes in the scope of the project is low. The answer to the traditional approach are agile project management methods dedicated mainly to projects characterized by high uncertainty and the inability to accurately plan all events in the project. The following table provides a comparative analysis of the traditional and agile project management cycle.

Table 1.

Comparison of the project management cycle in traditional and agile terms¹

Project management lifecycle	
Traditional approach	Agile approach
<ul style="list-style-type: none"> - deterministic and linear, based on precisely defined design stages, - defined key design processes - planning based on detailed schedules as a basis for project management 	<ul style="list-style-type: none"> - iterative and empirical, based on the delivery of functional elements, - short schedules of the value creation process, - adaptability and adaptation to changing conditions, - processes maximally simplified

Source: Own elaboration based on: Strojny, Szmigiel, 2015, p. 255.

The figure below shows an example of a project life cycle diagram consisting of 4 phases: preparation phase, planning phase, implementation phase and closure phase, monitoring and control process takes place throughout the duration of the project. The presented model may correspond to an adaptive approach using both traditional and agile project management

methodologies. This is illustrated primarily by the presented planning phase, which de facto should be considered in 3 stages: initial planning, proper planning, current planning.

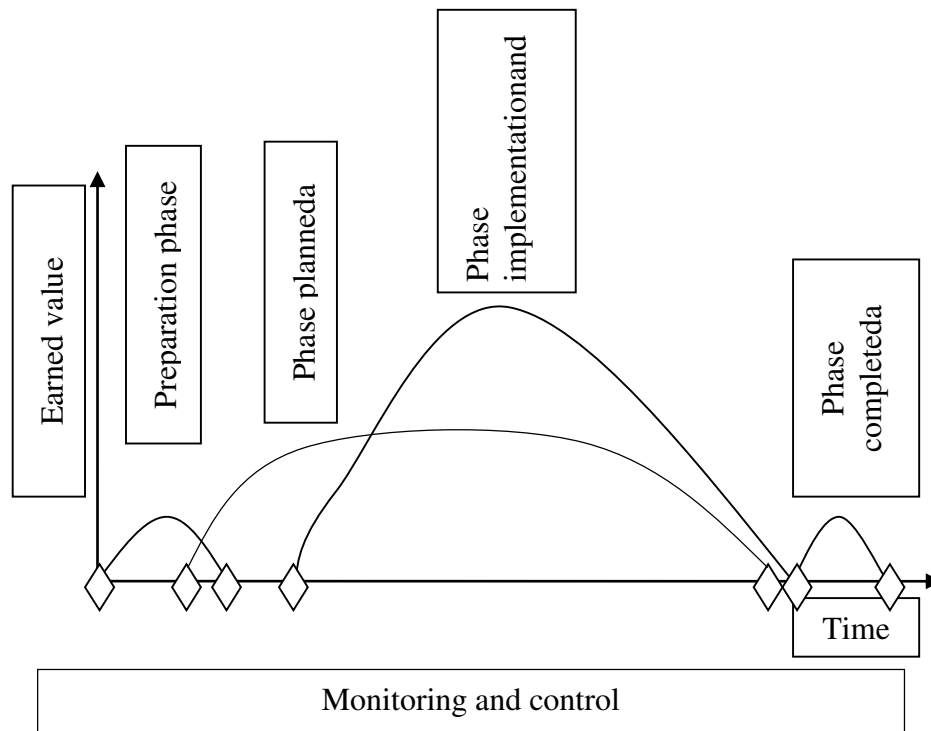


Figure 1. Project Life Cycle.

Source: own elaboration.

Initial planning is a stage that begins already in the preparation phase, where initial schedule assumptions are made, including the analysis of the necessary resources and project costs. Proper planning takes place in the planning phase and at this stage a basic project schedule is created, taking into account specific deadlines based on the availability of necessary resources and taking into account the risks and necessary cost outlays spread over time. Current planning takes place in the project implementation phase and should go hand in hand with a cyclical monitoring process, where the basis for planning current implementation activities is a base schedule in coordination with a report on the progress of project work verified in the cyclical project monitoring and control process. In addition, the presented approach to the project planning process allows to streamline the decision-making process and reduce the risks occurring in the project.

Project preparation phase. This is the conceptual phase. The impulse to take action in the field of a specific project is an idea derived from the need to implement a need. The purpose of this phase is to define the initial assumptions of the project as well as the possibilities and legitimacy of implementation. At this stage, the sources of financing, the time frame of the project, the benefits of implementation, and a preliminary stakeholder analysis is developed. The product produced in this phase is the project initiation document, e.g. the Project Charter. The way out of the preparation phase is the decision to implement or resign from the project.

Project planning phase. The phase, which consists of all planning activities related to the implementation of the project, project management plans, risk, communication, schedule, etc. are created. The essence of this phase is to get answers to the questions of how to achieve the set goal of the project, at what time and what are the necessary resources. This is an extremely important phase from the point of view of project implementation, because at this stage a skeleton of the implementation formula is created, which will have a direct impact on the effects achieved. At this stage, the main documents used during the project are developed (Cabbage, 2013).

Project Implementation Phase. The phase of actual implementation, production of project effects, value for the client. It is important in this phase to coordinate the resources assigned to the project in relation to the project work schedule. The key activity in this phase, in addition to the implementation and specification of previously planned tasks, is an adequate response to the changing reality (Szymborska, Charchuła, Duma, Janka, Karpińska, Kwiatek, Nocoń, 2021).

The Project Closing Phase includes the final management processes to lead to the final completion of the project (Szczepaniak, 2019). This phase should end with archiving the project documentation.

The important fact is that any subsequent phase will not be possible if the previous factor fails. For this reason, at each stage of the project life cycle, control and monitoring is carried out whether everything goes according to the plan (Targiel, 2015).

Each of the stages of the phase model is characterized by certain features. The table below presents a phase model consisting of four phases: definition phase, preparation phase, execution phase, completion phase. The analysis of each of the above-mentioned phases took into account the following elements: nature of the activity, purpose, processes, participants, inputs/costs.

Table 2.
Design phase model²

Description/ Phases	Definition phase	Preparation phase	Execution phase	Completion phase
Nature of the activity	Conceptual activity	Planning and organizational activities	Design and implementation activities	Implementation and reporting activities
Purpose	Define a project	Organizing and planning the work of the project	Project execution, control and coordination of works	Implementation, acceptance and settlement of the project, evaluation of project experience

Cont. table 2.

Processes	-Initiating a project -Defining the project	-Organizing the project team -Planning the structure of the project -Planning project dates -Project resource planning -Project budgeting -Organizing the execution of the project	-Designing the project result -Implementation of the project -Control of project execution (control, coordination)	- Closure of the project
Participants	Initiator, sponsor, users, specialists	Project team, sponsor, users, contractors, suppliers, specialists, experts	Contractors, subcontractors, suppliers, project team, sponsor, users, specialists, experts	Contractors, project team, sponsor, users, specialists, experts
Costs, Inputs	Low, 12%	Medium, 20 %	High, 61% (43% execution and 18% monitoring and control)	Low, 7%

Source: Own elaboration based on Trocki, Grucza, Ogonek, 2003, p. 32.

The phase model is a very important element from the point of view of strategic project management in an enterprise. The use of this tool at the level of operational management allows for good planning of the course of a specific project and supports supervision and control over its implementation. In addition, the key feature of this tool in relation to strategic management is the ability to decide on the business justification for the implementation of a specific project at its initial stage at low cost.

The phase model of the project is adapted to the specifications of a specific organization and projects implemented in it, it may differ both in the number of phases and the scope of activities that are recommended to be performed.

3. FIDIC contract conditions

All infrastructure investments start with approved project documentation. The design industry is characterized by very specific conditions and many limitations. In addition to all external conditions that the design office has to face, there are internal conflicts of interest. Designers producing a sales product most often disregard the financial sphere (Bilon, 2016), these are most often people with engineering education who can uncritically agree to introduce additional changes in the documentation in order to improve the designed facility, not paying attention to the costs of additional man-hours. This contradicts the concept of the iron triangle of the design, presented in Figure 2. The indicated concept defines the most important

dimensions in the project, which are: the scope of work, budget, and deadline for implementation, which shape the quality of the project. Changes in any of the listed elements (dimensions) in the triangle, assuming no change in the other, result in changes in the others (Leg, 2015). Considering the above, it is very important in running a design office to properly manage projects based on both engineering and management knowledge and practice.

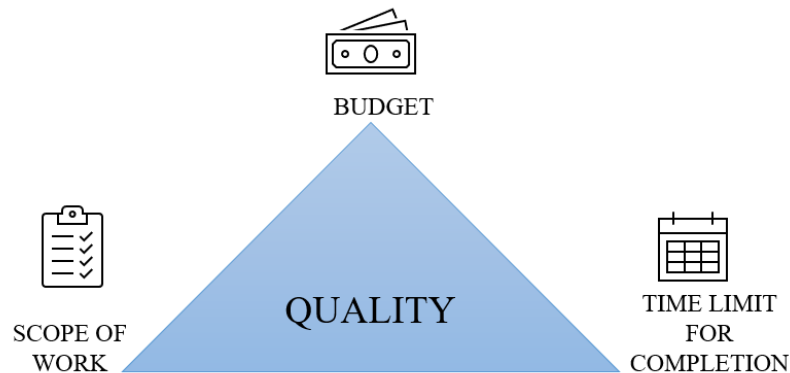


Figure 2. Golden triangle of the project.

Source: Own elaboration.

Contracts are one of the main elements of the entire project management cycle (Purba, Prastowo, 2020), therefore they largely translate into project success. Among the commonly used systems for the implementation of construction investments in Poland is a system based on the models of Contract Conditions developed by the International Federation of Consulting Engineers (Fédération Internationale Des Ingénieurs-Conseils French acronym: FIDIC), which was founded in 1913 by three national associations of consulting engineers in Europe (FIDIC, 2008). FIDIC contract conditions are widely recognized international standards - contract templates for design and construction contracts, describe the course of construction investments based on mutual obligations and relations of the contracting authority as the investor and the contractor as the construction contractor, as well as the contract engineer as the project administrator (./adviser.law/, 2023). FIDIC Contracts are based on a legal concept derived from common law. Contracts executed on FIDIC principles are known and recognized in the world as examples of good solutions developed on the basis of many years of experience (Chen, Wang, Zhang, You, 2018; Choi, Kim, 2016). FIDIC contracts are contracts of great importance and value, a large part of these contracts are large technology transfer contracts (Omran, 2019). Due to the size of the contracts and their inherent complexity, these contracts often involve various types of disputes. These disputes generally result in a significant loss of time and money for stakeholders (Walsh, 2017). The basic idea behind the FIDIC development was to create user-friendly systematized construction management rules, containing both practical tips and proposed management support tools. The purpose of the FIDIC Conditions of Contract is to maintain a balance between the requirements and interests of the parties, as well as a fair distribution of risks, threats and liability between the parties to the contract (Rybka, J., Rybka, D., 2020).

Issues related to the implementation of construction investments in accordance with FIDIC conditions are discussed in the national literature, among others by: (Połoński, Kowalski, Wrzesiński, 2019; Skoruski, 2019; Lendo-Siwicka, Pawluk, Połoński, Goszczyńska, 2016), which may indicate the growing popularity of the use of FIDIC conditions in Poland. The most common reason for the use of FIDIC Conditions of Contract is the size and complexity of the investment task. The popularity of the application of FIDIC Conditions of Contract in Poland was also greatly influenced by the sources of financing received for the implementation of infrastructure projects. Co-financing of contracts from the European Commission, the European Investment Bank or the World Bank became possible after adapting the provisions of Polish law to EU law (Lendo-Siwicka, Pawluk, Żerek, Trach, 2018). FIDIC Conditions of Contract are applied in Poland by incorporating their provisions into a specific contract within the limits of freedom of contract (Article 3531 of the Civil Code), and are increasingly used in the public and private sectors.

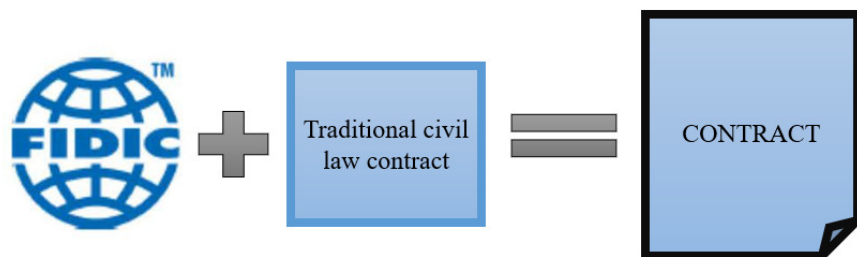


Figure 3. Diagram of contract elements using the FIDIC Conditions of Contract.

Source: Own elaboration.

In construction practice in Poland, two of them are most often used: the so-called red book entitled: Contract Conditions for Construction for engineering and construction works designed by the Contracting Authority, and the so-called yellow book – Contract Conditions for equipment and design and construction for electrical and mechanical equipment as well as engineering and construction works designed by the contractor (Pawłowski, Szymański, 2017). The other two that are included in the basic conditions for conducting contracts in Poland are: the Terms of the Contract for the "turnkey" implementation referred to as the silver book and the Short form of the contract referred to as the green book (Belter, 2018). The first editions of the FIDIC red, yellow and silver books were published in 1999, quickly gained popularity and became one of the most widely used engineering contract templates (Godwin, 2020). Due to the rapid development of the industry and the experience gained over the years in applying the Conditions of Contract, the FIDIC Contracts Committee was forced to update and in 2017 a new edition of the FIDIC Conditions of Contract was published.

The parties to the FIDIC contract are the Contracting Employer and the *Contractor*. The FIDIC Contract Engineer (Engineer Consultant) is the Employer's representative authorized by him to take economic, organizational and technical actions and decisions related to the performance of the contract (.pjm.pl., 2023).

The FIDIC Yellow Model defines the basic terms of the contract between the Contracting Authority and the Contractor regarding the development of design documentation and the execution of Construction Works. The FIDIC Yellow model, called the "design and build" model, is used, among others, in projects such as: power plants, water and sewage systems, industrial installations implemented for the public sector.

4. Methodology of own research

The aim of the article is to develop theoretical and practical assumptions of the phase model concept for infrastructure projects implemented from the perspective of design offices on the principles of Yellow FIDIC. In the article, the author develops and presents the assumptions of the phase model concept based on the available literature in the field of project management and the assumptions of the FIDIC Contract Conditions. The research problem is as follows: **What elements does the course of an infrastructure project implemented on the basis of the FIDIC Yellow Conditions of Contract consist of?** The defined research problem has been clarified by research issues within which the following research questions have been distinguished:

1. What is the organizational structure of the project implemented on the basis of the FIDIC Yellow Conditions of Contract?

2. What are the elements of the phase model of a project implemented on the basis of the FIDIC Yellow Conditions of Contract?

3. What are the phases of development of the documentation used in the implementation of the phase model based on the FIDIC Yellow Conditions of Contract?

In order to obtain answers to the research questions posed, literature research was carried out in the first place, which allows us to understand what has been researched and how and what are the key issues regarding a given scientific field (Zdonek, Hysa, Zdonek, 2016). This research allowed to learn about key sources of literature, main theories, ideas, concepts, points of view.

Operationalizing the assumptions of the phase model of the infrastructure project implemented on the basis of the Yellow FIDIC Conditions of Contract, a detailed analysis of the processes was carried out, on the basis of which schemes were developed using the business process modeling method. Business process modeling is the art of graphic presentation of business processes for the purposes of their optimization and archiving (Żytnerski, Zadora), allows you to document processes or create their definitions (Gawin, Marcinkowski, 2013). The use of the process decoupling method allows for a detailed analysis of the studied phenomenon, which in turn allows for the improvement of processes. Process modeling gives you more opportunities in the area of analysis and when planning changes. Thanks to modelling,

we have the opportunity to learn about processes from beginning to end, which guarantees a better understanding of specific stages (Lipski, Lipski, 2021).

The research was conducted in the sector of architecture and construction engineering, on a group of infrastructure projects. The architecture and environmental engineering sector significantly affects the development of all countries and contributes to the growth of gross domestic product. The architecture and civil engineering sector stands out from other industries around the world primarily due to the following factors: participation of several stakeholders, construction and non-construction involvement, uniqueness of the project, limited degree of automation, huge financial outlays, long time frames (Khawaja, Mustapha, 2021) all the indicated factors have an impact on a higher level of project risk than in other industries. Infrastructure projects are used to implement infrastructure investments aimed at financing the development of services provided to citizens and supporting the development of the economy (.pfr.pl, 2023). Infrastructure projects include primarily water and sewage networks, roads, schools, hospitals, bridges and airports. Infrastructure projects are characterized by specific features affecting the management of the organization:

- high level of risk,
- a high level of complexity,
- high variability of the scope of the project and its nature over time,
- the use of modern, non-standard technologies and solutions (Flyvbjerg, 2021).
- the existence of many stakeholders whose interests are – at best inconvergent – and sometimes also conflictual, with a high impact of stakeholders with a lot of power (Frąkiewicz-Wronka, 2010). The objectives of infrastructure projects often arouse controversy in the environment, which negatively affects the level of risk. Infrastructure projects require a lot of commitment and arouse interest in the eyes of various stakeholders (Vuorinen, Martinsuo, 2019), which is why proper stakeholder management is very important in infrastructure projects.

5. Assumptions of the concept of a phase model of the project implemented on the basis of the contract conditions of the Yellow FIDIC

Items The purpose of this subchapter is to present the results of the operationalization of the phase model of an infrastructural project, using for this purpose the literature research conducted above and based on the analysis of the FIDIC Conditions of Contract in the design and build formula, the so-called yellow book. According to the discussed formula, the Contractor is responsible for developing and approving the design documentation necessary for the implementation of the Works. The contractor may have his own design office, but in many cases he uses the services of independent design offices (subcontractor).

From the point of view of the design office, the form of investment implementation is very important. The implementation of the investment based on the so-called Yellow FIDIC seems to be slightly more complicated than the implementation of an order strictly at the request of the ordering party. This is usually due to the fact of multi-stage reconciliation of project documentation and different expectations of the Contractor (who is the client for the design office) and the Contracting Authority (being the investor of the investment). Figure 4 shows a diagram of the organizational structure based on the assumptions of the FIDIC Yellow Conditions of Contract.

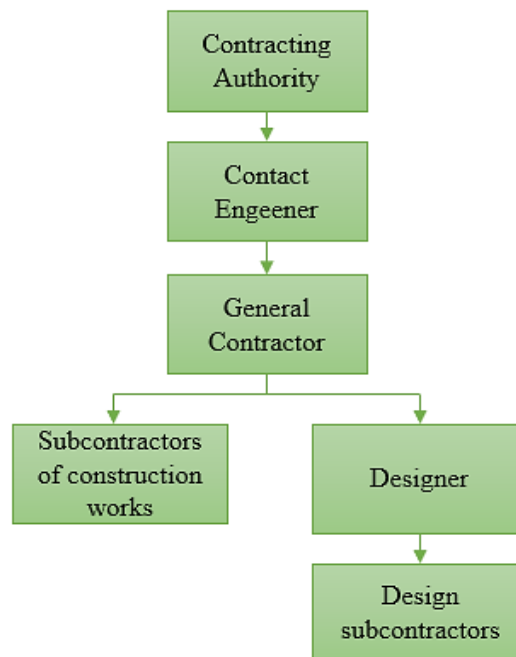


Figure 4. Diagram of the organizational structure for projects implemented in the "design and build" formula - Conditions of Contract FIDIC yellow.

Source: Own elaboration.

The above organizational chart presents the model of role dependencies in the project implemented under the FIDIC Yellow Conditions of Contract. The greatest decision-making power in the project belongs to the Contracting Authority, whose one of the basic tasks is to accept changes to the Contract. The basic task of the Contract Engineer is to manage the Contract on behalf of the Contracting Authority, direct contact with the Contractor and ongoing supervision over the implementation of the investment. The Contractor is a company selected or selected by the Investor as part of a tender. In the presented implementation model, the Contractor is responsible for the development of design documentation, therefore the Contractor is responsible for the designer's activities. The designer acting both as an internal resource of the Contractor and an external design office must act consistently with the provisions of the Contract concluded between the parties, i.e. the Contracting Authority and the General Contractor.

Figure 5 presents a model of manufactured products in the form of design documentation in the "design and build" implementation formula. The scope of responsibility for the delivery of individual products as part of the investment was also indicated. The basis for the development of design documentation for the Designer / design office is the Functional and Utility Program provided by the Contracting Authority at the stage of announcing the tender for the selection of the General Contractor.

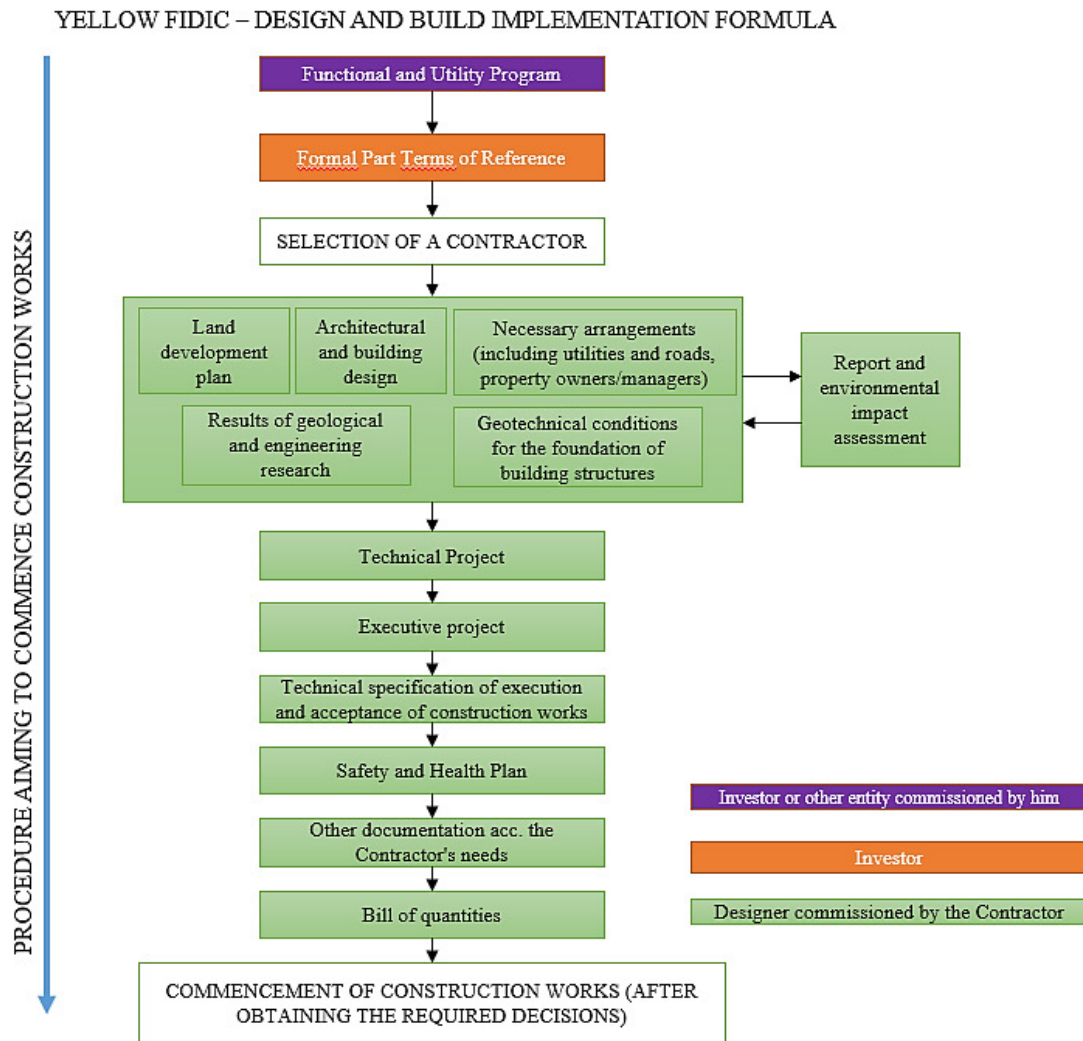


Figure 5. Sequence of preparation of project documentation in the "design and build" implementation formula.

Source: Own elaboration based on: Handbook for Investors of infrastructure projects, Ministry of Regional Development, Warsaw 2007-2013, p. 207.

The FIDIC Yellow Contract Conditions for Equipment and Construction Design are characterized by typical major events occurring in each project implemented in this formula. They are a kind of model of successive processes. The model in question is shown in the figure below.

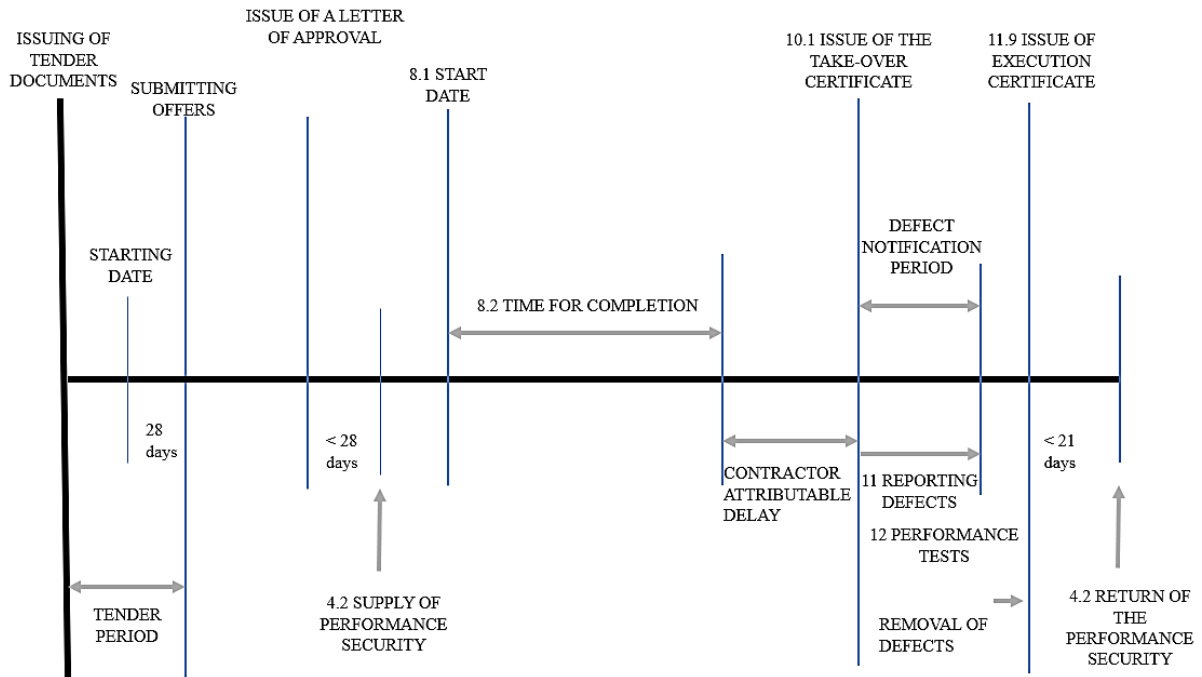


Figure 6. Typical sequence of major events for Equipment and Design and Construction.

Source: Own elaboration based on: *FIDIC SIDiR Contract Conditions of Equipment and Design and Construction for electrical and mechanical equipment as well as engineering and construction works designed by the Contractor. Fourth English-Polish edition 2008.*

In the phase model implemented in accordance with the assumptions of the Yellow FIDIC Conditions of Contract, 5 phases of the project can be distinguished. The diagram below shows a graphical presentation of phases for this model.

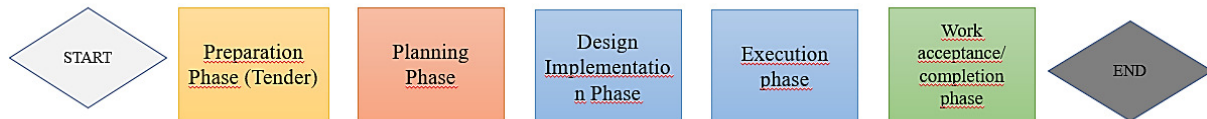


Figure 7. Phase diagram in the phase model of a project implemented in the "Design and Build" formula.

Source: Own elaboration.

A detailed description with an overview of the individual phases of the model is presented in the table below. For each phase, an analysis was carried out taking into account the following aspects: phase objective, milestone, basic tasks, good practices.

Table 3.

Assumptions of the phase model concept for infrastructure projects implemented on the basis of 3 FIDIC Yellow Conditions of Contract

Project phase model in accordance with the assumptions of the Contract Conditions FIDIC Yellow		
Project preparation phase – Offer preparation stage	Phase objective	Defining the project initiative, determining the need for project implementation (specify the project is beneficial, feasible or needed), providing resources for project planning, conducting risk analysis.
	Milestone	Submission of a bid
	Basic tasks	Detailed analysis of tender documentation; preparation of the offer
	Good practices	A detailed analysis of the tender documentation along with questions and answers provided at the stage of the tender procedure is very important at this stage. It is also necessary to analyze the provisions of the Terms of Contract, Model Agreement, Technical specification of execution and acceptance of construction works, General Requirements, Functional and Utility Program in terms of their impact on the price, deadline, as well as the possibility of occurrence of risks charged to the bidder. At this stage, it is worth engaging specialists in their fields to analyze the documentation in order to verify the documentation in terms of the requirements, then it is suggested to perform an analysis of opportunities and threats, e.g. using the brainstorming method
Planning phase	Phase objective	Verification of project implementation options, selection of appropriate management methodology, cost estimation, risk analysis resulting from the implementation of the project
	Milestone	Selection of the submitted offer as the most advantageous
	Basic tasks	Development of a work schedule, work growth monitoring \and management system, assignment of responsibility in the project, development of a communication model, development of a correspondence/documentation management system, development of a quality management system
	Good practices	During the planning phase, it is recommended to prepare a uniform text of the tender document conditions, such as the General and Special Conditions, tender questions and answers and other relevant documents, and to send them to the project team members to ensure efficient communication and eliminate ignorance resulting from lack of access to the documentation. It is also important to analyse in detail the deadlines resulting from the contract, contracts, KPA in order to develop a real schedule, and an appropriate system for monitoring deadlines. At this stage, it is important to thoroughly conduct a stakeholder analysis and develop a stakeholder management strategy.
Project implementation phase	Phase objective	Manufacturing the Product or Products of the Project, obtaining acceptance and the final acceptance protocol of the works, monitoring and responding to any risks and unforeseen emerging situations.
	Milestone	Signing the contract.
	Basic tasks	Preparation of complete design documentation, Obtaining the necessary arrangements, Obtaining a legally valid building permit / Certificates of no objection to the intention of construction
	Good practices	An important management task in this phase is the ongoing updating of the schedule – systematic introduction of changes to the schedule. It is important to monitor the progress of work on an ongoing basis and discuss the problems that have arisen in order to solve them quickly, this avoids implementation downtime after encountering a problem. It is recommended to record in a systematic way all events that took place during the implementation of the contract, primarily due to the fact that they can be the basis for submitting relevant notifications, as well as to gather experience that may serve subsequent implementations.

Cont. table 3.

Executive phase	Phase objective	Positive verification of the prepared project documentation.
	Milestone	Obtaining a legally valid building permit / Certificate of no objection to the intention of construction
	Basic tasks	Author's supervision over the implementation of the investment, development of as-built documentation.
	Good practices	In this phase, the main task of the design office is to verify whether the construction works performed by the General Contractor and its subcontractors are carried out in accordance with the provisions of the project. In the case of changes, the Designer decides whether a given change is a significant change and a change in the building permit is required, or whether it can be qualified as insignificant changes. It is important to keep an appropriate register of implementation changes in relation to the project documentation. This will allow you to maintain order in the documentation and facilitate the development of as-built documentation.
Acceptance phase/completion	Phase objective	Verification of the achieved goals set in the project, closing the project, determining the method of monitoring the benefits of the project.
	Milestone	Acceptance of final acceptance of works/final payment certificate
	Basic tasks	Settlement of the project, collection of good practices, verification of the benefits obtained, thanks to the entire project team, preparation and approval of the closing report.
	Good practices	During the closure phase, the dossier must be finally systematised. It is crucial to verify the benefits and determine how to further monitor the benefits and risks. A good way is to write down the so-called Lesson Learned, i.e. write down both good and bad practices that can be used to implement subsequent projects. Another important element from the perspective of the design office at the end of the project is to obtain references, i.e. certification of a well-performed service. If it is necessary to close the project early, the closing phase can be initiated at any time during the project.

Source: Own elaboration.

The project management method must be consistent with the contract terms model FIDIC yellow.

The FIDIC Conditions of Contract also set certain standards for document management. According to the model, all correspondence generated during the term of the Contract is conducted between the parties to the Contract, i.e. the Contracting Authority and the Contractor. All correspondence, as well as design documentation produced by the Designer, must go to the Contractor, who officially forwards the correspondence to the Ordering Party. In the design phase, the Designer takes an active part in the ongoing update of documentation. The table below contains a list of suggested documents used to manage the Contract under the FIDIC Yellow Contract Conditions model.

Table 4.*Document management scheme in the Contract Conditions model 4FIDIC Yellow*

Documents	Preparation phase (tender)	Planning phase	Implementation phase	Acceptance phase / Completion
Tender documentation received from the Contracting Authority	analysis	analysis	analysis	archiving
Project card	creation	update	update	archiving
Schedule	creation	update	update	archiving

Cont. table 4.

Stakeholder Analysis + Management Strategy	creation	update	update	archiving
Risk analysis + matrix	creation	update	update	archiving
Quote offer	creation	review	verification/update	archiving
Deadlines and obligations of the Contractor		creation	review	archiving
Deadlines and obligations of the Contract Engineer		creation	review	archiving
Deadlines and obligations of the Ordering Party		creation	review	archiving
Notice deadlines, including claims		creation	review	archiving
Deadlines according to KPA		creation	review	archiving
Monitoring of claims		creation	review	archiving
Issue Register		creation	update	archiving
Electronic correspondence log		creation	update	update / archiving
List of subcontractors		creation	update	archiving
Summary of quality assurance plans		creation	update	archiving
List of Technology and Organization Projects Robot		creation	update	archiving
Summary of Amendments to the Agreement		creation	update	archiving
Summary of implementation changes in relation to the project documentation			creation	archiving
Progress report		creation	update	archiving
Experience Report		creation	update	archiving
Partial acceptance report/ Interim Payment Certificate			create/update	archiving
Final acceptance report/ Final payment certificate			creation	archiving
Close report				create/archive

Source: Own elaboration.

Contracts concluded on the basis of the FIDIC Yellow Conditions of Contract are often multi-page and extensive in terms of their content, therefore it is suggested to create documents containing the most important provisions of the Contract concerning, above all, the applicable deadlines and responsibility in the project in order to verify them efficiently at the implementation stage. These documents should be made available to all members of the project team.

6. Summary

In this article, the main goal was achieved by presenting the concept of a phase model for infrastructure projects implemented from the perspective of the design office on the basis of the FIDIC Yellow Contract Conditions. The presented concept integrates the project phase model typical for project management with the FIDIC Yellow Contract Conditions model.

The development of the concept in question is the result of searching for an answer to the posed research problem, which is as follows: what elements does the course of an infrastructural project based on the assumptions of the Yellow FIDIC Conditions of Contract consist of? The answer to the presented research problem was obtained through the analysis of individual research questions.

Research question 1: What is the organizational structure of the project implemented on the basis of the FIDIC Yellow Conditions of Contract?

A detailed analysis of the organizational structure is presented both graphically and in descriptive form in Chapter 4. The key roles of the organizational structure developed based on the assumptions in the FIDIC K Treaty Frameworks are the Contracting Authority, the Contract Engineer and the General Contractor, the next role is the designer, who can be internal the resources of the General Contractor, or an external company. What is important is the dependence of individual roles on each other and a clearly defined scope of responsibility, as well as establishing an appropriate communication system.

Research question 2: What are the elements of the phase model of a project based on the FIDIC Yellow Conditions of Contract?

The basic elements of the phase model of the project implemented on the basis of the FIDIC Yellow Contract Conditions include the following phases: Preparation phase (tender), Planning phase, Project implementation phase, Contractor implementation phase, Acceptance/completion phase. The individual phases follow one after the other and are dependent on each other.

Research question 3: What are the phases of development of the documentation used in the implementation of the phase model based on the FIDIC Yellow Conditions of Contract?

The Yellow FIDIC Contract Conditions defines certain standards for contract management, these standards also apply to the documentation produced. It is important to work out the appropriate documentation management mode, as well as to train all members of the project team who have direct contact with the manufactured documentation in this area.

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